

Environmental Engineering

1st Stage

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                      |                               |                                                                                                                                                                                                                                          |                                                                                |
|------------------------------------|--------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                      |                               |                                                                                                                                                                                                                                          |                                                                                |
| Module Title                       | Calculus 1                           |                               | Module Delivery                                                                                                                                                                                                                          |                                                                                |
| Module Type                        | Support or related learning activity |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                                                                |
| Module Code                        | ENV111                               |                               |                                                                                                                                                                                                                                          |                                                                                |
| ECTS Credits                       | 6                                    |                               |                                                                                                                                                                                                                                          |                                                                                |
| SWL (hr/sem)                       | 150                                  |                               |                                                                                                                                                                                                                                          |                                                                                |
| Module Level                       | 1                                    | Semester of Delivery          |                                                                                                                                                                                                                                          | 1                                                                              |
| Administering Department           | ENV8                                 | College                       | ENG4                                                                                                                                                                                                                                     |                                                                                |
| Module Leader                      | Mayada Hazim                         |                               | e-mail                                                                                                                                                                                                                                   | <a href="mailto:mayada.hmah@uomosul.edu.iq">mayada.hmah@uomosul.edu.iq</a>     |
| Module Leader's Acad. Title        | Lecturer                             | Module Leader's Qualification | M.Sc.                                                                                                                                                                                                                                    |                                                                                |
| Module Tutor                       | Abeer Khalil Ibrahim                 |                               | e-mail                                                                                                                                                                                                                                   | <a href="mailto:abeer.alsaraf@uomosul.edu.iq">abeer.alsaraf@uomosul.edu.iq</a> |
| Peer Reviewer Name                 | Mayada Hazim                         |                               | e-mail                                                                                                                                                                                                                                   | <a href="mailto:mayada.hmah@uomosul.edu.iq">mayada.hmah@uomosul.edu.iq</a>     |
| Scientific Committee Approval Date | 21/9/2025                            | Version Number                | 2.0                                                                                                                                                                                                                                      |                                                                                |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>The aim of this course is to introduce the students to main topics of mathematic. The course will cover Prerequisites for mathematic, Limits, Continuity, and Differentiation (methods and applications), Matrices, Operations on matrices, and Solution of system of equations by matrix.</p> <p>At the end of the course, students will have a broad knowledge of the basic concepts, techniques and applications of Differentiation and Matrices. This will be achieved through theoretical lectures, tutorials and homework</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO-1:</b> Recognize fundamentals of math and the emphasis on functions and graphs(i).</p> <p><b>CLO-2:</b> understanding various limit problems both algebraically and graphically and using it by checking the continuity of various types of functions(i).</p> <p><b>CLO-3:</b> Finding the derivative of various types of functions using the differentiation rules (i).</p> <p><b>CLO-4:</b> Applying differentiation to find linear approximation and optimization problems(ii)</p> <p><b>CLO-5:</b> solve matrices and operations on matrices and using matrices in solving linear equations(i).</p>                                                                                                                                                                                                                                                                                                                                 |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p><b>Indicative content includes the following.</b></p> <p><u>Part A – Prerequisites for calculus</u><br/> Coordinates and Graphs in the Plane, Slope and Equations for Lines, Functions and Their Graphs, Shifts, Circles and Parabolas, A Review of Trigonometric Functions (17 hrs).</p> <p><u>Part B – Limits and Continuity</u><br/> Limits, The Sandwich Theorem and <math>(\sin \theta)/\theta</math>, Limits Involving Infinity, Continuous Functions. (10 hrs).</p> <p><u>Part C – Derivatives</u><br/> Slope, Tangent Lines, and Derivatives, Differentiation Rules, Velocity, Speed and Other Rate of Change, Derivatives of Trigonometric Functions, The Chain Rule, Implicit Differentiation and Fractional Powers, Linear Approximations and Differentials (17 hrs).</p> <p><u>Part D - Applications of Derivatives</u><br/> Related Rates of Change, Maximal, Minima and the Mean Value Theorem, Curve Sketching with <math>y'</math>, <math>y''</math>, Graphing Rational Functions-Asymptotes and Dominant Terms, Optimization (18 hrs.).</p> |

|                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                           |     |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----|
|                                                                                | <u>Part E - Matrices</u><br>Operation on matrices, Equal matrices, Addition and Subtraction of matrices, Multiplication by scalar, Multiplication of matrices, Transpose of a matrices, adjoin of a square matrix, Determinants, Properties of determinants, Singular matrix, Solution of system of equations by matrix inversion, Cramer's rule to solve the system of equations, Gaussian elimination. (18hrs).                                           |                                                                           |     |
| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم         |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                           |     |
| <b>Strategies</b><br>الاستراتيجيات                                             | Expanding students' perceptions of mathematic, familiarity with basic mathematical concepts and principles, and the ability to distinguish between different mathematical concepts. This course has several components that include studying lectures, tutorial, discussion, homework, and e-learning platforms. The course will be taught in English, and all compulsory assignments have to be submitted within the deadlines to be admitted to the exam. |                                                                           |     |
| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا       |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 78                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 72                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 4.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | 150                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                           |     |

| <b>Module Evaluation</b><br>تقييم المادة الدراسية |                    |             |                  |                    |                                    |
|---------------------------------------------------|--------------------|-------------|------------------|--------------------|------------------------------------|
|                                                   |                    | Time/Number | Weight (Marks)   | Week Due           | Relevant Learning Outcome          |
| Formative assessment                              | Quizzes            | 5           | 5% (25)          | 3, 5, 8, 11 and 14 | CLO-1, CLO-2, CLO-3, CLO-4, CLO-5  |
|                                                   | Online Assignments | 1           | 2% (2)           | 6                  | CLO-1, CLO-2.                      |
|                                                   | Onsite Assignment  | 5           | 2% (10)          | 3, 6, 9, 12 and 15 | CLO-1, CLO-2, CLO-3, CLO-4, CLO-5. |
|                                                   | Projects / Lab.    | 0           | 0                | 0                  |                                    |
|                                                   | Report             | 1           | 3% (3)           | 12                 | CLO-1, CLO-2, CLO-3, CLO-4.        |
| Summative assessment                              | Midterm Exam       | 2hrs        | 10% (10)         | 9                  | CLO-1, CLO -2, CLO -3,             |
|                                                   | Final Exam         | 3hrs        | 50% (50)         | 16                 | All                                |
| Total assessment                                  |                    |             | 100% (100 Marks) |                    |                                    |

## Delivery Plan (Weekly Syllabus)

### المنهاج الاسبوعي النظري

|                | Material Covered                                                                                                                   |
|----------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Week 1</b>  | Coordinates and Graphs in the Plane, Slope and Equations for Lines.                                                                |
| <b>Week 2</b>  | Functions and Their Graphs, shifts, circles and parabolas.                                                                         |
| <b>Week 3</b>  | A review of trigonometric functions.                                                                                               |
| <b>Week 4</b>  | Limits, the sandwich theorem and $(\sin \theta)/\theta$ , limits involving infinity.                                               |
| <b>Week 5</b>  | Continuous functions.                                                                                                              |
| <b>Week 6</b>  | Slope, tangent lines, and derivatives, differentiation rules, velocity, speed and other rate of change.                            |
| <b>Week 7</b>  | Derivatives of trigonometric functions.                                                                                            |
| <b>Week 8</b>  | The chain rule, implicit differentiation and fractional powers, linear approximations and differentials.                           |
| <b>Week 9</b>  | Related rates of change.                                                                                                           |
| <b>Week 10</b> | Maximal, minima and the mean value theorem, curve sketching with $y'$ , $y''$ .                                                    |
| <b>Week 11</b> | Graphing Rational Functions-Asymptotes and Dominant Terms.                                                                         |
| <b>Week 12</b> | Optimization.                                                                                                                      |
| <b>Week 13</b> | Operation on matrices, Equal matrices, Addition and Subtraction of matrices, Multiplication by scalar, Multiplication of matrices, |
| <b>Week 14</b> | Transpose of a matrices, adjoin of a square matrix, Determinants, Properties of determinants and Singular matrix.                  |
| <b>Week 15</b> | Solution of system of equations by matrix inversion, Cramer's rule, Gaussian elimination.                                          |
| <b>Week 16</b> | <b>Preparatory week before the final Exam</b>                                                                                      |

## Learning and Teaching Resources

### مصادر التعلم والتدريس

|                          | Text                                                                                                                                                      | Available in the Library? |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Required Texts</b>    | <ul style="list-style-type: none"> <li>Finney, R.L, &amp; Thomas, G.B, "Calculus" Addison. Wesley publishing company, USA, 11th, 2011.</li> </ul>         | Yes                       |
| <b>Recommended Texts</b> | <ul style="list-style-type: none"> <li>Anton, H., Bivens, I.C., Davis, S., Calculus: Early Transcendentals, Wiley, 10th edition, 2011.</li> </ul>         | Yes                       |
| <b>Websites</b>          | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

## Grading Scheme

### مخطط الدرجات

| Group                               | Grade                   | التقدير             | Marks %  | Definition                            |
|-------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| <b>Success Group<br/>(50 - 100)</b> | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                     | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                     | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                     | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                     | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>      | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                     | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                     |                         |                     |          |                                       |

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                           |                      |                                                                                                                                                                                                                                          |
|------------------------------------|---------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                           |                      |                                                                                                                                                                                                                                          |
| Module Title                       | Statics                   |                      | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Support                   |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV112                    |                      |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 6                         |                      |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 150                       |                      |                                                                                                                                                                                                                                          |
| Module Level                       | 1                         | Semester of Delivery | 1                                                                                                                                                                                                                                        |
| Administering Department           | ENV8                      | College              | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Salim Yousif, Samir Yasso |                      | e-mail <a href="mailto:syasso@uomosul.edu.iq">syasso@uomosul.edu.iq</a>                                                                                                                                                                  |
| Module Leader's Acad. Title        | lecturers                 |                      | Module Leader's Qualification Ph.D.                                                                                                                                                                                                      |
| Module Tutor                       | Ammar Mohammed            |                      | e-mail <a href="mailto:Ammar.mohammad@uomosul.edu.iq">Ammar.mohammad@uomosul.edu.iq</a>                                                                                                                                                  |
| Peer Reviewer Name                 | -----                     | e-mail               | E-mail                                                                                                                                                                                                                                   |
| Scientific Committee Approval Date | 26/10/2025                | Version Number       | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |      |          |   |
|-----------------------------------|------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |      |          |   |
| Prerequisite module               | None | Semester | 0 |
| Co-requisites module              | None | Semester |   |

| Module Aims, Learning Outcomes and Indicative Contents   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Module Objectives<br>أهداف المادة الدراسية               | <p>The primary purpose of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowledge of the physical and mathematical principles of mechanics; also required is the ability to visualize physical configurations in terms of real materials, actual constraints, and the practical limitations which govern the behavior of machines and structures. One of the primary objectives in a mechanics course is to help the student develop this ability to visualize, which is so vital to problem formulation. Indeed, the construction of a meaningful mathematical model is often a more important experience than its solution.</p> |

|                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                        | Maximum progress is made when the principles and their limitations are learned together within the context of engineering application.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Module Learning Outcomes</b><br><br>مخرجات التعلم للمادة الدراسية   | <p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p><b>CLO-1:</b> Makes the students able to recognize different force systems, moments and couple.</p> <p><b>CLO-2:</b> The ability to draw Free Body Diagram and label the reactions on it.</p> <p><b>CLO-3:</b> Makes the students able to apply equilibrium equations in statics.</p> <p><b>CLO-4:</b> The ability to analyze different types of structures.</p> <p><b>CLO-5:</b> The ability to determine the section properties – first and second moment of the area.</p> <p><b>CLO-6:</b> The ability to apply friction principles.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Indicative Contents</b><br><br>المحتويات الإرشادية                  | <p>Indicative content includes the following.</p> <p><b><u>Part A – Force systems and resultants</u></b></p> <ul style="list-style-type: none"> <li>To discuss the concept of the moment of a force and show how to calculate it in two and three dimensions.</li> <li>To provide a method for finding the moment of a force about a specified axis.</li> <li>To define the moment of a couple.</li> <li>To present methods for determining the resultants of nonconcurrent force systems.</li> <li>To indicate how to reduce a simple distributed loading to a resultant force having a specified location.</li> </ul> <p><b><u>Part B – Equilibrium</u></b></p> <ul style="list-style-type: none"> <li>To develop the equations of equilibrium for a rigid body.</li> <li>To introduce the concept of the free-body diagram for a rigid body.</li> <li>To show how to solve rigid-body equilibrium problems using the equations of equilibrium.</li> </ul> <p><b><u>Part C – Structural Analysis (Trusses)</u></b></p> <ul style="list-style-type: none"> <li>To show how to determine the forces in the members of a truss using the method of joints and the method of sections.</li> <li>To analyze the forces acting on the members of frames and machines composed of pin-connected members.</li> </ul> <p><b><u>Part D - Friction</u></b></p> <p>To introduce the concept of dry friction and show how to analyze the equilibrium of rigid bodies subjected to this force.</p> <p><b><u>Part E - Center of gravity and Centroid</u></b></p> <ul style="list-style-type: none"> <li>To discuss the concept of the center of gravity, center of mass, and the centroid.</li> <li>To show how to determine the location of the center of gravity and centroid for a system of discrete particles and a body of arbitrary Shape.</li> </ul> <p><b><u>Part F - Moment of inertia</u></b></p> <ul style="list-style-type: none"> <li>To develop a method for determining the moment of inertia for an area.</li> <li>To introduce the product of inertia and show how to determine the maximum and minimum moments of inertia for an area.</li> <li>To discuss the mass moment of inertia.</li> </ul> |
| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Strategies</b><br>الاستراتيجيات                                     | This course has several components that include lectures, individual & group assignments, Exercises. The course will be taught in English, and all mandatory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                             |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------|----------------------|-----------------------------------|
|                                             |                                                                                                                                                       | assignments have to be submitted within the deadlines to be admitted to the exams. |                                          |                      |                                   |
| Student Workload (SWL)                      |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
| الحمل الدراسي للطلاب محسوب ل ١٥ اسبوعا      |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
| Structured SWL (h/sem)                      |                                                                                                                                                       | 78                                                                                 | Structured SWL (h/w)                     |                      | 5.2                               |
| الحمل الدراسي المنتظم للطلاب خلال الفصل     |                                                                                                                                                       |                                                                                    | الحمل الدراسي المنتظم للطلاب أسبوعيا     |                      |                                   |
| Unstructured SWL (h/sem)                    |                                                                                                                                                       | 72                                                                                 | Unstructured SWL (h/w)                   |                      | 4.8                               |
| الحمل الدراسي غير المنتظم للطلاب خلال الفصل |                                                                                                                                                       |                                                                                    | الحمل الدراسي غير المنتظم للطلاب أسبوعيا |                      |                                   |
| Total SWL (h/sem)                           |                                                                                                                                                       | 150                                                                                |                                          |                      |                                   |
| الحمل الدراسي الكلي للطلاب خلال الفصل       |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
| Module Evaluation                           |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
| تقييم المادة الدراسية                       |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
|                                             |                                                                                                                                                       | Time/Number                                                                        | Weight (Marks)                           | Week Due             | Relevant Learning Outcome         |
| Formative assessment                        | Quizzes                                                                                                                                               | 5                                                                                  | 3% (15)                                  | 3, 5, ,10, 12 and 14 | CLO-1, CLO-1, CLO-2, CLO-2, CLO-3 |
|                                             | Reports                                                                                                                                               | 2                                                                                  | 4% (8)                                   | 11                   | CLO-5                             |
|                                             | Assignments                                                                                                                                           | 7                                                                                  | 1% (7)                                   | 3, 4, 6, 8, and 12   | CLO-2, CLO-2, CLO-3, CLO-2, CLO-3 |
|                                             | Onsite Assignment                                                                                                                                     | 10                                                                                 | 1% (10)                                  | TBD                  | CLO-2, CLO-2, CLO-3, CLO-2, CLO-3 |
| Summative assessment                        | Midterm Exam                                                                                                                                          | 2hrs                                                                               | 10% (10)                                 | 7                    | CLO-1, CLO -2 and CLO-3           |
|                                             | Final Exam                                                                                                                                            | 3hrs                                                                               | 50% (50)                                 | 16                   | All                               |
| Total assessment                            |                                                                                                                                                       |                                                                                    | 100% (100 Marks)                         |                      |                                   |
| Delivery Plan (Weekly Syllabus)             |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
| المنهاج الاسبوعي النظري                     |                                                                                                                                                       |                                                                                    |                                          |                      |                                   |
|                                             | Material Covered                                                                                                                                      |                                                                                    |                                          |                      |                                   |
| Week 1                                      | Introduction, Fundamental concepts, Units of measurements, The international system of units, Numerical calculations, General procedure for analysis. |                                                                                    |                                          |                      |                                   |
| Week 2                                      | Scalars and Vectors, Vector Operations. The Free-Body Diagram                                                                                         |                                                                                    |                                          |                      |                                   |
| Week 3                                      | Coplanar Force Systems. Force System Resultants                                                                                                       |                                                                                    |                                          |                      |                                   |
| Week 4                                      | Principle of Moments. Moment of a Couple                                                                                                              |                                                                                    |                                          |                      |                                   |
| Week 5                                      | Reduction of a Simple Distributed Loading. Conditions for Rigid-Body Equilibrium, Free-Body Diagrams.                                                 |                                                                                    |                                          |                      |                                   |
| Week 6                                      | Two- and Three-Force Members.                                                                                                                         |                                                                                    |                                          |                      |                                   |
| Week 7                                      | Midterm Exam                                                                                                                                          |                                                                                    |                                          |                      |                                   |
| Week 8                                      | Simple Trusses, The Method of Joints.                                                                                                                 |                                                                                    |                                          |                      |                                   |

|                |                                                                           |
|----------------|---------------------------------------------------------------------------|
| <b>Week 9</b>  | Simple Trusses, The Method of sections.                                   |
| <b>Week 10</b> | Frame analysis                                                            |
| <b>Week 11</b> | Centroid of a Body.                                                       |
| <b>Week 12</b> | Centroid of Composite Bodies.                                             |
| <b>Week 13</b> | Definition of Moments of Inertia for Areas, Moments of Inertia for Areas. |
| <b>Week 14</b> | Moments of Inertia for Composite Areas.                                   |
| <b>Week 15</b> | Friction.                                                                 |
| <b>Week 16</b> | Preparatory week before the final Exam.                                   |

### Learning and Teaching Resources

مصادر التعلم والتدريس

|                          | Text                                                                                                                         | Available in the Library? |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Required Texts</b>    | Hibbeler, R.C. " ENGINEERING MECHANICS – DYNAMIC 14 <sup>TH</sup> EDITION 2016" Pearson Prentice Hall                        | Yes                       |
| <b>Required Texts</b>    | MERIAM J.L., KRAIGE L.G. , BOLTON J.N. " Engineering Mechanics Volume 1 Statics " Ninth Edition 2018 John Wiley & Sons, Inc. | Yes                       |
| <b>Recommended Texts</b> | د.نزار جبرائيل - فخري ياسين – د.هشام العناز "الميكانيك الهندسي"                                                              | Yes                       |
| <b>Recommended Texts</b> |                                                                                                                              |                           |
| <b>Websites</b>          |                                                                                                                              |                           |

### Grading Scheme

مخطط الدرجات

| Group                               | Grade                   | التقدير             | Marks %  | Definition                            |
|-------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| <b>Success Group<br/>(50 - 100)</b> | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                     | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                     | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                     | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                     | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>      | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                     | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                     |                         |                     |          |                                       |

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                     |                                                                                                                                                                                                                                          |                              |
|------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| معلومات المادة الدراسية            |                     |                                                                                                                                                                                                                                          |                              |
| Module Title                       | Engineering Drawing | Module Delivery                                                                                                                                                                                                                          |                              |
| Module Type                        | Core                | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                              |
| Module Code                        | ENV113              |                                                                                                                                                                                                                                          |                              |
| ECTS Credits                       | 7                   |                                                                                                                                                                                                                                          |                              |
| SWL (hr/sem)                       | 175                 |                                                                                                                                                                                                                                          |                              |
| Module Level                       | 1                   |                                                                                                                                                                                                                                          |                              |
| Administering Department           | ENV8                | College                                                                                                                                                                                                                                  | ENG4                         |
| Module Leader                      | Mohammed Hisham     | e-mail                                                                                                                                                                                                                                   | m.h.alkafaf@uomosul.edu.iq   |
| Module Leader's Acad. Title        | Lectures            | Module Leader's Qualification                                                                                                                                                                                                            | MSC                          |
| Module Tutor                       | Ayad Abdullah Mousa | e-mail                                                                                                                                                                                                                                   | ayad_engineer@uomosul.edu.iq |
| Peer Reviewer Name                 | AMMAR MOHAMED       | e-mail                                                                                                                                                                                                                                   | E-mail                       |
| Scientific Committee Approval Date | 20/01/2026          | Version Number                                                                                                                                                                                                                           | 1.0                          |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونواتج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>The aim of this course is to help the students to use the technical drawing and performs drawing exercises with ruler, compass, T-square. make the student able to draw circles with straight lines, arcs and polygon. learns and applies dimensioning rules. knows the properties of cross section view and carry out the perspective drawings due to views.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p><b>CLO-1:</b> use the technical drawing tools properly and to plot pictures according to the dimensions and properties of technical drawing. (i)</p> <p><b>CLO-2:</b>Using scale, types of scales and measurement techniques to drawings.(i)</p> <p><b>CLO-3:</b>Applying several geometric shapes by using a compass. (iii)</p> <p><b>CLO-4:</b>Learning and applies dimensioning rules.(iii)</p> <p><b>CLO-5:</b>Implementing the properties of cross section view. (iii)</p> <p><b>CLO-6:</b>Carrying out the perspective drawings due to views. (iii)</p> <p><b>CLO-7:</b>Increasing the students ability to imagine. (iii)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p style="text-align: center;"><b>Indicative content includes the following.</b></p> <p><u>Part A – Graphic instruments and their use</u><br/> This lectures will describe the most common drafting instruments in use and discuss how they are use. (5 hrs)</p> <p><u>Part B – Graphic geometry and engineering applications</u><br/> In order to create the drafter or designer needs to know how to construct various common geometric patterns, for example parallel line, circle, arc, polygon and ellipse. (20 hrs)</p> <p><u>Part C – Theory of projection. Orthographic projection</u><br/> Explain the theory of projection.Consisting of a set of two or more separate views of an object taken from different direction. (15 hrs)</p> <p><u>Part D - Isometric drawing</u><br/> A three dimension drawing or sketch shows the entire object in one view from the two or three plains(front, top, side view) (15 hrs)</p> <p><u>Part E - Missing view</u><br/> Find the missing view from the other views. (10 hrs)</p> <p><u>Part F - Section</u><br/> (10 hrs)</p> |

| <b>Learning and Teaching Strategies</b><br><b>استراتيجيات التعلم والتعليم</b> |                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                             | This course has several components that include lectures, classwork, homework and quiz. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| <b>Student Workload (SWL)</b><br><b>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا</b> |            |                                                                           |            |
|---------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------|------------|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل        | <b>93</b>  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | <b>6.2</b> |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل  | <b>82</b>  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | <b>5.5</b> |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل               | <b>175</b> |                                                                           |            |

| <b>Module Evaluation</b><br><b>تقييم المادة الدراسية</b> |                     |             |                  |                                           |                           |
|----------------------------------------------------------|---------------------|-------------|------------------|-------------------------------------------|---------------------------|
|                                                          |                     | Time/Number | Weight (Marks)   | Week Due                                  | Relevant Learning Outcome |
| <b>Formative assessment</b>                              | <b>Quizzes</b>      | 4           | 20 % (20)        | 5, 8, ,11 and 13                          | All                       |
|                                                          | <b>Classwork</b>    | 10          | 12 % (10)        | 2, 3, 4, 6,7,9,10,12,14 and 15            | All                       |
|                                                          | <b>homework</b>     | 14          | 8 % (8)          | 2, 3, 4,5, 6,7,8,9,10,11, 12,13,14 and 15 | All                       |
| <b>Summative assessment</b>                              | <b>Midterm Exam</b> | 2hr         | 10% (10)         | 7                                         | All                       |
|                                                          | <b>Final Exam</b>   | 3hr         | 50% (50)         | 16                                        | All                       |
| <b>Total assessment</b>                                  |                     |             | 100% (100 Marks) |                                           |                           |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br><b>المنهاج الاسبوعي للمختبر</b> |                         |
|--------------------------------------------------------------------------------|-------------------------|
|                                                                                | <b>Material Covered</b> |

|            |                                                                  |
|------------|------------------------------------------------------------------|
| Week 1     | Introduction . Graphic instruments and their use. Types of lines |
| Week 2 - 5 | Graphic geometry and engineering applications                    |
| Week 6-8   | Theory of projection. Orthographic projection                    |
| Week 9-11  | Isometric drawing                                                |
| Week 12-13 | Missing view                                                     |
| Week 14-15 | Section                                                          |

| Learning and Teaching Resources<br>مصادر التعلم والتدريس |                                                                                                                                                           |                           |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                          | Text                                                                                                                                                      | Available in the Library? |
| Required Texts                                           | <ul style="list-style-type: none"> <li>T.E.French ,engineering drawing and graphic technology ( 1986 )</li> </ul>                                         | Yes                       |
| Recommended Texts                                        | <ul style="list-style-type: none"> <li>ثامر محمد نوري (كتاب الرسم الهندسي المساعد) 2021</li> </ul>                                                        | Yes                       |
|                                                          | <ul style="list-style-type: none"> <li>د.احمد العبيدي (الرسم الهندسي والهندسة الوصفية) 2021</li> </ul>                                                    | Yes                       |
| Websites                                                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme<br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |                                                                                                                                                                                                                                                                                                                                                |
| Module Title                                             | Environmental Thermodynamics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               | Module Delivery                                                                                                                                                                                                                                                                                                                                |
| Module Type                                              | Supportive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                               | <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Theory</li> <li><input checked="" type="checkbox"/> Lecture</li> <li><input checked="" type="checkbox"/> Lab</li> <li><input checked="" type="checkbox"/> Tutorial</li> <li><input type="checkbox"/> Practical</li> <li><input type="checkbox"/> Seminar</li> </ul> |
| Module Code                                              | ENV114                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |                                                                                                                                                                                                                                                                                                                                                |
| ECTS Credits                                             | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                               |                                                                                                                                                                                                                                                                                                                                                |
| SWL (hr/sem)                                             | 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                                                                                                                                                                                                                                                                                                                                                |
| Module Level                                             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Semester of Delivery          |                                                                                                                                                                                                                                                                                                                                                |
| Administering Department                                 | ENV8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | College                       | ENG4                                                                                                                                                                                                                                                                                                                                           |
| Module Leader                                            | Maan S. Mohammed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | e-mail                        | <a href="mailto:maandabbagh@uomosul.edu.iq">maandabbagh@uomosul.edu.iq</a>                                                                                                                                                                                                                                                                     |
| Module Leader's Acad. Title                              | Ass. Professor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Module Leader's Qualification | M.Sc                                                                                                                                                                                                                                                                                                                                           |
| Module Tutor                                             | Maan S. Mohammed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | e-mail                        | <a href="mailto:maandabbagh@uomosul.edu.iq">maandabbagh@uomosul.edu.iq</a>                                                                                                                                                                                                                                                                     |
| Peer Reviewer Name                                       | Maan S. Mohammed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | e-mail                        | <a href="mailto:maandabbagh@uomosul.edu.iq">maandabbagh@uomosul.edu.iq</a>                                                                                                                                                                                                                                                                     |
| Scientific Committee Approval Date                       | 3/10/2025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Version Number                | 2.0                                                                                                                                                                                                                                                                                                                                            |
| Relation with other Modules                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |                                                                                                                                                                                                                                                                                                                                                |
| العلاقة مع المواد الدراسية الأخرى                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |                                                                                                                                                                                                                                                                                                                                                |
| Prerequisite module                                      | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Semester                      |                                                                                                                                                                                                                                                                                                                                                |
| Co-requisites module                                     | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Semester                      |                                                                                                                                                                                                                                                                                                                                                |
| Module Aims, Learning Outcomes and Indicative Contents   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |                                                                                                                                                                                                                                                                                                                                                |
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |                                                                                                                                                                                                                                                                                                                                                |
| Module Aims<br>أهداف المادة الدراسية                     | <p>Students will be able to:</p> <ol style="list-style-type: none"> <li>Write clear the objectives of this integrated subject.</li> <li>Enable the student to know theoretical and practical concepts of the thermodynamic processes.</li> <li>Enable the student to know theoretical and practical concepts of the physics materials properties and heat effect on it.</li> <li>Enable the student to measure the temperature and pressure with conventional and modern measuring devices.</li> <li>Enable the student to know the types of energy and practice applications.</li> <li>Develop the fundamental principles and laws of thermodin and to explore the implications of these principles for system behavior including:</li> <li>formulate the models necessary to study.</li> <li>Enable the student to know the types of system and their applications and how to deal with its</li> <li>an ability to work with concepts mathematically, and a functional understanding of how these ideas play out in the real world.</li> <li>Analyze and design heat transfer systems through the application of these principles.</li> <li>Use graphs and diagrams to convey results.</li> <li>develop the problem-solving skills essential to good engineering practice of heat</li> </ol> |                               |                                                                                                                                                                                                                                                                                                                                                |

|                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                          | <p>transfer in real-world applications.</p> <p>13. Decide on strategies to be used and assumptions that need to be made.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p><b>Module Learning Outcomes</b><br/>مخرجات التعلم للمادة الدراسية</p> | <p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks:</p> <p><b>CLO 1:</b> Study of some concepts, definitions, and types of the systems.</p> <p><b>CLO 2:</b> Measurement of pressure and temperature and know and explain the devices work principle of temperature and pressure</p> <p><b>CLO 3:</b> Study the basic concepts of thermodynamics.</p> <p><b>CLO 4:</b> Develop a flexible and creative problem-solving ability and translate physical descriptions into mathematical equations.</p> <p><b>CLO 5:</b> Examine intermediate results or other quantities that could be used to ensure a solution.</p> <p><b>CLO 6:</b> Identify what they don't understand and ask specific questions to gain understanding and develop their ability to communicate ideas of science.</p> <p><b>CLO 7:</b> Enable the students who to use the programs of internet search to benefit sources, enable the student to prepare the daily special thermodynamics reports and prepare brochures which deal with the thermal effects on the environment.</p> <p><b>CLO 8:</b> Enable the student to work in research centers and industrial institutions.</p> <p><b>CLO 9:</b> Understand and apply the basic idea of heat transfer theorem to physical systems.</p> <p><b>CLO 10:</b> Study of types of energy and their application.</p> <p><b>CLO 11:</b> Study the difference between the closed and opened systems the mathematical models of the physical systems are explained and define and describe the steady state principle</p> <p><b>CLO 12:</b> The mode of Heat Transfer.</p> <p><b>CLO 13:</b> An ability to identify, analyze, and solve complex engineering problems according to principles of engineering, science, and mathematics.</p> <p><b>CLO 14:</b> An ability to acquire and apply new knowledge and using appropriate learning strategies.</p> <p><b>CLO 15:</b> An ability to participate and work professionally and ethically in different projects to function on multi-disciplinary teams.</p> |
| <p><b>Indicative Contents</b><br/>المحتويات الإرشادية</p>                | <p>Indicative content includes the following.</p> <p><b>Basic Quantities, including:</b> [10 hrs]</p> <ul style="list-style-type: none"> <li>State SI units and write the units and their abbreviations correctly.</li> <li>The advantage of developing the student's ability to understand thermodynamics objects.</li> <li>Know the types of energy and practice applications.</li> <li>Know the difference between heat transfer and work.</li> <li>How can be calculate the heat lost and gain from or by the system.</li> <li>How can be calculate the energy from or by the system.</li> <li>Distinguish heat transfer in the closed system.</li> <li>Distinguish work in the closed system.</li> </ul> <p><b>Types of energy and it is applications:</b> [10 hrs]</p> <ul style="list-style-type: none"> <li>State, explain, and apply different between the gage pressure.</li> <li>Differentiate between the pressure for the solid, liquid and gases.</li> <li>How can calculate and transfer the units.</li> <li>Solve problems using the</li> </ul> <p><b>The perfect gas law</b> [10hrs]</p> <ul style="list-style-type: none"> <li>What is the perfect gas (ideal gas)</li> <li>Study the general gas law.</li> <li>the behavior of many Gas constant, Boyle's law, Charles's law and Gay-Lussac's law.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>First law of thermodynamics and their application:</b> [10 hrs]</p> <ul style="list-style-type: none"> <li>In order to deal with the subject of applied thermodynamics rigorously it is necessary to know the difference between applications.</li> <li>The state of working fluid.</li> <li>Study the non-flow equation.</li> <li>Study the steady flow equation.</li> <li>The different between the closed system and open system and their application</li> </ul> <p><b>Heat Transfer:</b> [5 hrs]</p> <ul style="list-style-type: none"> <li>Heat Transfer by conduction.</li> <li>Heat Transfer by convection.</li> <li>Heat Transfer by radiation.</li> </ul> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Learning and Teaching Strategies

#### استراتيجيات التعلم والتعليم

|                                    |                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b><br>الاستراتيجيات | The primary strategy for delivering this module will be to encourage students to participate in the exercises while refining and expanding their critical thinking skills. This will be accomplished through classes, interactive tutorials, and the consideration of simple experiments involving sampling activities that students find interesting. |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Student Workload (SWL)

#### الحمل الدراسي للطالب

|                                                                         |     |                                                                     |     |
|-------------------------------------------------------------------------|-----|---------------------------------------------------------------------|-----|
| Structured SWL (h/sem)<br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 48  | Structured SWL (h/w)<br>الحمل الدراسي المنتظم للطالب أسبوعياً       | 3.2 |
| Unstructured SWL (h/sem)<br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 52  | Unstructured SWL (h/w)<br>الحمل الدراسي غير المنتظم للطالب أسبوعياً | 3.5 |
| Total SWL (h/sem)<br>الحمل الدراسي الكلي للطالب خلال الفصل              | 100 |                                                                     |     |

### Module Evaluation

#### تقييم المادة الدراسية

|                      |                     | Time/Number | Weight (Marks)   | Week Due         | Relevant Learning Outcome          |
|----------------------|---------------------|-------------|------------------|------------------|------------------------------------|
| Formative assessment | Quizzes             | 5           | 4% (20)          | 4,6,9,11, and 15 | CLO 1,2,10,11, and 12              |
|                      | Assignments         | 4           | 2% (8)           | 5,7,10,12        | CLO 1,2,11, and 12                 |
|                      | On-site Assignments | 2           | 2% (4)           | 3,8              | CLO 10, and 12                     |
|                      | Reports             | 2           | 4% (8)           | 5, and 13        | CLO 1,2,10,11, and 12              |
| Summative assessment | Midterm Exam        | 2hrs        | 10% (10)         | 7                | CLO1,2,3,4,5,6,7,8,9,10,11, and 12 |
|                      | Final Exam          | 3hrs        | 50% (50)         | 16               | All                                |
| Total assessment     |                     |             | 100% (100 Marks) |                  |                                    |

### Delivery Plan (Weekly Syllabus)

#### المنهاج الأسبوعي النظري

|        | Material Covered                   |
|--------|------------------------------------|
| Week 1 | Introduction, dimensions and unit. |

|                |                                                                                                                     |            |      |
|----------------|---------------------------------------------------------------------------------------------------------------------|------------|------|
|                | Some concepts and definitions and types of the systems.                                                             |            |      |
| <b>Week 2</b>  | Measurement of pressure and temperature                                                                             |            |      |
| <b>Week 3</b>  | Perfect gas laws                                                                                                    |            |      |
| <b>Week 4</b>  | Solved problems sheet No.1                                                                                          | Homework 1 | Quiz |
| <b>Week 5</b>  | Forms of Energy                                                                                                     |            |      |
| <b>Week 6</b>  | Solved problems sheet No.2                                                                                          | Homework 2 | Quiz |
| <b>Week 7</b>  | Mid-term Exam                                                                                                       |            |      |
| <b>Week 8</b>  | Thermodynamics laws / First law of thermodynamics<br>Thermodynamic processes - Applied to the closed system process |            |      |
| <b>Week 9</b>  | Solved problems sheet No.3                                                                                          | Homework 3 | Quiz |
| <b>Week 10</b> | Thermodynamic processes - Applied to the open system process                                                        |            |      |
| <b>Week 11</b> | Solved problems sheet No.4                                                                                          | Homework 4 | Quiz |
| <b>Week 12</b> | The modes of heat transfer                                                                                          |            |      |
| <b>Week 13</b> | Environmental application of Heat transfer                                                                          |            |      |
| <b>Week 14</b> | Isothermal and non-isothermal operations                                                                            |            |      |
| <b>Week 15</b> | Solved problems sheet No.5                                                                                          | Homework 5 | Quiz |
| <b>Week 16</b> | Final Exam of the semester                                                                                          |            |      |

### Learning and Teaching Resources

#### مصادر التعلم والتدريس

|                          | Text                                                                                                                                                      | Available in the Library? |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Required Texts</b>    | Applied thermodynamics fifth edition by t.d eastop and a. mcconkey                                                                                        | Yes                       |
| <b>Recommended Texts</b> | Y. A. Çengel and M. A. Boles, Thermodynamics: An Engineering Approach, 5th ed, McGraw-Hill, 2006                                                          | No                        |
| <b>Websites</b>          | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

### Grading Scheme

#### مخطط الدرجات

| Group                           | Grade                   | التقدير             | Marks (%) | Definition                                  |
|---------------------------------|-------------------------|---------------------|-----------|---------------------------------------------|
| <b>Success Group (50 - 100)</b> | <b>A - Excellent</b>    | امتياز              | 90 - 100  | Outstanding Performance.                    |
|                                 | <b>B - Very Good</b>    | جيد جدا             | 80 - 89   | Above average with some errors.             |
|                                 | <b>C - Good</b>         | جيد                 | 70 - 79   | Sound work with notable errors.             |
|                                 | <b>D - Satisfactory</b> | متوسط               | 60 - 69   | Fair but with major shortcomings.           |
|                                 | <b>E - Sufficient</b>   | مقبول               | 50 - 59   | Work meets minimum criteria.                |
| <b>Fail Group (0 – 49)</b>      | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)   | More work is required, but credit is given. |
|                                 | <b>F – Fail</b>         | راسب                | (0-44)    | A significant amount of work is required.   |
|                                 |                         |                     |           |                                             |

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |             |                               |                                                                                                                                                                                                                                          |
|------------------------------------|-------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |             |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Statistics  |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Core        |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input checked="" type="checkbox"/> Seminar |
| Module Code                        | ENV115      |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 3           |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 75          |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 1           | Semester of Delivery          |                                                                                                                                                                                                                                          |
| Administering Department           | ENV8        | College                       | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Abdulmuhsin | e-mail                        | mss_qzz@uomosul.edu.iq                                                                                                                                                                                                                   |
| Module Leader's Acad. Title        | Professor   | Module Leader's Qualification | M.Sc.                                                                                                                                                                                                                                    |
| Module Tutor                       | -----       | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Peer Reviewer Name                 | -----       | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Scientific Committee Approval Date | 3/11/2025   | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |      |          |       |
|-----------------------------------|------|----------|-------|
| العلاقة مع المواد الدراسية الأخرى |      |          |       |
| Prerequisite module               | None | Semester | ..... |
| Co-requisites module              | None | Semester | ..... |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | There is a need to know how to deal with a large amount of data. The objectives of this module are how to generate informative data and how to extract information from data and to explain the valuable methods to present these data and extract the conclusions from them. Additionally, the module includes how to describe the data in a clear manner.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <b>CLO-1:</b> Represent the collected data in a frequency table and histograms<br><b>CLO-2:</b> Identify the methods of statistical description<br><b>CLO-3:</b> Measure the deviation and dispersion of the data from the centre if it is symmetrical or skewed.<br><b>CLO-4:</b> Explaining the principles of probability and its use in statistical tests<br><b>CLO-5:</b> Using probability laws as tools to find the percentage of occasion occurrence.<br><b>CLO-6:</b> Employing probability distributions in decision-making<br><b>CLO-7:</b> Applying probability to test the hypotheses.<br><b>CLO-8:</b> Utilize normal distribution curve in the analysis of the problems.<br><b>CLO-9:</b> Using statistics as a tool for quality assurance of laboratory test.<br><b>CLO-10:</b> Test the relationships between variables. |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | Part A – Introduction to Statistics (3 hrs.)<br>Part B – Frequency distribution and data presentation (6 hrs.)<br>Part C – Measures of central tendency and variation (6 hrs.)<br>Part D – Probability distribution, rules and laws (6 hrs.)<br>Part E – Probability and combinatorial analysis (6 hrs.)<br>Part F – Normal distribution (6 hrs.)<br>Part G – Application of Normal distribution and hypotheses testing (9 hrs)<br>Part H – Correlation between variables                                                                                                                                                                                                                                                                                                                                                                |

| <b>Learning and Teaching Strategies</b><br><b>استراتيجيات التعلم والتعليم</b> |                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                             | This course will include lectures, individual & group assignments. Exercises will include different methods to treat the data statistically according to type of data. The course will be taught in Arabic, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| <b>Student Workload (SWL)</b><br><b>الحمل الدراسي للطالب محسوب لـ 15 اسبوعا</b>       |    |                                                                                  |     |
|---------------------------------------------------------------------------------------|----|----------------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br><b>الحمل الدراسي المنتظم للطالب خلال الفصل</b>       | 33 | <b>Structured SWL (h/w)</b><br><b>الحمل الدراسي المنتظم للطالب أسبوعيا</b>       | 2.2 |
| <b>Unstructured SWL (h/sem)</b><br><b>الحمل الدراسي غير المنتظم للطالب خلال الفصل</b> | 42 | <b>Unstructured SWL (h/w)</b><br><b>الحمل الدراسي غير المنتظم للطالب أسبوعيا</b> | 2.8 |
| <b>Total SWL (h/sem)</b><br><b>الحمل الدراسي الكلي للطالب خلال الفصل</b>              | 75 |                                                                                  |     |

| Module Evaluation<br>تقييم المادة الدراسية |              |             |                  |                     |                                                       |
|--------------------------------------------|--------------|-------------|------------------|---------------------|-------------------------------------------------------|
|                                            |              | Time/Number | Weight (Marks)   | Week Due            | Relevant Learning Outcome                             |
| Formative assessment                       | Quizzes      | 6           | 24% (24)         | 2, 3, 4, 5, 7, 8, 9 | CLO-1, CLO-2, CLO-3, CLO-4, CLO4, CLO5 and CLO-7      |
|                                            | Assignments  | 2           | 6% (6)           | 2, 7                | CLO-1, CLO-2, CLO-4 and CLO5                          |
|                                            | Report       | 1           | 4% (4)           | 8                   | CLO-7, CLO-10                                         |
|                                            | On site      | 1           | 6%(6)            | 2-13                | CLO-7, CLO-10                                         |
| Summative assessment                       | Midterm Exam | 1           | 10% (10)         | 10                  | (1)CLO-1, CLO-2, CLO-3;<br>(2) CLO-4, CLO-5 and CLO-6 |
|                                            | Final Exam   | 3hr         | 50% (50)         | 16                  | All                                                   |
| Total assessment                           |              |             | 100% (100 Marks) |                     |                                                       |

| Delivery Plan (Weekly Syllabus)<br>المنهاج الأسبوعي النظري |                                                                                                                                                                                |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                            | Material Covered                                                                                                                                                               |
| Week 1                                                     | Nature of Statistics: Introduction, statistical notations<br>Frequency Distributions: Frequency Distribution Table, Cumulative Frequency                                       |
| Week 2                                                     | Graphical presentation: Frequency Distribution, Cumulative Frequency Distribution.<br>Measures of central Tendency for raw and tabulated data: The Mean: Arithmetic, Geometric |
| Week 3                                                     | Harmonic mean, Median, Mode.<br>Measures of Dispersion or Variation: Range, Mean Deviation,                                                                                    |
| Week 4                                                     | Variance and Standard deviation for raw and tabulated data, Standardized score, Relationship between central tendency measures and unimodal distribution                       |
| Week 5                                                     | Probability and distributions: Sample space,                                                                                                                                   |
| Week 6                                                     | probability rules, events and cases                                                                                                                                            |
| Week 7                                                     | Probability laws: Addition law, Multiplication law.                                                                                                                            |
| Week 8                                                     | Combinations and permutations.                                                                                                                                                 |
| Week 9                                                     | Probability and Combinatorial analysis                                                                                                                                         |
| Week 10                                                    | Normal distribution                                                                                                                                                            |
| Week 11                                                    | Application of Normal distribution                                                                                                                                             |
| Week 12                                                    | Hypotheses testing: Z-test                                                                                                                                                     |
| Week 13                                                    | t distribution: t-test for a mean                                                                                                                                              |
| Week 14                                                    | Chi-square distribution: Chi-square test for variance and standard deviation                                                                                                   |
| Week 15                                                    | Correlation : Correlation coefficient                                                                                                                                          |
| Week 16                                                    | Preparatory week before the final Exam                                                                                                                                         |

| Learning and Teaching Resources |                                                                                                                                                           |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                           |                           |
|                                 | Text                                                                                                                                                      | Available in the Library? |
| Required Texts                  | Introduction to Statistics by Al-Rawi Kh.                                                                                                                 | Yes                       |
| Recommended Texts               | <ul style="list-style-type: none"> <li>Statistics for Sanitary Engineers by Berthouex and Brown, 2<sup>nd</sup> ed. (2002)</li> </ul>                     | No                        |
| Websites                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                            |                      |                                                                                                                                                                                                                                          |                                                                                                                                                            |
|------------------------------------|--------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                            |                      |                                                                                                                                                                                                                                          |                                                                                                                                                            |
| Module Title                       | Calculus 2                                 |                      | Module Delivery                                                                                                                                                                                                                          |                                                                                                                                                            |
| Module Type                        | Support or related learning activity       |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                                                                                                                                            |
| Module Code                        | ENV121                                     |                      |                                                                                                                                                                                                                                          |                                                                                                                                                            |
| ECTS Credits                       | 6                                          |                      |                                                                                                                                                                                                                                          |                                                                                                                                                            |
| SWL (hr/sem)                       | 150                                        |                      |                                                                                                                                                                                                                                          |                                                                                                                                                            |
| Module Level                       | 1                                          | Semester of Delivery |                                                                                                                                                                                                                                          | 2                                                                                                                                                          |
| Administering Department           | ENV8                                       | College              | ENG4                                                                                                                                                                                                                                     |                                                                                                                                                            |
| Module Leader                      | Mayada Hazim                               |                      | e-mail                                                                                                                                                                                                                                   | <a href="mailto:mayada.hmah@uomosul.edu.iq">mayada.hmah@uomosul.edu.iq</a>                                                                                 |
| Module Leader's Acad. Title        | Lecturer                                   |                      | Module Leader's Qualification                                                                                                                                                                                                            | M.Sc.                                                                                                                                                      |
| Module Tutor                       | Abeer Khalil Ibrahim<br>Aya Thamer Ibrahim |                      | e-mail                                                                                                                                                                                                                                   | <a href="mailto:abeer.alsaraf@uomosul.edu.iq">abeer.alsaraf@uomosul.edu.iq</a><br><a href="mailto:aya.thamer@uomosul.edu.iq">aya.thamer@uomosul.edu.iq</a> |
| Peer Reviewer Name                 | Mayada Hazim                               |                      | e-mail                                                                                                                                                                                                                                   | <a href="mailto:mayada.hmah@uomosul.edu.iq">mayada.hmah@uomosul.edu.iq</a>                                                                                 |
| Scientific Committee Approval Date | 19/10/2025                                 |                      | Version Number                                                                                                                                                                                                                           | 2.0                                                                                                                                                        |

| Relation with other Modules       |        |  |          |   |
|-----------------------------------|--------|--|----------|---|
| العلاقة مع المواد الدراسية الأخرى |        |  |          |   |
| Prerequisite module               | ENV111 |  | Semester | 1 |
| Co-requisites module              |        |  | Semester |   |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>The aim of this course is to introduce the students to the main topics of Calculus. The course will cover Integration, Applications of Definite Integrals, The Calculus of Transcendental Function, Techniques of Integration and Polar Coordinates. At the end of the course, students will have a broad knowledge of the basic concepts of integration, techniques of integration, applications of definite integrals, and Polar coordinates. This will be achieved through theoretical lectures, tutorials and homework.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO-1:</b> Recognize indefinite integrals and definite integral and know the basic properties(i).</p> <p><b>CLO-2:</b> Use applications of definite integral to find areas between curves, volumes, lengths of plane curves and areas of surfaces of revolution(ii).</p> <p><b>CLO-3:</b> Identified and understand of transcendental functions and know the basic properties(i).</p> <p><b>CLO-4:</b> Applied techniques of integration to change unfamiliar integrals into integrals we can recognize and solve(i).</p> <p><b>CLO-5:</b> Identified and understand of Polar Coordinates and know the basic properties(i).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p><b>Indicative content includes the following.</b></p> <p><u>Part A – Integration</u><br/> Calculus and Area, Formulas for Finite sums, Definite Integrals, The Fundamental Theorems of Integral Calculus, Indefinite Integrals, Integration by Substitution –Running the Chain Rule Backward(10 hrs).</p> <p><u>Part B –Applications of Definite Integrals</u><br/> Areas between Curves, Calculus and Area, Volumes of Solids of Revolution-Disks and Washers, Cylindrical Shells-An Alternative to Washers, Lengths of Curves in the Plane, Areas of Surfaces of Revolution(15 hrs).</p> <p><u>Part C –The Calculus of Transcendental Function</u><br/> Inverse Function and Their Derivatives, <math>\ln x</math>, <math>e^x</math>, and Logarithmic Differentiation, Indeterminate Forms and Hospital's Rule, Other Exponential and Logarithmic Function, The Inverse Trigonometric Function, Derivatives of Inverse Trigonometric Functions(15 hrs).</p> <p><u>Part D - Techniques of Integration</u><br/> Basic Integration Formulas, Integration by Parts, Trigonometric Integrals, Trigonometric Substitutions, Rational Functions and Partial Fractions, Using Integral Tables. Improper Integrals. (20 hrs).</p> |

|                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |     |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----|
|                                                                                | <u>Part E - Plane Curves and Polar Coordinates</u><br>Polar Coordinates: Definition of Polar Coordinates, Negative Values of r, Changing to Radian Measure, The Use of Radian Measure, Elementary Coordinate Equations and Inequalities, Cartesian Versus Polar Coordinates, Graphing in Polar Coordinates: Symmetry and Slope, Faster Graphing, Finding the Points Where Curves Intersect. (15 hrs).                                                 |                                                                           |     |
| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم         |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |     |
| <b>Strategies</b><br>الاستراتيجيات                                             | Expanding students' perceptions of Calculus, familiarity with basic Calculus concepts and principles, and the ability to distinguish between different mathematical concepts. This course has several components that include studying lectures, tutorial, discussion, homework, and e-learning platforms. The course will be taught in English, and all compulsory assignments have to be submitted within the deadlines to be admitted to the exam. |                                                                           |     |
| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا       |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 78                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 72                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 4.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 150                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                           |     |

| <b>Module Evaluation</b><br>تقييم المادة الدراسية |                    |             |                  |                    |                                    |
|---------------------------------------------------|--------------------|-------------|------------------|--------------------|------------------------------------|
|                                                   |                    | Time/Number | Weight (Marks)   | Week Due           | Relevant Learning Outcome          |
| Formative assessment                              | Quizzes            | 5           | 5% (25)          | 3, 5, ,8,11 and 14 | CLO-1, CLO-2, CLO-3, CLO-4, CLO-5  |
|                                                   | Online Assignments | 1           | 3% (3)           | 6                  | CLO-1, CLO-2.                      |
|                                                   | Onsite Assignment  | 4           | 2% (8)           | 3, 6, 9, 12 and 15 | CLO-1, CLO-2, CLO-3, CLO-4, CLO-5. |
|                                                   | Projects / Lab.    | 0           | 0                | 0                  |                                    |
|                                                   | Report             | 1           | 4% (4)           | 12                 | CLO-1, CLO-2, CLO-3, CLO-4.        |
| Summative assessment                              | Midterm Exam       | 2hrs        | 10% (10)         | 9                  | CLO-1, CLO -2, CLO -3,             |
|                                                   | Final Exam         | 3hrs        | 50% (50)         | 16                 | All                                |
| Total assessment                                  |                    |             | 100% (100 Marks) |                    |                                    |

## Delivery Plan (Weekly Syllabus)

### المنهاج الاسبوعي النظري

|                | Material Covered                                                                                                                      |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Week 1</b>  | Calculus and Area, Formulas for Finite sums, Definite Integrals, The Fundamental Theorems of Integral Calculus, Indefinite Integrals, |
| <b>Week 2</b>  | Integration by Substitution –Running the Chain Rule Backward.                                                                         |
| <b>Week 3</b>  | Areas between Curves, Calculus and Area.                                                                                              |
| <b>Week 4</b>  | Volumes of Solids of Revolution-Disks and Washers, Cylindrical Shells-An Alternative to Washers.                                      |
| <b>Week 5</b>  | Lengths of Curves in the Plane, Areas of Surfaces of Revolution                                                                       |
| <b>Week 6</b>  | Inverse Function and Their Derivatives, $\ln x$ , $e^x$ , and Logarithmic Differentiation                                             |
| <b>Week 7</b>  | Indeterminate Forms and Hospital's Rule, Other Exponential and Logarithmic Function.                                                  |
| <b>Week 8</b>  | The Inverse Trigonometric Function, Derivatives of Inverse Trigonometric Functions.                                                   |
| <b>Week 9</b>  | Basic Integration Formulas, Integration by Parts.                                                                                     |
| <b>Week 10</b> | Trigonometric Integrals, Trigonometric Substitutions.                                                                                 |
| <b>Week 11</b> | Rational Functions and Partial Fractions.                                                                                             |
| <b>Week 12</b> | Using Integral Tables. Improper Integrals.                                                                                            |
| <b>Week 13</b> | Polar Coordinates: Definition of Polar Coordinates, Negative Values of $r$ , Changing to Radian Measure, The Use of Radian Measure.   |
| <b>Week 14</b> | Elementary Coordinate Equations and Inequalities, Cartesian Versus Polar Coordinates,                                                 |
| <b>Week 15</b> | Graphing in Polar Coordinates: Symmetry and Slope, Faster Graphing, Finding the Points Where Curves Intersect.                        |
| <b>Week 16</b> | <b>Preparatory week before the final Exam</b>                                                                                         |

| Learning and Teaching Resources                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                           |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------|---------------------------------------|
| مصادر التعلم والتدريس                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                           |                     |          |                                       |
|                                                                                                                                                                                                                                                                                                                                                                                      | Text                                                                                                                                                      |                     |          | Available in the Library?             |
| Required Texts                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"><li>Finney, R.L. &amp; Thomas, G.B, "Calculus" Addison. Wesley publishing company, USA,11th,2011.</li></ul>             |                     |          | Yes                                   |
| Recommended Texts                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"><li>Anton, H., Bivens, I.C., Davis, S., Calculus: Early Transcendentals, Wiley, 10th edition, 2011.</li></ul>           |                     |          | Yes                                   |
| Websites                                                                                                                                                                                                                                                                                                                                                                             | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                     |          |                                       |
| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                           |                     |          |                                       |
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                           |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                                                                                                                                                     | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent                                                                                                                                             | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good                                                                                                                                             | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good                                                                                                                                                  | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory                                                                                                                                          | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient                                                                                                                                            | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail                                                                                                                                                 | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail                                                                                                                                                  | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                           |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                                                                                                                                                           |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |              |                               |                                                                                                                                                                                                                                          |
|------------------------------------|--------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |              |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Dynamics     |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Support      |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV122       |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 5            |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 125          |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 1            | Semester of Delivery          | 2                                                                                                                                                                                                                                        |
| Administering Department           | ENV8         | College                       | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Salim Yousef | e-mail                        | <a href="mailto:sua@uomosul.edu.iq">sua@uomosul.edu.iq</a>                                                                                                                                                                               |
| Module Leader's Acad. Title        | Lecturer     | Module Leader's Qualification | Phd                                                                                                                                                                                                                                      |
| Module Tutor                       | Salim Yousef | e-mail                        |                                                                                                                                                                                                                                          |
| Peer Reviewer Name                 | Salim Yousef | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Scientific Committee Approval Date | 17/09/2025   | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |      |          |   |
|-----------------------------------|------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |      |          |   |
| Prerequisite module               | None | Semester | 0 |
| Co-requisites module              | None | Semester |   |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <ul style="list-style-type: none"> <li>To learn basic concepts and system of forces.</li> <li>To enable students to understand the relationship of physical processes, kinetics and kinematics.</li> <li>To develop skills to use the basic principles of mechanics in engineering applications.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO#1:</b> To define and explain principles of engineering mechanics (dynamics) related to experimental engineering domain.</p> <p><b>CLO#2:</b> The ability to draw Free Body Diagram and label the reactions on it</p> <p><b>CLO#3:</b> To solve problems of dynamics using principles of engineering mechanics.</p> <p><b>CLO#4:</b> To discuss and clarify concepts of principles of engineering mechanics (dynamics) for different simple situations.</p> <p><b>CLO#5:</b> To prepare free body diagrams of real case phenomenon considering engineering mechanics point of view.</p> <p><b>CLO#6:</b> To understand Newton's law in motion and recognize different kinds of particle motions.</p> <p><b>CLO#7:</b> To understand the principle of Newton's second law, work, power, and efficiency.</p> <p><b>CLO#8:</b> To understand the principle of Linear Impulse and Momentum for a System of Particles, and the concept of a conservative force.</p> <p><b>CLO#9:</b> Application of principles of work-Energy and Impulse-momentum in the dynamic analysis.</p> <p><b>CLO#10:</b> An ability to identify, analyze, and solve complex engineering problems according to principles of engineering, science, and mathematics.</p> <p><b>CLO#11:</b> An ability to acquire and apply new knowledge and using appropriate learning strategies.</p> <p><b>CLO#12:</b> An ability to participate and work professionally and ethically in different projects to function on multi-disciplinary teams.</p> |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p><b><u>Part A: Basic Considerations</u></b></p> <ul style="list-style-type: none"> <li>To introduce the concepts of position, displacement, velocity, and acceleration.</li> <li>Vector Operations <ul style="list-style-type: none"> <li>Algebra and Computations</li> <li>Vector Calculus—Velocity and Acceleration</li> </ul> </li> <li>Newtonian Mechanics <ul style="list-style-type: none"> <li>Newton's Laws</li> <li>Systems of Units</li> <li>Energy and Momentum</li> </ul> </li> </ul> <p><b><u>Part B: Particle Kinematics</u></b></p> <ul style="list-style-type: none"> <li>Rectilinear Kinematics: Continuous Motion</li> <li>Curvilinear Motion: <ul style="list-style-type: none"> <li>Rectangular Components</li> <li>Normal and Tangential Components</li> </ul> </li> <li>Rectangular Cartesian Coordinates</li> <li>Curvilinear Coordinates <ul style="list-style-type: none"> <li>Cylindrical and Polar Coordinates</li> <li>Spherical Coordinates</li> <li>Arbitrary Curvilinear Coordinates</li> </ul> </li> <li>Motion of a Projectile</li> <li>Absolute Dependent Motion Analysis of Two Particles</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Part C: Relative Motion</b></p> <ul style="list-style-type: none"> <li>• Coordinate Transformations <ul style="list-style-type: none"> <li>◦ Rotation Transformations</li> <li>◦ Rotation Sequences</li> </ul> </li> <li>• Displacement</li> <li>• Time Derivatives <ul style="list-style-type: none"> <li>◦ Angular Velocity and Acceleration</li> <li>◦ Analytical Description</li> </ul> </li> <li>• Velocity and Acceleration Analysis Using a Moving Reference Frame</li> <li>• Observations from a Moving Reference Frame.</li> </ul> <p><b>Part D – Particle Kinetics</b></p> <ul style="list-style-type: none"> <li>• Newton's Second Law of Motion</li> <li>• Equation of Motion: Rectangular Coordinates</li> <li>• Investigate central-force motion and apply it to problems in space mechanics.</li> <li>• The principle of work and energy</li> <li>• Power and Efficiency</li> <li>• Principle of Linear Impulse and Momentum for a System of Particles</li> <li>• The concept of a conservative force</li> <li>• Theorem of conservation of energy to solve kinetic problems.</li> <li>• Friction Forces and Spring Forces.</li> </ul> |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | This course has several components that include lectures, individual & group assignments, Exercises. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا       |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 48  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 3.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 77  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 5.1 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 125 |                                                                           |     |

| Module Evaluation     |                     |             |                  |                   |                                                                   |
|-----------------------|---------------------|-------------|------------------|-------------------|-------------------------------------------------------------------|
| تقييم المادة الدراسية |                     |             |                  |                   |                                                                   |
|                       |                     | Time/Number | Weight (Marks)   | Week Due          | Relevant Learning Outcome                                         |
| Formative assessment  | Quizzes             | 5           | 3% (15)          | 3,5,10,12, and 14 | CLO#2, CLO#3, CLO#4, CLO#6, CLO#7, CLO#8, and CLO#9               |
|                       | On-site Assignments | 5           | 2% (10)          | 2,4,9,11, and 13  | CLO#1, CLO#2, CLO#3, CLO#4, CLO#5, CLO#6, CLO#7, CLO#8, and CLO#9 |
|                       | Report              | 1           | 5% (5)           | 6                 | CLO#10, CLO#11, and CLO#12                                        |
|                       | Online Assignment   | 5           | 2% (10)          | 2,4,9,11, and 13  | CLO#1, CLO#2, CLO#3, CLO#4, CLO#5, CLO#6, CLO#7, CLO#8, and CLO#9 |
| Summative assessment  | Midterm Exam        | 2hr         | 10% (10)         | 7                 | CLO#1, CLO#2, CLO#3, CLO#4, CLO#5, and CLO#6                      |
|                       | Final Exam          | 3hr         | 50% (50)         | 16                | All                                                               |
| Total assessment      |                     |             | 100% (100 Marks) |                   |                                                                   |

| Delivery Plan (Weekly Syllabus) |                                                                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                                                                                |
|                                 | Material Covered                                                                                                                                               |
| Week 1                          | Introduction to concepts of position, displacement, velocity, and acceleration.                                                                                |
| Week 2                          | Vector Operations: Algebra and Computations and Vector Calculus—Velocity and Acceleration.                                                                     |
| Week 3                          | Newtonian Mechanics: Newton's Laws, Systems of Units, and Energy and Momentum                                                                                  |
| Week 4                          | Rectilinear Kinematics: Continuous Motion.<br>Curvilinear Motion: Rectangular Components, and Normal and Tangential Components                                 |
| Week 5                          | Rectangular Cartesian Coordinates<br>Curvilinear Coordinates: Cylindrical and Polar Coordinates, Spherical Coordinates, and Arbitrary Curvilinear Coordinates. |
| Week 6                          | Motion of a Projectile and Absolute Dependent Motion Analysis of Two Particles.                                                                                |
| Week 7                          | Coordinate Transformations: Rotation Transformations, and Rotation Sequences                                                                                   |
| Week 8                          | Displacement, Time Derivatives: Angular Velocity and Acceleration, and Analytical Description.                                                                 |
| Week 9                          | Velocity and Acceleration Analysis Using a Moving Reference Frame.                                                                                             |

|                |                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------|
| <b>Week 10</b> | Observations from a Moving Reference Frame.                                                                  |
| <b>Week 11</b> | Newton's Second Law of Motion and Equation of Motion: Rectangular Coordinates                                |
| <b>Week 12</b> | Investigate central-force motion and apply it to problems in space mechanics.                                |
| <b>Week 13</b> | The principle of work and energy, and Power and Efficiency                                                   |
| <b>Week 14</b> | Principle of Linear Impulse and Momentum for a System of Particles, and the concept of a conservative force. |
| <b>Week 15</b> | Theorem of conservation of energy to solve kinetic problems, and Friction Forces and Spring Forces.          |
| <b>Week 16</b> | Final Exam of the semester                                                                                   |

| Learning and Teaching Resources |                                                                                                                                                                                    |                           |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                                                    |                           |
|                                 | Text                                                                                                                                                                               | Available in the Library? |
| <b>Required Texts</b>           | <ul style="list-style-type: none"> <li>Hibbeler, R.C. " ENGINEERING MECHANICS – DYNAMIC 14<sup>TH</sup> EDITION 2016" Pearson Prentice Hall</li> </ul>                             | Yes                       |
| <b>Required Texts</b>           | <ul style="list-style-type: none"> <li>MERIAM J.L., KRAIGE L.G., BOLTON J.N. " Engineering Mechanics Volume 2 Dynamics " Ninth Edition 2018 John Wiley &amp; Sons, Inc.</li> </ul> | Yes                       |
| <b>Recommended Texts</b>        | د.نزار جبرائيل - فخري ياسين – د.هشام العناز "الميكانيك الهندسي"                                                                                                                    | Yes                       |
| <b>Recommended Texts</b>        | MERIAM J.L., KRAIGE L.G., BOLTON J.N. " Engineering Mechanics Volume 2 Dynamics " Ninth Edition 2018 John Wiley & Sons, Inc.                                                       | No                        |
| <b>Websites</b>                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a>                          |                           |

| Grading Scheme                      |                         |                     |          |                                       |
|-------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                        |                         |                     |          |                                       |
| Group                               | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group<br/>(50 - 100)</b> | <b>A - Excellent</b>    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                     | <b>B - Very Good</b>    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                     | <b>C - Good</b>         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                     | <b>D - Satisfactory</b> | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                     | <b>E - Sufficient</b>   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>      | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                     | <b>F – Fail</b>         | راسب                | (0-44)   | Considerable amount of work required  |
|                                     |                         |                     |          |                                       |

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

## MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

| Module Information                 |                                         |                               |                                                                                                                                                                                                                                                     |
|------------------------------------|-----------------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                         |                               |                                                                                                                                                                                                                                                     |
| Module Title                       | Principles of Environmental engineering |                               | Module Delivery                                                                                                                                                                                                                                     |
| Module Type                        | core                                    |                               | <input checked="" type="checkbox"/> Theory<br><input checked="" type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input checked="" type="checkbox"/> Seminar |
| Module Code                        | ENV123                                  |                               |                                                                                                                                                                                                                                                     |
| ECTS Credits                       | 4                                       |                               |                                                                                                                                                                                                                                                     |
| SWL (hr/sem)                       | 100                                     |                               |                                                                                                                                                                                                                                                     |
| Module Level                       | 1                                       | Semester of Delivery          | 2                                                                                                                                                                                                                                                   |
| Administering Department           | Environmental Engineering (EE)          | College                       | College of Engineering                                                                                                                                                                                                                              |
| Module Leader                      | Hanan Haqi Ismael                       | e-mail                        | hanan.eng2014@uomosul.edu.iq                                                                                                                                                                                                                        |
| Module Leader's Acad. Title        | Lecturer                                | Module Leader's Qualification | MSC                                                                                                                                                                                                                                                 |
| Module Tutor                       | Thura Azzam Abed                        | e-mail                        | thura.azzam@uomosul.edu.iq                                                                                                                                                                                                                          |
| Peer Reviewer Name                 | Dr. Amar Thamer                         | e-mail                        | Dr.ammarthamir@uomosul.edu.iq                                                                                                                                                                                                                       |
| Scientific Committee Approval Date | 15/9/2025                               | Version Number                | 1.0                                                                                                                                                                                                                                                 |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| Module Aims, Learning Outcomes and Indicative Contents   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Module Aims</b><br>أهداف المادة الدراسية              | The aim of the course is to introduce the student to the main principles of environmental engineering and everything related to environmental pollution: an introduction to the environment, environmental pollution, and the factors that lead to environmental deterioration. Types of pollution (water pollution, air pollution, noise pollution, thermal pollution, water pollution, water sources and their characteristics, Chemical and physical properties of water, water quality, surface water pollution and its sources, groundwater pollution and its sources, treatment of water for drinking purposes with a table of units and a brief explanation of each unit, Treatment and disposal of waste water, |

|                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                      | characteristics of waste water, treatment objective, plan of waste water treatment units<br>Treatment and disposal of waste water, characteristics of waste water, treatment goal, plan of waste water treatment units, with site visits being conducted to identify the treatment units and environmental projects established and under implementation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Module Learning Outcomes</b><br><br>مخرجات التعلم للمادة الدراسية | 1. Understanding the environment, its surrounding factors, types of pollution, and how to preserve it architecturally.<br>2. Summarizing the common types of pollution (water pollution, air pollution, etc.)<br>3. Explaining each type of environmental pollution with ways to treat it or reduce its effects on the environment.<br>4. Introducing the student to many environmental terms.<br>5. Analyzing some environmental problems using engineering methods.<br>6. Finding engineering solutions that are compatible with available capabilities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Indicative Contents</b><br><br>المحتويات الإرشادية                | 1. Introduction to the environment and environmental pollution CLO1 2 hours.<br>2. Surface and groundwater pollution with treatment units. CLO2.<br>Water sources and their characteristics, chemical and physical properties of water. Surface water pollution and its sources, groundwater pollution and its sources. Treatment of water for drinking purposes with a table of units and a brief explanation of each unit. Solving problems using the mass balance method. 10 hours.<br>3. Environmental pollution with solid waste. CLO3<br>Introduction, sources and characteristics of solid waste, solid waste, solid waste collection, solid waste disposal methods. Finding the area of the sanitary landfill site with drawing typical sections. 10 hours.<br>4. air pollution. CLO4<br>Introduction to air pollution, its sources and effects, characteristics of pollutants, air pollutant removal units. 5 hours<br>5. Noise, thermal and radiation pollution. CLO5 10 hours<br>Introduction to noise pollution, its sources, how to calculate noise, introduction to thermal pollution, sources of thermal pollution, the effect of thermal emissions on the environment. Radioactive pollution, its sources and types. |

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | This course will include many in-person and electronic lectures. The student will also be assigned assignments and reports. Field visits will be conducted for students to some environmental projects. The language of instruction will be in Arabic, and Arabic and English methodical books will be approved. |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعاً      |     |                                                                            |     |
|--------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 63  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعياً       | 4.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 37  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعياً | 2.5 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | 100 |                                                                            |     |

| <b>Module Evaluation</b><br>تقييم المادة الدراسية |                          |             |                  |            |                                   |
|---------------------------------------------------|--------------------------|-------------|------------------|------------|-----------------------------------|
|                                                   |                          | Time/Number | Weight (Marks)   | Week Due   | Relevant Learning Outcome         |
| <b>Formative assessment</b>                       | <b>Quizzes</b>           | 4           | 20%              | 4, 8,10,12 | CLO-1, CLO-1, CLO-2, CLO-2        |
|                                                   | <b>Homework</b>          | 3           | 12%              | 5, 7,9,11  | CLO-2, CLO-2, CLO-3, CLO-2, CLO-3 |
|                                                   | <b>Report</b>            | 1           | 4%               | 13-1       | CLO-2 to CLO-5                    |
|                                                   | <b>Class assignments</b> | 1           | 4%               | 12-4       | CLO-2 to CLO-5                    |
| <b>Summative assessment</b>                       | <b>Midterm Exam</b>      | 1.5 hr      | 10%              | 6          | All                               |
|                                                   | <b>Final Exam</b>        | 3hr         | 50%              | 16         | CLO-1, CLO -2 and CLO-3           |
| <b>Total assessment</b>                           |                          |             | 100% (100 Marks) |            | All                               |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري والالكتروني |                                                                                                                                                                                         |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                               | <b>Week Material Covered</b>                                                                                                                                                            |
| <b>Week 1</b>                                                                 | The environment, the factors that led to its deterioration, the role of the environmental engineer to reduce pollution, types of environmental pollution.                               |
| <b>Week 2</b>                                                                 | Water pollution: sources of water and their characteristics, chemical and physical properties of water, surface water pollution and its sources, groundwater pollution and its sources. |
| <b>Week 3</b>                                                                 | Mass balance, lakes, the phenomenon of thermal stratification, nutrients, seasonal reversals, solving mathematical problems. Concentrations of pollutants in lakes are not found.       |
| <b>Week 4</b>                                                                 | Drinking water treatment plant, factors that must be studied to select units.                                                                                                           |
| <b>Week 5</b>                                                                 | Drawing of a typical treatment unit for treating surface and ground drinking water, with a simplified explanation of each unit.                                                         |
| <b>Week 6</b>                                                                 | Wastewater treatment units, their sources and characteristics, a simplified explanation of a typical treatment unit.                                                                    |
| <b>Week 7</b>                                                                 | Exam 1                                                                                                                                                                                  |
| <b>Week 8</b>                                                                 | Environmental pollution with solid waste, introduction, sources and characteristics of solid waste, solid waste, solid waste collection.                                                |
| <b>Week 9</b>                                                                 | Solid waste disposal methods. Calculating the area of the sanitary tract site with a typical section                                                                                    |

|                |                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|
|                | drawing.                                                                                                                                    |
| <b>Week 10</b> | Air pollution, introduction to air pollution, its sources and effects, characteristics of pollutants.                                       |
| <b>Week 11</b> | Units for removing air pollutants and particles, solving mathematical problems.                                                             |
| <b>Week 12</b> | Noise pollution, introduction to noise pollution, its sources, how to calculate noise.                                                      |
| <b>Week 13</b> | Exam 2                                                                                                                                      |
| <b>Week 14</b> | Thermal pollution, Introduction to thermal pollution, sources of thermal pollution, and the effect of thermal emissions on the environment. |
| <b>Week 15</b> | <b>Radioactive pollution. Its sources. Types of radiation that are harmful to the environment. Methods of prevention.</b>                   |
| <b>Week 16</b> | <b>Preparing for the final exam.</b>                                                                                                        |

| Learning and Teaching Resources |                                                                                                                                                           |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                           |                           |
|                                 | Text                                                                                                                                                      | Available in the Library? |
| <b>Required Texts</b>           | Environmental Technology Dr. Tariq Muhammad Saeed                                                                                                         |                           |
| <b>Recommended Texts</b>        | Metcalf and Eddy "Wastewater engineering, treatment and resource recovery", McGraw hill, New York, 2014.                                                  |                           |
| <b>Websites</b>                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                         |                     |           |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|-----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                         |                     |           |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks (%) | Definition                            |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A - Excellent</b>    | امتياز              | 90 - 100  | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B - Very Good</b>    | جيد جدا             | 80 - 89   | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C - Good</b>         | جيد                 | 70 - 79   | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D - Satisfactory</b> | متوسط               | 60 - 69   | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E - Sufficient</b>   | مقبول               | 50 - 59   | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                       | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)   | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F – Fail</b>         | راسب                | (0-44)    | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |           |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |           |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                   |                      |                                                                                                                                                                                                                                          |                                |
|------------------------------------|-------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| معلومات المادة الدراسية            |                   |                      |                                                                                                                                                                                                                                          |                                |
| Module Title                       | Geology           |                      | Module Delivery                                                                                                                                                                                                                          |                                |
| Module Type                        | Supported         |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input checked="" type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                |
| Module Code                        | ENV124            |                      |                                                                                                                                                                                                                                          |                                |
| ECTS Credits                       | 3                 |                      |                                                                                                                                                                                                                                          |                                |
| SWL (hr/sem)                       | 75                |                      |                                                                                                                                                                                                                                          |                                |
| Module Level                       | 1                 | Semester of Delivery |                                                                                                                                                                                                                                          | 2                              |
| Administering Department           | ENV8              | College              | ENG4                                                                                                                                                                                                                                     |                                |
| Module Leader                      | Dr. Mohammed      |                      | e-mail                                                                                                                                                                                                                                   | mohammed1979eng@uomosul.edu.iq |
| Module Leader's Acad. Title        | Assist. Professor |                      | Module Leader's Qualification                                                                                                                                                                                                            | Ph.D.                          |
| Module Tutor                       | -----             |                      | e-mail                                                                                                                                                                                                                                   | E-mail                         |
| Peer Reviewer Name                 | -----             |                      | e-mail                                                                                                                                                                                                                                   | E-mail                         |
| Scientific Committee Approval Date | 12/09/2025        |                      | Version Number                                                                                                                                                                                                                           | 1.0                            |

| Relation with other Modules       |      |  |          |
|-----------------------------------|------|--|----------|
| العلاقة مع المواد الدراسية الأخرى |      |  |          |
| Prerequisite module               | None |  | Semester |
| Co-requisites module              | None |  | Semester |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>This course aims to introduce the students to the category of Environmental Geology. Geology –is the study of the earth, its materials and their properties, its internal and external physical, chemical, and biological properties, and its history. Environment – anything, living or nonliving that surrounds and influences living organisms. Environmental Geology – the application of geology to environmental concerns. This will be achieved through descriptive lectures.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p>Important: Write at least 6 Learning Outcomes, it is better to be equal to the number of study weeks.</p> <p><b>CLO-1:</b> The students will learn and take some information on the principles of geology, especially the earth's materials and compounds. (i)</p> <p><b>CLO-2:</b> The students will be able to distinguish the different types of rocks and soils(ii)</p> <p><b>CLO-3:</b> apply the principles of the contour line to draw topographic maps (iii)</p> <p><b>CLO-4:</b> The student who completes the course can communicate orally with others about some topics related to the relationship between environment and earth science and write some simple reports in this regard (v)</p> <p><b>CLO-5:</b> Report the data obtained from the selective topics of environmental geology given and organized during the course (iv)</p> <p><b>CLO-6:</b> Creating some opinions about the emerging environmental issues and trying to give some solutions compatible with the problems related to environmental geology (vii)</p> |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p>Indicative content includes the following.</p> <p><u>Part A Introduction</u><br/> Introduction, objectives, the general definition of environmental geology<br/> Historical geology (4 hrs)</p> <p><u>Part B – Structural Geology</u><br/> Composition, formation of the earth's crust, types of rocks (8 hrs)</p> <p><u>Part C – Geology of water</u><br/> Geology of water supply, (part1) Surface Water, (part2) Ground Water<br/> Geology of dams and reservoirs (8 hrs)</p> <p><u>Part D – materials and maps geology</u><br/> Geology of building materials<br/> Topographical and geological maps<br/> Environmental geology: special subjects (10 hrs)</p>                                                                                                                                                                                                                                                                                                                                                                               |

| <b>Learning and Teaching Strategies</b><br><b>استراتيجيات التعلم والتعليم</b> |                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                             | <p>This course has several components that include lectures, individual or group assignments, rock lab visits, and e-learning platforms. The course will be taught in Arabic and English, and all mandatory reports have to be submitted within the deadlines.</p> |

| Student Workload (SWL)                                                         |    |                                                                           |     |
|--------------------------------------------------------------------------------|----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا                                        |    |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 33 | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 2.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 42 | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 2.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 75 |                                                                           |     |

| Module Evaluation     |                 |             |                  |          |                            |
|-----------------------|-----------------|-------------|------------------|----------|----------------------------|
| تقييم المادة الدراسية |                 |             |                  |          |                            |
|                       |                 | Time/Number | Weight (Marks)   | Week Due | Relevant Learning Outcome  |
| Formative assessment  | Quizzes         | 3           | 25 % (25)        | 3, 6, 9  | CLO-1, CLO-1, CLO-2, CLO-4 |
|                       | Assignments     |             | 5% (5)           |          |                            |
|                       | Projects / Lab. |             |                  |          |                            |
|                       | Report          | 1           | 10 % (10)        |          | All                        |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 7        | CLO-1, CLO -2 and CLO-3    |
|                       | Final Exam      | 3hr         | 50% (50)         | 16       | All                        |
| Total assessment      |                 |             | 100% (100 Marks) |          |                            |

| Delivery Plan (Weekly Syllabus) |                                                                       |
|---------------------------------|-----------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                       |
|                                 | Material Covered                                                      |
| Week 1                          | Introduction, objectives, general definition of environmental geology |
| Week 2                          | Historical geology                                                    |
| Week 3                          | Composition, formation of the earth's crust                           |
| Week 4                          | Composition, formation of the earth's crust                           |
| Week 5                          | Structural geology, rocks                                             |

|                |                                                |
|----------------|------------------------------------------------|
| <b>Week 6</b>  | Structural geology, rocks                      |
| <b>Week 7</b>  | Geology of water supply, (part1) Surface Water |
| <b>Week 8</b>  | Geology of water supply,, (part2) Ground Water |
| <b>Week 9</b>  | Environmental geology: special subjects        |
| <b>Week 10</b> | Geology of dams and reservoirs                 |
| <b>Week 11</b> | Geology of dams and reservoirs                 |
| <b>Week 12</b> | Geology of building materials                  |
| <b>Week 13</b> | Topographical and geological maps              |
| <b>Week 14</b> | Topographical and geological maps              |
| <b>Week 15</b> | Environmental geology: special subjects        |
| <b>Week 16</b> | <b>Preparatory week before the Final Exam</b>  |

| <b>Learning and Teaching Resources</b> |                                                                                                                                                           |                                  |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| مصادر التعلم والتدريس                  |                                                                                                                                                           |                                  |
|                                        | <b>Text</b>                                                                                                                                               | <b>Available in the Library?</b> |
| <b>Required Texts</b>                  | Ghazi Atia Zarraq, Dr.Lafta Salman Kadhim, Dr.Mahmood Fadhil Abid, " Environmental Geology ", Iraq, 2016                                                  | No.                              |
| <b>Recommended Texts</b>               | <ul style="list-style-type: none"> <li>Courses from the internet</li> </ul>                                                                               | Yes                              |
| <b>Websites</b>                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                                  |

| <b>Grading Scheme</b>               |                         |                     |                |                                          |
|-------------------------------------|-------------------------|---------------------|----------------|------------------------------------------|
| مخطط الدرجات                        |                         |                     |                |                                          |
| <b>Group</b>                        | <b>Grade</b>            | <b>التقدير</b>      | <b>Marks %</b> | <b>Definition</b>                        |
| <b>Success Group<br/>(50 - 100)</b> | <b>A - Excellent</b>    | امتياز              | 90 - 100       | Outstanding Performance                  |
|                                     | <b>B - Very Good</b>    | جيد جدا             | 80 - 89        | Above average with some errors           |
|                                     | <b>C - Good</b>         | جيد                 | 70 - 79        | Sound work with notable errors           |
|                                     | <b>D - Satisfactory</b> | متوسط               | 60 - 69        | Fair but with major shortcomings         |
|                                     | <b>E - Sufficient</b>   | مقبول               | 50 - 59        | Work meets minimum criteria              |
| <b>Fail Group<br/>(0 – 49)</b>      | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)        | More work is required but credit awarded |
|                                     | <b>F – Fail</b>         | راسب                | (0-44)         | A considerable amount of work required   |
|                                     |                         |                     |                |                                          |

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                     |                               |                                                                                                                                                                                                                                          |
|------------------------------------|---------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                     |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Drawing by Computer |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Support             |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV125              |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 7                   |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 175                 |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 1                   | Semester of Delivery          |                                                                                                                                                                                                                                          |
| Administering Department           | ENV8                | College                       | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Mohammed Hisham     | e-mail                        | <a href="mailto:m.h.alkafaf@uomosul.edu.iq">m.h.alkafaf@uomosul.edu.iq</a>                                                                                                                                                               |
| Module Leader's Acad. Title        | Lectures            | Module Leader's Qualification | MSC                                                                                                                                                                                                                                      |
| Module Tutor                       | Ayad Abdullah       | e-mail                        | <a href="mailto:ayad_engineer@uomosul.edu.iq">ayad_engineer@uomosul.edu.iq</a>                                                                                                                                                           |
|                                    | Abeer Khalil        |                               | <a href="mailto:abeer.khalil@uomosul.edu.iq">abeer.khalil@uomosul.edu.iq</a>                                                                                                                                                             |
| Peer Reviewer Name                 | Ammar Mohamed       | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Scientific Committee Approval Date | 12/09/2025          | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |                     |          |   |
|-----------------------------------|---------------------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                     |          |   |
| Prerequisite module               | Engineering Drawing | Semester | 1 |
| Co-requisites module              | None                | Semester |   |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | This course contains comprehensive training in AutoCAD. It incorporates the features, commands, and techniques for creating, editing, and printing 2D drawings with AutoCAD LT.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <b>CLO-1:</b> Become familiar with the AutoCAD user interface. (i)<br><br><b>CLO-2:</b> Understand the fundamental concepts and features of AutoCAD. (i)<br><br><b>CLO-3:</b> Use the precision drafting tools in AutoCAD to develop accurate technical drawings. (i)<br><br><b>CLO-4:</b> Present drawings in a detailed and visually impressive manner. (ii)                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p style="text-align: center;"><b>Indicative content includes the following.</b></p> <p><u>Part A</u><br/>Getting started with AutoCAD (4 hrs)</p> <p><u>Part B</u><br/>Basic drawing and editing commands (drawing lines, erasing objects, drawing vertical lines, drawing rectangles, drawing circles, undo and redo actions) (8 hrs)</p> <p><u>Part C</u><br/>Create a simple drawing (4 hrs)</p> <p><u>Part D</u><br/>Making changes in your drawing (selecting objects for editing, moving objects, copying rotating objects, scaling objects, mirroring objects) (12 hrs)</p> <p><u>Part E</u><br/>Annotation commands; Hatch , hatch edit , Image draw order (24 hrs)</p> <p><u>Part F</u><br/>Organizing drawing with layers , creating new drawings with templates , layer states (8 hrs)</p> |
| <b>Strategies</b>                                                                                                                | This course has several components that include lectures, classwork, homework and quiz. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Student Workload (SWL)                                                         |            |                                                                           |            |
|--------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------|------------|
| الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا                                        |            |                                                                           |            |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | <b>63</b>  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | <b>4.2</b> |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | <b>112</b> | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | <b>7.5</b> |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | <b>175</b> |                                                                           |            |

| Module Evaluation     |              |             |                  |                     |                           |
|-----------------------|--------------|-------------|------------------|---------------------|---------------------------|
| تقييم المادة الدراسية |              |             |                  |                     |                           |
|                       |              | Time/Number | Weight (Marks)   | Week Due            | Relevant Learning Outcome |
| Formative assessment  | Quizzes      | 2           | 20 % (20)        | 6, 10               | All                       |
|                       | Classwork    | 7           | 12 % (12)        | 2, 3, 4, 9,11,12,13 | All                       |
|                       | homework     | 2           | 8 % (8)          | 5,8                 | All                       |
| Summative assessment  | Midterm Exam | 2hr         | 10% (10)         | 7                   | All                       |
|                       | Exp. exam    | 1 hr        | 10 % (10)        | 15                  | All                       |
|                       | Final Exam   | 3hr         | 40% (40)         | 16                  | All                       |
| Total assessment      |              |             | 100% (100 Marks) |                     |                           |

| Delivery Plan (Weekly Lab. Syllabus) |                                                                                                                                   |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي للمختبر             |                                                                                                                                   |
|                                      | Material Covered                                                                                                                  |
| Week 1                               | Getting started with AutoCAD                                                                                                      |
| Week 2 - 5                           | drawing lines, erasing objects, drawing vertical and horizontal lines, drawing rectangles, drawing circles, undo and redo actions |
| Week 6                               | Create a simple drawing                                                                                                           |
| Week 8-13                            | Annotation commands; Hatch, hatch edit, Image draw order                                                                          |
| Week 14-15                           | Organizing drawing with layers , creating new drawings with templates, layer states                                               |

| Learning and Teaching Resources<br>مصادر التعلم والتدريس |                                                                                                                                                           |                           |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                          | Text                                                                                                                                                      | Available in the Library? |
| Required Texts                                           | Autodesk AutoCAD 2018 online Help                                                                                                                         | Yes                       |
| Websites                                                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme<br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

Environmental Engineering

2nd Stage

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                      |                               |                                                                                                                                                                                                                                                     |                                                                                |
|------------------------------------|--------------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                      |                               |                                                                                                                                                                                                                                                     |                                                                                |
| Module Title                       | Mathematics                          |                               | Module Delivery                                                                                                                                                                                                                                     |                                                                                |
| Module Type                        | Support or related learning activity |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input checked="" type="checkbox"/> Seminar |                                                                                |
| Module Code                        | ENV211                               |                               |                                                                                                                                                                                                                                                     |                                                                                |
| ECTS Credits                       | 6                                    |                               |                                                                                                                                                                                                                                                     |                                                                                |
| SWL (hr/sem)                       | 150                                  |                               |                                                                                                                                                                                                                                                     |                                                                                |
| Module Level                       | 2                                    | Semester of Delivery          |                                                                                                                                                                                                                                                     | 3                                                                              |
| Administering Department           | ENV8                                 | College                       | ENG4                                                                                                                                                                                                                                                |                                                                                |
| Module Leader                      | Nadia Afram Yaqoob                   |                               | e-mail                                                                                                                                                                                                                                              | <a href="mailto:n.alrhmany@uomosul.edu.iq">n.alrhmany@uomosul.edu.iq</a>       |
| Module Leader's Acad. Title        | Lecturer                             | Module Leader's Qualification | M.Sc.                                                                                                                                                                                                                                               |                                                                                |
| Module Tutor                       | Abeer Khalil Ibrahim                 |                               | e-mail                                                                                                                                                                                                                                              | <a href="mailto:abeer.alsaraf@uomosul.edu.iq">abeer.alsaraf@uomosul.edu.iq</a> |
| Peer Reviewer Name                 | Nadia Afram Yaqoob                   |                               | e-mail                                                                                                                                                                                                                                              | <a href="mailto:n.alrhmany@uomosul.edu.iq">n.alrhmany@uomosul.edu.iq</a>       |
| Scientific Committee Approval Date | 17/09/2025                           | Version Number                | 1.0                                                                                                                                                                                                                                                 |                                                                                |

| Relation with other Modules       |          |          |   |
|-----------------------------------|----------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |          |          |   |
| Prerequisite module               | Calculus | Semester | 1 |
| Co-requisites module              | None     | Semester |   |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>This course provides students with the fundamentals for plane analytic geometry (Circle, parabola, Ellipse, Hyperbola), partial derivatives for Functions of two or more variables, Hyperbolic function, Catenary, Multiple Integration and Differential equations (1<sup>st</sup> order 1<sup>st</sup> degree).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO-1:</b> Identify the fundamentals for plane analytic geometry (Circle, parabola, Ellipse, Hyperbola) (i)</p> <p><b>CLO-2:</b> Identify and understand the partial derivatives for function of two or more variable. (i)</p> <p><b>CLO-3:</b> Find the error in the dimension, area and volume and estimate the least amount of material for constructions tanks by using total differentiation for functions of two or more variable. (ii)</p> <p><b>CLO-4:</b> Use the partial derivatives to find the maximum and minimum of functions of several independent variables (Lagrange multipliers method). (ii)</p> <p><b>CLO-5:</b> Identify the hyperbolic function, their graphs, their derivatives, their integrals, and their inverse functions. (i)</p> <p><b>CLO-6:</b> Applied the hyperbolic function in catenary of cable. (ii)</p> <p><b>CLO-7:</b> Find the area, volume, mass, center of gravity, moment and moment of inertia of the functions by using multiple integration (ii)</p> <p><b>CLO-8:</b> Use double integral in polar coordinate to find the area and volume of the functions. (ii)</p> <p><b>CLO-9:</b> Understand the formation and solution of ordinary differential equation 1<sup>st</sup> order 1<sup>st</sup> degree. (i)</p> |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p><b>Indicative content includes the following</b></p> <p><u>Part A –Plan analytic Geometry/conic section</u> Circle, Parabola, Ellipse, Hyperbola. (5 hrs.)</p> <p><u>Part B – partial derivative</u> Functions of two or more variables, Domain and range for functions of two or more variables, Limits and Continuity for functions of two or more variables, Partial derivatives for functions of two or more variables, Chain rule, Total differentiation for Functions of two or more variables, Max. and min. of function of several independent variables, Max. and min. of function of several independent variables (method of Lagrange multipliers). (20 hrs.)</p> <p><u>Part C – Hyperbolic function</u> Hyperbolic function identities, Derivatives and Integration of hyperbolic function, Graphs of hyperbolic functions, Invers of hyperbolic function, Graphs of hyperbolic functions in invers, Differentials and integrations of hyperbolic functions in invers, catenary of cable (10 hrs.)</p>                                                                                                                                                                                                                                                                                                                                                                 |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><u>Part D - Multiple Integration</u> Double Integration, Revised Integration, Physical Applications of the Double Integration, Double Integration in Polar Form, Triple Integration. (20 hrs.)</p> <p><u>Part E - Differential Equations (D.E.)</u> Formation of D.E., The Solution of 1st order 1st degree D.E. (Variable Separable Method, Homogenous Method, Linear Method, Exact Method). (20 hrs.)</p> |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | <p>This course has several components that include studying lectures, tutorial, discussion, homework, and e-learning platforms. The course will be taught in English, and all compulsory assignments have to be submitted within the deadlines to be admitted to the exam.</p> |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا       |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 78  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 72  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 4.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | 150 |                                                                           |     |

| Module Evaluation     |                    |             |                |                  |                                                               |
|-----------------------|--------------------|-------------|----------------|------------------|---------------------------------------------------------------|
| تقييم المادة الدراسية |                    |             |                |                  |                                                               |
|                       |                    | Time/Number | Weight (Marks) | Week Due         | Relevant Learning Outcome                                     |
| Formative assessment  | Quizzes            | 5           | 6 % (30)       | 5,7,10,11 and 15 | CLO-1, CLO-2, CLO-3, CLO-4, CLO-5, CLO-6, CLO-7, CLO-8, CLO-9 |
|                       | Online Assignments | 1           | 2 % (2)        | 6                | CLO-1, CLO-2, CLO-3                                           |
|                       | Onsite Assignments | 3           | 2 % (6)        | 9,11 and 15      | CLO-2, CLO-7, CLO-8, CLO-9                                    |
|                       | Projects/Lab       | 0           | 0              |                  |                                                               |
|                       | Report             | 1           | 2% (2)         | 12               | CLO-2, CLO-3, CLO-4, CLO-7, CLO-8                             |
| Summative assessment  | Midterm Exam       | 2hr         | 10% (10)       | 9                | CLO-1 to CLO-7                                                |
|                       | Final Exam         | 3hr         | 50% (50)       | 16               | All                                                           |
| Total assessment      |                    |             | (100 Marks)    |                  |                                                               |

| Delivery Plan (Weekly Syllabus) |                                                                                                                                                                                              |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                                                                                                              |
|                                 | Material Covered                                                                                                                                                                             |
| Week 1                          | Plan analytic Geometry / conic section (Circle, Parabola, Ellipse, Hyperbola).                                                                                                               |
| Week 2                          | Functions of two or more variables, Domain and range of two or more variables                                                                                                                |
| Week 3                          | Limits and Continuity for functions of two or more variables, Chain rule,                                                                                                                    |
| Week 4                          | Total differentiation for Functions of two or more variables, Max. and min. of function of several independent variables,                                                                    |
| Week 5                          | Max. and min. of function of several independent variables (method of Lagrange multipliers)                                                                                                  |
| Week 6                          | Hyperbolic function identities, Derivatives and Integration of hyperbolic function, Graphs of hyperbolic functions, Invers of hyperbolic function, Graphs of hyperbolic functions in invers. |
| Week 7                          | Differentials and integrations of hyperbolic functions in invers, catenary of cable.                                                                                                         |
| Week 8                          | Double Integration, Revised Integration.                                                                                                                                                     |

|                |                                                                                            |
|----------------|--------------------------------------------------------------------------------------------|
| <b>Week 9</b>  | Physical Applications of the Double Integration.                                           |
| <b>Week 10</b> | Double Integration in Polar Form.                                                          |
| <b>Week 11</b> | Triple Integration.                                                                        |
| <b>Week 12</b> | Differential Equations (D.E.), Formation of D.E.                                           |
| <b>Week 13</b> | The Solution of 1st order 1st degree D.E. by Variable Separable Method, Homogenous Method. |
| <b>Week 14</b> | The Solution of 1st order 1st degree D.E. by Linear Method.                                |
| <b>Week 15</b> | The Solution of 1st order 1st degree D.E. by Exact Method.                                 |
| <b>Week 16</b> | <b>Preparatory week before the final Exam</b>                                              |

### Learning and Teaching Resources

مصادر التعلم والتدريس

|                          | Text                                                                                                                                                      | Available in the Library? |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Required Texts</b>    | <ul style="list-style-type: none"> <li>Finney, R.L,&amp; Thomas ,G.B, "Calculus" Addison. Wesley publishing company, USA,11<sup>th</sup>,2011.</li> </ul> | Yes                       |
| <b>Recommended Texts</b> | <ul style="list-style-type: none"> <li>Anton, H., Bivens, I.C., Davis, S., Calculus: Early Transcendentals, Wiley, 10th edition, 2011.</li> </ul>         | Yes                       |
| <b>Websites</b>          | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

### Grading Scheme

مخطط الدرجات

| Group                               | Grade                   | التقدير             | Marks %  | Definition                            |
|-------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| <b>Success Group<br/>(50 - 100)</b> | <b>A – Excellent</b>    | امتياز              | 90 – 100 | Outstanding Performance               |
|                                     | <b>B - Very Good</b>    | جيد جدا             | 80 – 89  | Above average with some errors        |
|                                     | <b>C – Good</b>         | جيد                 | 70 – 79  | Sound work with notable errors        |
|                                     | <b>D - Satisfactory</b> | متوسط               | 60 – 69  | Fair but with major shortcomings      |
|                                     | <b>E – Sufficient</b>   | مقبول               | 50 – 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>      | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                     | <b>F – Fail</b>         | راسب                | (0-44)   | Considerable amount of work required  |
|                                     |                         |                     |          |                                       |

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                        |                               |                                                                                                                                                                                                                                                     |
|------------------------------------|------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                        |                               |                                                                                                                                                                                                                                                     |
| Module Title                       | Fluids Mechanics       |                               | Module Delivery                                                                                                                                                                                                                                     |
| Module Type                        | Core                   |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV212                 |                               |                                                                                                                                                                                                                                                     |
| ECTS Credits                       | 5                      |                               |                                                                                                                                                                                                                                                     |
| SWL (hr/sem)                       | 125                    |                               |                                                                                                                                                                                                                                                     |
| Module Level                       | 2                      | Semester of Delivery          |                                                                                                                                                                                                                                                     |
| Administering Department           | ENV8                   | College                       | ENG4                                                                                                                                                                                                                                                |
| Module Leader                      | Mohammed Salim Mahmood | e-mail                        | <a href="mailto:Mohammedsalim@uomosul.edu.iq">Mohammedsalim@uomosul.edu.iq</a>                                                                                                                                                                      |
| Module Leader's Acad. Title        | Assist. Lecturer       | Module Leader's Qualification | M.Sc.                                                                                                                                                                                                                                               |
| Module Tutor                       | -----                  | e-mail                        | E-mail                                                                                                                                                                                                                                              |
| Peer Reviewer Name                 | -----                  | e-mail                        | E-mail                                                                                                                                                                                                                                              |
| Scientific Committee Approval Date | 12/9/2024              | Version Number                | 2                                                                                                                                                                                                                                                   |

| Relation with other Modules       |                       |          |   |
|-----------------------------------|-----------------------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                       |          |   |
| Prerequisite module               | Engineering mechanics | Semester | 2 |
| Co-requisites module              |                       | Semester |   |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>Fluid mechanics deals with the fluid while it is in its static and motion conditions, as the curriculum deals with the basic principles and laws derived on the basis of these principles that govern the fluid in each case. The focus is on the fluid, which is in its liquid state, especially water, as the environmental engineer deals with water in various engineering aspects in the applied field. The application of the laws is clarified through various mathematical examples with their illustrations, after the mathematical formulas for these laws are derived. The curriculum also includes deepening the understanding and assimilation of the theoretical side through practical application by conducting laboratory experiments on a number of the main topics of the subject.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO-1:</b> Defining the formulas that give the main parameters of fluids (i).<br/> <b>CLO-2 :</b> Defining the basic laws that control the behave of fluids in static and dynamics state (i).<br/> <b>CLO-3:</b> Formulate the main equations that cover the fundamentals of concern fields (i).<br/> <b>CLO-4 :</b> Applying the formulas and equations to solve different problems in various fields to give the results that can be used in different sides of engineering (ii).<br/> <b>CLO-5:</b> Applying a certain design procedures for special cases of problems.<br/> <b>CLO-6 :</b> Correlating the theoretical principles with practical by carrying out laboratory experiments with analysis of results and discussion (iii).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p><b>Indicative content includes the following.</b></p> <p>1. Theoretical part:</p> <ul style="list-style-type: none"> <li>• Fluids properties, Fluid statics: Pressure in fluid; Types of pressure; Pressure measuring devices.(15 hrs)</li> <li>• Pressure force on submerged plane surface; Pressure force on submerged curved surface. (10 hrs)</li> <li>• Fluid Kinematics: Flow patterns; Continuity equation and its applications. (10 hrs)</li> <li>• Bernoulli's equation and its applications. (10 hrs)</li> <li>• Momentum equation and its applications. (10 hrs)</li> <li>• Flow of real fluid in pipe, friction loss, types of problems, minor losses. (10 hrs)</li> <li>• Pipes in series and parallel. (10 hrs)</li> </ul> <p>2. Laboratory part:</p> <ul style="list-style-type: none"> <li>• Determine the force exerted on submerged plane surface. (2 hrs)</li> <li>• Prove the Bernoulli equation. (2 hrs)</li> <li>• Determine the Reynold number. (2 hrs)</li> <li>• Study flow through orifice in tank. (2 hrs)</li> <li>• Calculate the discharge in pipe using Venturi meter and orifice meter. (2 hrs)</li> <li>• Calculate the discharge through open channel using rectangular and triangle weir. (2 hrs)</li> <li>• Determine the force exerted by water jet on plane and curved surface. (2 hrs)</li> <li>• Determine the friction factor in pipe. (2 hrs)</li> </ul> |

| Learning and Teaching Strategies<br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                               | This course has several components that include lectures, individual & group assignments, field visits and e-learning platforms. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| Student Workload (SWL)<br>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا              |            |                                                                           |     |
|--------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | <b>78</b>  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | <b>47</b>  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 3.1 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | <b>125</b> |                                                                           |     |

| Module Evaluation<br>تقييم المادة الدراسية |                            |             |                  |                         |                                                 |
|--------------------------------------------|----------------------------|-------------|------------------|-------------------------|-------------------------------------------------|
|                                            |                            | Time/Number | Weight (Marks)   | Week Due                | Relevant Learning Outcome                       |
| <b>Formative assessment</b>                | <b>Quizzes</b>             | 5           | 5% (25)          | 4,6,10,12 and 14        | CLO-1, CLO-1, CLO-2, CLO-2 ,CLO-3 ,CLO-3 ,CLO-5 |
|                                            | <b>Online assignments</b>  | 2           | 1% (2)           | 6, and 12               | CLO-1,CLO-2, CLO-2, CLO-3                       |
|                                            | <b>On site assignments</b> | 5           | 1% (5)           | 2,6,8,10,14             | CLO-1, CLO-2, CLO-2 ,CLO-3 ,CLO-3               |
|                                            | <b>Report / Lab.</b>       | 8           | 1% (8)           | 3, ,5,6,7, 9, 11, 12,13 | CLO-4, CLO-6                                    |
| <b>Summative assessment</b>                | <b>Midterm Exam</b>        | 2hr         | 10% (10)         | 8                       | CLO-1, CLO -2 and CLO-3                         |
|                                            | <b>Final Exam</b>          | 3hr         | 50% (50)         | 16                      | All                                             |
| <b>Total assessment</b>                    |                            |             | 100% (100 Marks) |                         |                                                 |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |                                                                                                    |
|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|                                                                   | Material Covered                                                                                   |
| Week 1-2                                                          | Fluids properties, Fluid statics: Pressure in fluid; Types of pressure; Pressure measuring devices |
| Week 3-4                                                          | Pressure force on submerged plane surface; Pressure force on submerged curved surface              |
| Week 4-5                                                          | Fluid Kinematics: Flow patterns; Continuity equation and its applications                          |
| Week 6-8                                                          | Bernoulli's equation and its applications                                                          |
| Week 9-10                                                         | Momentum equation and its applications                                                             |
| Week 11-12                                                        | Flow of real fluid in pipe, friction loss, types of problems, minor losses                         |
| Week 13-15                                                        | Pipes in series and parallel                                                                       |
| Week 16                                                           | Preparatory week before the final Exam                                                             |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |                                                                       |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
|                                                                         | Material Covered                                                      |
| Week 1-2                                                                | Determine the force exerted on submerged plane surface                |
| Week 3-4                                                                | Determine the friction factor in pipe                                 |
| Week 5-6                                                                | Prove the Bernoulli equation                                          |
| Week 7-8                                                                | Determine the Reynold number                                          |
| Week 9-10                                                               | Calculate the discharge in pipe using orifice meter                   |
| Week 11-12                                                              | Calculate the discharge in pipe using Venturi meter and orifice meter |
| Week 13-15                                                              | Determine the force exerted by water jet on plane and curved surface  |

| <b>Learning and Teaching Resources</b><br>مصادر التعلم والتدريس |
|-----------------------------------------------------------------|
|-----------------------------------------------------------------|

|                          | Text                                                                                                                                                       | Available in the Library? |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Required Texts</b>    | <ul style="list-style-type: none"> <li>Esposito, A., 1998, Fluid Mechanics with applications, Prentice Hall, Inc.</li> </ul>                               | yes                       |
| <b>Recommended Texts</b> | <ul style="list-style-type: none"> <li>Cengel Y. and Cimbala J., 2014, Fluid Mechanics Fundamentals and Applications, 4th edition, McGraw Hill.</li> </ul> | Yes                       |
| <b>Websites</b>          |                                                                                                                                                            |                           |

| <b>Grading Scheme</b><br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                       | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                                                    |                               |                                                                                                                                                                                                                                                     |
|------------------------------------|--------------------------------------------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                                                    |                               |                                                                                                                                                                                                                                                     |
| Module Title                       | Chemistry                                                          |                               | Module Delivery                                                                                                                                                                                                                                     |
| Module Type                        | Core                                                               |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input checked="" type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV213                                                             |                               |                                                                                                                                                                                                                                                     |
| ECTS Credits                       | 4                                                                  |                               |                                                                                                                                                                                                                                                     |
| SWL (hr/sem)                       | 100                                                                |                               |                                                                                                                                                                                                                                                     |
| Module Level                       | 2                                                                  | Semester of Delivery          |                                                                                                                                                                                                                                                     |
| Administering Department           | ENV8                                                               | College                       | ENG4                                                                                                                                                                                                                                                |
| Module Leader                      | Waad Mohammed Ali (Theoretical)<br>Abeer Hashim Hassan (practical) |                               | e-mail<br><a href="mailto:waadd1976@uomosul.edu.iq">waadd1976@uomosul.edu.iq</a><br><a href="mailto:abeerhashim2014@uomosul.edu.iq">abeerhashim2014@uomosul.edu.iq</a>                                                                              |
| Module Leader's Acad. Title        | Lecturer                                                           | Module Leader's Qualification | M.S.C                                                                                                                                                                                                                                               |
| Module Tutor                       | -----                                                              | e-mail                        | E-mail                                                                                                                                                                                                                                              |
| Peer Reviewer Name                 | -----                                                              | e-mail                        | E-mail                                                                                                                                                                                                                                              |
| Scientific Committee Approval Date | 16/09/2024                                                         | Version Number                | 1.0                                                                                                                                                                                                                                                 |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <p>The aim of this course is to introduce the students to the area of environmental chemistry. The course will cover the chemistry of the air, water and soil and examine the environmental fate of anthropogenic chemicals released into the environment. We will see how chemical principles can be used to explain and predict reactions, partitioning, and concentrations of anthropogenic chemicals in different environmental compartments. We will examine some of the effects of pollutants on humans, other animals, plants and the nonliving parts of the earth. And, we will consider possible green chemistry, engineering and societal approaches to mitigating deleterious effects of pollution. The course will be beneficial to chemists, chemical and environmental engineers, and environmental scientists.</p>                                                                                                                                                                                                                                                                                                               |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO-1:</b> Identify and evaluate the relative importance of various reactions, physical processes and</p> <p><b>CLO-2:</b> Demonstrate an understanding of atmospheric chemistry and air pollution</p> <p><b>CLO-3:</b> Solve problems involving the principles of chemical kinetics.</p> <p><b>CLO-4:</b> Describe the greenhouse effect, climate change; and distinguish between fossil fuels and renewable energy technologies.</p> <p><b>CLO-5:</b> Describe chemical reactions and processes responsible for creating the “ozone hole”.</p> <p><b>CLO-6:</b> Describe the scientific basis underlying global climate change and the American Chemical Society position and recommendations regarding climate change.</p> <p><b>CLO-7:</b> Calculate equilibrium concentrations of organic pollutants in environmental compartments based on partition coefficients. Assess the advantages and limitations of such calculations.</p> <p><b>CLO-8:</b> Explain basic concepts of water chemistry and water pollution</p> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p><b>Indicative content includes the following.</b></p> <p><u>Part A – Atmospheric Chemistry and Air Pollution</u></p> <p>· Stratospheric Chemistry: The Ozone Layer · The Ozone Holes · The Chemistry of Ground-Level Air Pollution · The Environmental and Health Consequences of Polluted Air— Outdoors and Indoors</p> <p><u>Part B – The Greenhouse Effect, Climate Change, Fossil Fuels and CO<sub>2</sub></u></p> <p>· The Greenhouse Effect · Energy Use, Fossil Fuels, CO<sub>2</sub> Emissions, and Global Climate Change · Biofuels and Other Alternative Fuels · Renewable Energy Technologies: Hydroelectric, Wind, Solar, Geothermal, and Marine Energy and Their Storage ·</p> <p><u>Part C – Toxic Organic Compounds</u></p> <p>Toxic Heavy metals · Pesticides · Dioxins, Furans, and PCBs Other Toxic Organic Compounds of Environmental Concern · Wastes, Soils and Sediment</p> <p><u>Part D – Water chemistry and Water Pollution</u></p> <p>The Chemistry of Natural Waters · The Pollution and Purification of Water</p>                                                                                                |

| Learning and Teaching Strategies |                                                                              |
|----------------------------------|------------------------------------------------------------------------------|
| استراتيجيات التعلم والتعليم      |                                                                              |
| <b>Strategies</b>                | This course has several components that include lectures, individual & group |

|  |                                                                                                                                                                                                                                                   |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | assignments, field visits and e-learning platforms. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. The basic laboratory work supports lecture topics. |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Student Workload (SWL)                                                         |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطلاب محسوب لـ ١٥ أسبوعا                                        |     |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 63  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 4.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 37  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 2.4 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 100 |                                                                           |     |

| Module Evaluation     |                    |             |                  |                                           |                                   |
|-----------------------|--------------------|-------------|------------------|-------------------------------------------|-----------------------------------|
| تقييم المادة الدراسية |                    |             |                  |                                           |                                   |
|                       |                    | Time/Number | Weight (Marks)   | Week Due                                  | Relevant Learning Outcome         |
| Formative assessment  | Quizzes            | 4           | 4% (16)          | 2, 3, ,12 and 14                          | CLO-1, CLO-2, CLO-3, CLO-5        |
|                       | Assignments        | 5           | 2% (10)          | 2, 3, 4, 6, and 10                        | CLO-2, CLO-2, CLO-3, CLO-2, CLO-3 |
|                       | Projects / Lab.    | 7           | 1% (7)           | 1,2,3,4,5,6,7,8,9, 10,11,12,13,14, and 15 | All                               |
|                       | Report Theoretical | 2           | 1% (2)           | 13                                        | CLO-1, CLO3, CLO8                 |
|                       | Report Practical   | 5           | 1% (5)           | 3,6,9,12,15                               | CLO-1, CLO3, CLO8                 |
| Summative assessment  | Midterm Exam       | 2hr         | 10% (10)         | 7                                         | CLO-1, CLO -2 and CLO-3           |
|                       | Final Exam         | 3hr         | 50% (50)         | 16                                        | All                               |
| Total assessment      |                    |             | 100% (100 Marks) |                                           |                                   |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |                                            |
|-------------------------------------------------------------------|--------------------------------------------|
|                                                                   | Material Covered                           |
| <b>Week 1</b>                                                     | Introduction to Environmental Chemistry    |
| <b>Week 2</b>                                                     | Basic Chemical Concepts                    |
| <b>Week 3</b>                                                     | Chemical Reactions and Stoichiometry       |
| <b>Week 4</b>                                                     | Acid Base Reactions                        |
| <b>Week 5</b>                                                     | Oxidation-Reduction Reactions              |
| <b>Week 6</b>                                                     | Reactions Involving gases                  |
| <b>Week 7</b>                                                     | Common Ion Effect                          |
| <b>Week 8</b>                                                     | Equilibrium Among Gases and Liquid         |
| <b>Week 9</b>                                                     | Reactions Kinetics                         |
| <b>Week 10</b>                                                    | Gas Transfer Across Air – water Interfaces |
| <b>Week 11</b>                                                    | Organic Chemistry                          |
| <b>Week 12</b>                                                    | Water Chemistry                            |
| <b>Week 13</b>                                                    | Buffers                                    |
| <b>Week 14</b>                                                    | Soil Chemistry                             |
| <b>Week 15</b>                                                    | Atmospheric Chemistry                      |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |                                                                     |
|-------------------------------------------------------------------------|---------------------------------------------------------------------|
|                                                                         | Material Covered                                                    |
| <b>Week 1</b>                                                           | Safety in laboratories.                                             |
| <b>Week 2</b>                                                           | Introduction to chemical analyses.                                  |
| <b>Week 3</b>                                                           | Water and solutions.                                                |
| <b>Week 4</b>                                                           | Types of solutions.                                                 |
| <b>Week 5</b>                                                           | Distinguish between an acid and a base.                             |
| <b>Week 6 &amp; week 7</b>                                              | Methods for calculating the volume and concentrations of solutions. |
| <b>Week 8 &amp; week 9</b>                                              | Titration and the types of titrations.                              |
| <b>Week 10</b>                                                          | Types of indicators.                                                |
| <b>Week 11</b>                                                          | Titration of acids and base.                                        |
| <b>Week 12</b>                                                          | Alkalinity in water                                                 |
| <b>Week 13</b>                                                          | Acidity in water.                                                   |

|                   |                     |
|-------------------|---------------------|
| Week 14 & week 15 | Methods of analysis |
|-------------------|---------------------|

| Learning and Teaching Resources |                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |
|                                 | Text                                                                                                                                                                                                                                                                                                                                                                                                                              | Available in the Library? |
| Required Texts                  | <ul style="list-style-type: none"> <li>Gary W. vanLoon and Stephen J. Duffy "Environmental Chemistry: A Global Perspective" 3rd Edition, Oxford University Press, 2010</li> </ul>                                                                                                                                                                                                                                                 | Yes                       |
| Recommended Texts               | <ul style="list-style-type: none"> <li>Colin Baird and Michael Cann "Environmental Chemistry" 5th Edition, 2012.</li> <li>Lab Manual: Environmental Laboratory Exercise for Instrumental Analysis and Environmental Chemistry by Dunnivant, ISBN # 9780471488569, Publisher: Wiley</li> <li>APHA, AWWA and WPCF (1998). Standard Methods for the Examination of Water and Wastewater. 18th ed., APHA, Washington, D.C.</li> </ul> | Yes                       |
| Websites                        |                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A – Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C – Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E – Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                       |                      |                                                                                                                                                                                                                                          |                                |
|------------------------------------|-----------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| معلومات المادة الدراسية            |                       |                      |                                                                                                                                                                                                                                          |                                |
| Module Title                       | Engineering Surveying |                      | Module Delivery                                                                                                                                                                                                                          |                                |
| Module Type                        | Supported             |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                |
| Module Code                        | ENV214                |                      |                                                                                                                                                                                                                                          |                                |
| ECTS Credits                       | 4                     |                      |                                                                                                                                                                                                                                          |                                |
| SWL (hr/sem)                       | 100                   |                      |                                                                                                                                                                                                                                          |                                |
| Module Level                       | 2                     | Semester of Delivery |                                                                                                                                                                                                                                          | 3                              |
| Administering Department           | ENV8                  | College              | ENG4                                                                                                                                                                                                                                     |                                |
| Module Leader                      | Dr. Mohammed          |                      | e-mail                                                                                                                                                                                                                                   | mohammed1979eng@uomosul.edu.iq |
| Module Leader's Acad. Title        | Assist. Professor     |                      | Module Leader's Qualification                                                                                                                                                                                                            | Ph.D.                          |
| Module Tutor                       | -----                 |                      | e-mail                                                                                                                                                                                                                                   | E-mail                         |
| Peer Reviewer Name                 | -----                 |                      | e-mail                                                                                                                                                                                                                                   | E-mail                         |
| Scientific Committee Approval Date | 12/09/2024            | Version Number       | 1.0                                                                                                                                                                                                                                      |                                |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>This course aims to introduce the students to the category of Engineering surveying . Introductory and definitions, which are used in plane surveying: Instruments for measuring distance obstacles in measurements Instruments for setting out right angles, Tape corrections. Leveling, Areas, and volumes. Computation of volumes. The Theodolite and Traverse surveying. Tachometry. Curves. Total instrument station, GPS field procedure. This will be achieved through descriptive lectures.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p>Important: Write at least 6 Learning Outcomes, it is better to be equal to the number of study weeks.</p> <p><b>CLO-1:</b> The students will be able to define and distinguish the fundamentals of measuring. (i)</p> <p><b>CLO-2:</b> after taking analysis and synthesis design processes, the student can make a primary design of some issues of roads (ii)</p> <p><b>CLO-3:</b> The student will be able to conduct some tests and measurements of surveying, like elevations and coordinates using different devices. (iii)</p> <p><b>CLO-4:</b> The students will be able to make suitable judgments in engineering situations of surveying problems like road construction. (v)</p> <p><b>CLO-5:</b> Report the data obtained from the selective topics of surveying topics given and organized during the course (iv)</p> <p><b>CLO-6:</b> Creating some opinions about the emerging environmental issues and trying to give some solutions compatible with the problems related to surveying aspects (vii)</p> |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p>Indicative content includes the following.</p> <p><u>Part A Introduction</u><br/> Basic Definitions, Types of Surveying, Units, and conversions<br/> Linear measurements, tape measurements, and corrections (9 hrs)</p> <p><u>Part B – Leveling</u><br/> Leveling definitions and instruments, Leveling methods, Longitudinal and cross-sections, Contouring (21hrs)</p> <p><u>Part C – Theodolites</u><br/> Theodolites, Angles, bearings, coordinates (9 hrs)</p> <p><u>Part D – Surveying topics</u><br/> Total Station Surveying, GPS principles, Vertical Curves (6 hrs)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                       |

| <b>Learning and Teaching Strategies</b><br><b>استراتيجيات التعلم والتعليم</b> |                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                             | <p>This course has several components that include lectures, individual or group assignments, rock lab visits, and e-learning platforms. The course will be taught in Arabic and English, and all mandatory reports have to be submitted within the deadlines.</p> |

| Student Workload (SWL)                                                         |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا                                        |     |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 78  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 22  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 1.5 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | 100 |                                                                           |     |

| Module Evaluation     |                    |             |                  |                |                           |
|-----------------------|--------------------|-------------|------------------|----------------|---------------------------|
| تقييم المادة الدراسية |                    |             |                  |                |                           |
|                       |                    | Time/Number | Weight (Marks)   | Week Due       | Relevant Learning Outcome |
| Formative assessment  | Quizzes            | 3           | 18 % (18)        | 3, 6, 9 and 11 | CLO-1, CLO-2, CLO-4       |
|                       | Assignments Online | 7           | 7% (7)           | 2,4,8,10,12    | CLO-1, CLO-2, CLO-4       |
|                       | Quiz /Lab.         | 1           | 5% (5)           | 16             | CLO-3                     |
|                       | Report             | 10          | 10 % (10)        | All            | CLO-3                     |
| Summative assessment  | Midterm Exam       | 2hr         | 10% (10)         | 7              | CLO-1, CLO-2, CLO-4       |
|                       | Final Exam         | 3hr         | 50% (50)         | 16             | CLO-1, CLO-2, CLO-4       |
| Total assessment      |                    |             | 100% (100 Marks) |                |                           |

| Delivery Plan (Weekly Syllabus) |                                                               |
|---------------------------------|---------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                               |
|                                 | Material Covered                                              |
| Week 1                          | Basic Definitions, Types of Surveying, Units, and conversions |
| Week 2                          | Linear measurements                                           |

|                |                                                   |
|----------------|---------------------------------------------------|
| <b>Week 3</b>  | tape measurements                                 |
| <b>Week 4</b>  | corrections                                       |
| <b>Week 5</b>  | Leveling definitions and instruments              |
| <b>Week 6</b>  | Leveling methods                                  |
| <b>Week 7</b>  | Longitudinal and cross-sections                   |
| <b>Week 8</b>  | Contouring                                        |
| <b>Week 9</b>  | Contouring                                        |
| <b>Week 10</b> | Theodolites                                       |
| <b>Week 11</b> | Angles, bearings                                  |
| <b>Week 12</b> | coordinates                                       |
| <b>Week 13</b> | Total Station Surveying                           |
| <b>Week 14</b> | GPS principles                                    |
| <b>Week 15</b> | Vertical Curves                                   |
| <b>Week 16</b> | <b>The preparatory week before the Final Exam</b> |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |                                                     |
|-------------------------------------------------------------------------|-----------------------------------------------------|
|                                                                         | <b>Material Covered</b>                             |
| <b>Week 1</b>                                                           | Area measurement by tape and guiding                |
| <b>Week 2</b>                                                           | Construct right angles in different ways            |
| <b>Week 3</b>                                                           | Projecting a building using a tape measure          |
| <b>Week 4</b>                                                           | Projecting a building using the polygon method      |
| <b>Week 5</b>                                                           | Leveling device installation                        |
| <b>Week 6</b>                                                           | Leveling the ground using a leveling device         |
| <b>Week 7</b>                                                           | Leveling the ground using a leveling device         |
| <b>Week 8</b>                                                           | Longitudinal section and cross-section              |
| <b>Week 9</b>                                                           | Longitudinal section and cross-section              |
| <b>Week 10</b>                                                          | Theodolite device installation                      |
| <b>Week 11</b>                                                          | Projecting a building using a Theodolite device     |
| <b>Week 12</b>                                                          | Projecting a building using a Theodolite device     |
| <b>Week 13</b>                                                          | Total station device installation                   |
| <b>Week 14</b>                                                          | Use the quick functions in the Total Station device |
| <b>Week 15</b>                                                          | Use the quick functions in the Total Station device |

| Learning and Teaching Resources<br>مصادر التعلم والتدريس |                                                                                                                                                           |                           |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                          | Text                                                                                                                                                      | Available in the Library? |
| Required Texts                                           | B. Kavannagh. "Surveying with Construction Applications", 6th edition                                                                                     | yes                       |
| Recommended Texts                                        | Courses from internet                                                                                                                                     | Yes                       |
| Websites                                                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme<br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|------------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                               |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance                  |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors           |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors           |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings         |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria              |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work is required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | A considerable amount of work required   |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                          |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                       |                               |                                                                                                                                                                                                                                          |                         |
|------------------------------------|-----------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| معلومات المادة الدراسية            |                       |                               |                                                                                                                                                                                                                                          |                         |
| Module Title                       | Strength of materials |                               | Module Delivery                                                                                                                                                                                                                          |                         |
| Module Type                        | Support               |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                         |
| Module Code                        | ENV215                |                               |                                                                                                                                                                                                                                          |                         |
| ECTS Credits                       | 4                     |                               |                                                                                                                                                                                                                                          |                         |
| SWL (hr/sem)                       | 100                   |                               |                                                                                                                                                                                                                                          |                         |
| Module Level                       | 2                     | Semester of Delivery          |                                                                                                                                                                                                                                          | 3                       |
| Administering Department           | ENV8                  | College                       | ENG4                                                                                                                                                                                                                                     |                         |
| Module Leader                      | Rana Burhan           |                               | e-mail                                                                                                                                                                                                                                   | rn.burha@uomosul.edu.iq |
| Module Leader's Acad. Title        | Lecturer              | Module Leader's Qualification | MSc.                                                                                                                                                                                                                                     |                         |
| Module Tutor                       | -----                 |                               | e-mail                                                                                                                                                                                                                                   | E-mail                  |
| Peer Reviewer Name                 | -----                 |                               | e-mail                                                                                                                                                                                                                                   | E-mail                  |
| Scientific Committee Approval Date | 2/10/2024             | Version Number                | 1.0                                                                                                                                                                                                                                      |                         |

| Relation with other Modules       |                       |          |   |
|-----------------------------------|-----------------------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                       |          |   |
| Prerequisite module               | Engineering Mechanics | Semester | 2 |
| Co-requisites module              | None                  | Semester |   |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>This course is a study of the effect of external loads on structural elements and the behavior of the elements under these loads. Determination of different types of stresses, strains and the relation between them, calculation of stresses in thin-walled pressure vessels, drawing shear and bending-moment diagrams of beams, calculation of bending and shear stresses in beams, and calculating deflections in beams using double integration method are explained in details. The course aims to expand the student's understanding of the structural elements behavior under different loads- that is essential to design and evaluate any structural member.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO-1:</b> Explain the different types of stresses, the relation between them and Understanding how to calculate them (i).</p> <p><b>CLO-2:</b> Recognize the relation between stress and strain and explain how to calculate them (i).</p> <p><b>CLO-3:</b> Apply fundamental mechanics to evaluate the suitable structural element dimensions that can be applied without exceeding the stress and strain limits of member (ii).</p> <p><b>CLO-4:</b> Demonstrate an understanding of the assumptions and limitations of the theories used in mechanics of materials to draw the shear and moment diagrams for beams subjected to various loads (i)</p> <p><b>CLO-5:</b> Find the maximum shear value and maximum moment value for beams subjected to various loads (i)</p> <p><b>CLO-6:</b> Apply the theories of mechanics of materials to determine the bending and shear stresses for beams subjected to various loads (i)</p> <p><b>CLO-7:</b> Formulate deflection equations for beams subjected to various loads (i).</p> <p><b>CLO-8:</b> Demonstrate an understanding of theories of deflection to find deflection values for beams subjected to various loads (ii)</p> |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p><b>Indicative content includes the following.</b></p> <p><u>Part A – Simple Stresses</u><br/> Normal Stress, Shear Stress, Bearing Stress, Thin Walled Cylinders (Pressure Vessels) (9hrs)</p> <p><u>Part B – Simple Strain</u><br/> Strain (Simple Strain ,Stress-Strain Diagram, Hooke's Law, Poisson's Ratio, Statically Indeterminate Problems , Thermal Strain) (9 hrs)</p> <p><u>Part C – Shear and Moment in Beams</u><br/> Introduction, Supports and Load, Shear-Moment Equations, Area Method for Drawing Shear and Moment Diagram (9 hrs)</p> <p><u>Part D - Stresses in Beams</u><br/> Stresses in Beams(Shear and Flexural Stresses in Beams) (9 hrs)</p> <p><u>Part F - Beam Deflections</u><br/> Double Integration Method (9 hrs)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Learning and Teaching Strategies<br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                               | This course has several components that include lectures, individual & group assignments, field visits and e-learning platforms. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| Student Workload (SWL)<br>الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا              |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 48  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 3.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 52  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 3.5 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 100 |                                                                           |     |

| Module Evaluation<br>تقييم المادة الدراسية |                            |             |                |                      |                                            |
|--------------------------------------------|----------------------------|-------------|----------------|----------------------|--------------------------------------------|
|                                            |                            | Time/Number | Weight (Marks) | Week Due             | Relevant Learning Outcome                  |
| <b>Formative assessment</b>                | <b>Quizzes</b>             | 5           | 5 % (25)       | 4, 6, 8, 11 and 13   | CLO-1,3, CLO-2,3, CLO-4,5, CLO-6           |
|                                            | <b>On line Assignments</b> | 1           | 2 % (2)        | 6                    | CLO-1,3, CLO-2,3, CLO-4,5, CLO-6 , CLO-7,8 |
|                                            | <b>On site Assignments</b> | 5           | 2 % (10)       | 4, 6, 10, 12, and 14 | CLO-1,3, CLO-2,3, CLO-4,5, CLO-6 , CLO-7,8 |
|                                            | <b>Projects / Lab.</b>     | 0           | 0% (0)         |                      |                                            |
|                                            | <b>Report</b>              | 1           | 3 % (3)        | 10                   | CLO-1, CLO-2, CLO-3, CLO4                  |
| <b>Summative assessment</b>                | <b>Midterm Exam</b>        | 2hr         | 10% (10)       | 14                   | CLO-1, CLO-2, CLO-3, CLO4, CLO5, CLO-6     |

|                         |                   |     |                  |    |     |
|-------------------------|-------------------|-----|------------------|----|-----|
|                         | <b>Final Exam</b> | 3hr | 50% (50)         | 16 | All |
| <b>Total assessment</b> |                   |     | 100% (100 Marks) |    |     |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |                                                                    |
|-------------------------------------------------------------------|--------------------------------------------------------------------|
|                                                                   | <b>Material Covered</b>                                            |
| <b>Week 1</b>                                                     | Introduction to Strength of Materials                              |
| <b>Week 2</b>                                                     | Normal Stress                                                      |
| <b>Week 3</b>                                                     | Shear Stress, Bearing Stress                                       |
| <b>Week 4</b>                                                     | Thin Walled Cylinders (Pressure Vessels) + quiz                    |
| <b>Week 5</b>                                                     | Simple Strain , Stress-Strain Diagram, Hooke's Law                 |
| <b>Week 6</b>                                                     | Statically Indeterminate Problems                                  |
| <b>Week 7</b>                                                     | Statically Indeterminate Problems                                  |
| <b>Week 8</b>                                                     | Shear and Moment in Beams (Introduction, Supports and Load) + quiz |
| <b>Week 9</b>                                                     | Area Method for Drawing Shear and Moment Diagram                   |
| <b>Week 10</b>                                                    | Area Method for Drawing Shear and Moment Diagram                   |
| <b>Week 11</b>                                                    | Shear and stress in beams+ quiz                                    |
| <b>Week 12</b>                                                    | Shear Stresses in Beams                                            |
| <b>Week 13</b>                                                    | Flexural Stresses in Beams+ quiz                                   |
| <b>Week 14</b>                                                    | Beam Deflections (Double Integration Method) + term exam           |
| <b>Week 15</b>                                                    | Beam Deflections (Double Integration Method)                       |
| <b>Week 16</b>                                                    | <b>Preparatory week before the final Exam</b>                      |

| Learning and Teaching Resources<br>مصادر التعلم والتدريس |                                                                                                                                                                                                                                      |                           |
|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                          | Text                                                                                                                                                                                                                                 | Available in the Library? |
| Required Texts                                           | <ul style="list-style-type: none"> <li>F. L. Singer and A. Pytel , Strength of materials , 3ed edition, 1980</li> </ul>                                                                                                              | Yes                       |
| Recommended Texts                                        | <ul style="list-style-type: none"> <li>Pytel and J. Kiusalaas, Mechanics of materials , 2nd edition ,2012, Library of Congress.</li> <li>K.S. Yadav , Strength of materials, 2nd edition , 2018, ISBN: 978-81-89401-50-4.</li> </ul> | Yes                       |
| Websites                                                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a>                                                                            |                           |

| Grading Scheme<br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                         |                      |                                                                                                                                                                                                                               |                                                                                                  |
|------------------------------------|-------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                         |                      |                                                                                                                                                                                                                               |                                                                                                  |
| Module Title                       | Engineering Hydrology   |                      | Module Delivery                                                                                                                                                                                                               |                                                                                                  |
| Module Type                        | Support                 |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                                                                                  |
| Module Code                        | ENV216                  |                      |                                                                                                                                                                                                                               |                                                                                                  |
| ECTS Credits                       | 3                       |                      |                                                                                                                                                                                                                               |                                                                                                  |
| SWL (hr/sem)                       | 75                      |                      |                                                                                                                                                                                                                               |                                                                                                  |
| Module Level                       | 2                       | Semester of Delivery |                                                                                                                                                                                                                               | 3                                                                                                |
| Administering Department           | ENV8                    | College              | ENG4                                                                                                                                                                                                                          |                                                                                                  |
| Module Leader                      | Aaisha Mohand Almokhtar |                      | e-mail                                                                                                                                                                                                                        | <a href="mailto:aaisha.21enp45@student.uomosul.edu.iq">aaisha.21enp45@student.uomosul.edu.iq</a> |
| Module Leader's Acad. Title        |                         |                      | Module Leader's Qualification                                                                                                                                                                                                 |                                                                                                  |
| Module Tutor                       | -----                   |                      | e-mail                                                                                                                                                                                                                        |                                                                                                  |
| Peer Reviewer Name                 | -----                   |                      | e-mail                                                                                                                                                                                                                        |                                                                                                  |
| Scientific Committee Approval Date | 12/9/2024               | Version Number       | 1.0                                                                                                                                                                                                                           |                                                                                                  |

| Relation with other Modules       |      |          |       |
|-----------------------------------|------|----------|-------|
| العلاقة مع المواد الدراسية الأخرى |      |          |       |
| Prerequisite module               | None | Semester | ----- |
| Co-requisites module              | None | Semester |       |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>The aim of this course is to introduce the students to the area of hydrological processes and practices including introduction to the Hydrology. The course will cover discussion of the basic physical principles of the water cycle, different climate factors and components (evaporation, condensation, precipitation, runoff, stream flow). At the end of the course the students will have a working knowledge for estimating Precipitation in different methods as well as Abstraction from Precipitation, Stream flow Measurement, Run-Off, Hydrograph, and Flood Routing and have the skills of analytical skills (analyze data collected in the field and examine the results) and Communication skills (prepare detailed reports that document their research methods and findings). This will be achieved through descriptive lectures with Preparing hydrological reporting and supervised tutorials.</p> |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p>CLO-1: Recognize the water issues and natural phenomena of different hydrologic process (i)<br/> CLO-2: Apply the basic engineering concepts to solve issues associated with hydrologic process (i)<br/> CLO-3: Organizing the needed solution, tabulation and calculation for the hydrological problems(i)<br/> CLO-4: Deriving standard hydrological relationship Using several methods (i).<br/> CLO-5: Report the data obtained from the site visits that will be organized during the Course(iv)<br/> CLO-6: Manage risk and uncertainty for flood measurement (vii)</p>                                                                                                                                                                                                                                   |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p>Indicative content includes the following.</p> <p><b><u>Part A – Introduction and Climate Factors</u></b><br/> An introduction to the Hydrology. Climate Factors, Precipitation, Abstraction from Precipitation (27 hrs)<br/> <b><u>Part B – Measurements</u></b><br/> Stream flow Measurement, Run-Off, (9 hrs)<br/> <b><u>Part C – hydrologic details</u></b><br/> Hydrograph, Flood Routing (9 hrs)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| <b>Learning and Teaching Strategies</b><br><b>استراتيجيات التعلم والتعليم</b> |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                             | <p>This course has several components that include lectures, individual &amp; group assignments, field visits and e-learning platforms. Exercises involving the use of computer applications tools to understand the hydrologic processes. The course will be taught in English in addition to the Arabic, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams.</p> |

| <b>Student Workload (SWL)</b><br><b>الحمل الدراسي للطالب محسوب ل ١٥ اسبوعا</b>  |    |                                                                                  |     |
|---------------------------------------------------------------------------------|----|----------------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br><b>الحمل الدراسي المنتظم للطالب خلال الفصل</b> | 33 | <b>Structured SWL (h/w)</b><br><b>الحمل الدراسي المنتظم للطالب أسبوعيا</b>       | 2.2 |
| <b>Unstructured SWL (h/sem)</b><br><b>الحمل الدراسي غير المنتظم للطالب خلال</b> | 42 | <b>Unstructured SWL (h/w)</b><br><b>الحمل الدراسي غير المنتظم للطالب أسبوعيا</b> | 2.8 |

|                                                                   |           |  |  |
|-------------------------------------------------------------------|-----------|--|--|
| الفصل                                                             |           |  |  |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل | <b>75</b> |  |  |

| Module Evaluation<br>تقييم المادة الدراسية |                     |             |                |           |                            |
|--------------------------------------------|---------------------|-------------|----------------|-----------|----------------------------|
|                                            |                     | Time/Number | Weight (Marks) | Week Due  | Relevant Learning Outcome  |
| Formative assessment                       | Quizzes             | 4           | 4% (16)        | 4,6,11,14 | CLO-1, CLO-2, CLO-6        |
|                                            | Online assignments  | 4           | 2% (8)         | 4,7,12,14 | CLO-2, CLO-3, CLO-4, CLO-5 |
|                                            | On site assignments | 4           | 2% (8)         | 3,6,9,12  | CLO-1, CLO-2, CLO-3, CLO-4 |
|                                            | Report              | 2           | 4% (8)         | 7, and 14 | CLO-2, and CLO-6           |
| Summative assessment                       | Midterm Exam        | 2hr         | 10% (10)       | 10        | CLO-1, CLO-2, CLO-3, CLO-4 |
|                                            | Final Exam          | 3hr         | 50% (50)       | 16        | All                        |
| Total assessment                           |                     |             | 100%(100Marks) |           |                            |

| Delivery Plan (Weekly Syllabus)<br>المنهاج الاسبوعي النظري |                                                                                                                                                                                                                                                |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                            | Material Covered                                                                                                                                                                                                                               |
| <b>Week 1</b>                                              | Introduction, objectives, definition of hydrology, branch of Hydrology, hydrological cycle, Hydrological Budget Equation, Engineering Hydrology Application, Typical Failure Factors for Hydraulic Installations, Source of Data.              |
| <b>Week 2</b>                                              | Climate Factors, Temperature, Solar Radiation, Evaporation, Humidity, Vapor Pressure, Wind.                                                                                                                                                    |
| <b>Week 3</b>                                              | Precipitation, Forms of Precipitation, Measurement of precipitation, Types of rain gauge                                                                                                                                                       |
| <b>Week 4</b>                                              | Errors in rainfall measurement, Precipitation Gage Network, adequacy of rain measurement stations, Preparation of data, Methods for calculating missing information, Test for Consistency of Records.                                          |
| <b>Week 5</b>                                              | Average Precipitation over Area, Accumulated Rainfall, Hyetograph, Rainfall Intensity, Probable Maximum Precipitation, Point Rainfall, Depth- area- duration –Relationship, Depth-Area-Duration, Intensity –Duration – Return period relation. |
| <b>Week 6</b>                                              | Abstraction from Precipitation, Losses from precipitation, Evaporation, Evaporimeter, Types of evaporation                                                                                                                                     |

|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | meters, Class A Evaporation Pan, Pan Coefficient.                                                                                                                                                                                                  |
| <b>Week 7</b>  | Evaporation Measurement Stations, Empirical Evaporation Equations, Analytical methods for estimating evaporation, Types of evaporation meters, reducing evaporation from tanks                                                                     |
| <b>Week 8</b>  | Evapotranspiration, Potential Evapotranspiration, vapotranspiration Equations, Penman Equation, Blaney – Criddle formula, Evapotranspiration Equations                                                                                             |
| <b>Week 9</b>  | Infiltration, Measurement of Infiltration, Infiltration Capacity, Infiltration Capacity Values, Infiltration Indices.                                                                                                                              |
| <b>Week 10</b> | Stream flow measurement, Water stage, time curve-Stage , Stream measurement, Measurement of velocity, Calibration, Equalization of the current meter device, steps for measuring discharge by speed- area method.                                  |
| <b>Week 11</b> | chemical methods for measuring discharge, indirect method and classified into two types: 1- Flow measurement facilities 2- Slope- Area method, calibration curve in case of unsteady flow.                                                         |
| <b>Week 12</b> | Run – off, Factors affecting the volume of runoff, Direct Runoff, Base Flow, annual runoff volume, Empirical Equation, Rational method, Unit hydrograph, CN-SCS method, Flow- Duration Curve, Flow– Mass Curve, Calculation of Maintainable Demand |
| <b>Week 13</b> | Hydrograph, Surface Runoff, Inter Flow, Base Flow, Hydrograph component, Factors affecting flood hydrograph, Direct Runoff.                                                                                                                        |
| <b>Week 14</b> | Base Flow, Base Flow Separation, Effective Rain, Unit Hydrograph, Unit Hydrograph Assumptions, Unit Hydrograph Derivation, Unit Hydrograph for Different Duration, S - Curve Method , Uses and limitations of standard hydrograph.                 |
| <b>Week 15</b> | Flood Routing, Hydrologic Storage Routing, Hydrologic Channel Routing.                                                                                                                                                                             |

### Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

|                   | Material Covered |
|-------------------|------------------|
| <b>Week 1-2</b>   |                  |
| <b>Week 5-6</b>   |                  |
| <b>Week 7-8</b>   |                  |
| <b>Week 9-10</b>  |                  |
| <b>Week 10-11</b> |                  |
| <b>Week 13-14</b> |                  |

### Learning and Teaching Resources

مصادر التعلم والتدريس

|                       | Text                                                                                   | Available in the Library? |
|-----------------------|----------------------------------------------------------------------------------------|---------------------------|
| <b>Required Texts</b> | K. Subramana, “ENGINEERING HYDROLOGY”, Second Edition<br>Mc Graw hill, New Delhi, 1997 | Yes                       |

|                          |                                                                                                                                                           |     |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Recommended Texts</b> | Linsely , R.K., M .A . Kohlerand Paulhus. “HYDROLOGY OF ENGINEERING”, McGraw-Hill, Singapore, 1988                                                        | Yes |
| <b>Websites</b>          | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |     |

| <b>Grading Scheme</b><br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                       | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                             |                               |                                                                                                                                                                                                                                                     |                                                                                                                                                          |
|------------------------------------|---------------------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                             |                               |                                                                                                                                                                                                                                                     |                                                                                                                                                          |
| Module Title                       | Water quality Engineering                   |                               | Module Delivery                                                                                                                                                                                                                                     |                                                                                                                                                          |
| Module Type                        | Core                                        |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input checked="" type="checkbox"/> Seminar |                                                                                                                                                          |
| Module Code                        | ENV221                                      |                               |                                                                                                                                                                                                                                                     |                                                                                                                                                          |
| ECTS Credits                       | 7                                           |                               |                                                                                                                                                                                                                                                     |                                                                                                                                                          |
| SWL (hr/sem)                       | 175                                         |                               |                                                                                                                                                                                                                                                     |                                                                                                                                                          |
| Module Level                       | 2                                           | Semester of Delivery          |                                                                                                                                                                                                                                                     | 4                                                                                                                                                        |
| Administering Department           | ENV8                                        | College                       | ENG4                                                                                                                                                                                                                                                |                                                                                                                                                          |
| Module Leader                      | Mayada Hazim Mohammed<br>Nadia Afram Yaqoob |                               | e-mail                                                                                                                                                                                                                                              | <a href="mailto:mayada.hmah@uomosul.edu.iq">mayada.hmah@uomosul.edu.iq</a> ,<br><a href="mailto:n.alrhmany@uomosul.edu.iq">n.alrhmany@uomosul.edu.iq</a> |
| Module Leader's Acad. Title        | Lecturer                                    | Module Leader's Qualification | M.Sc.                                                                                                                                                                                                                                               |                                                                                                                                                          |
| Module Tutor                       | -----                                       |                               | e-mail                                                                                                                                                                                                                                              | E-mail                                                                                                                                                   |
| Peer Reviewer Name                 | Mayada Hazim                                | e-mail                        | <a href="mailto:mayada.hmah@uomosul.edu.iq">mayada.hmah@uomosul.edu.iq</a>                                                                                                                                                                          |                                                                                                                                                          |
| Scientific Committee Approval Date | 26/11/2025                                  | Version Number                | 1.0                                                                                                                                                                                                                                                 |                                                                                                                                                          |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

## Module Aims, Learning Outcomes and Indicative Contents

### أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

|                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Module Objectives</b><br/>أهداف المادة الدراسية</p>                | <p>The aim of this course is to introduce the students to basic concepts on Water Quality Engineering. The course will cover water resources, principal sources of water pollution, Water Quality Management (rivers, lakes and ground water) , Water quality criteria and standards, Laws and Regulations, Mechanism of pollutant fate in the environment, Modeling of water quality in natural systems. The Lab part : the main goal of this part is to equip students with the expertise and skills necessary for monitoring water quality and analyzing it quantitatively. Also, it incorporates the chemical concepts necessary for managing water quality and reducing pollution.</p> <p>At the end of the course, students will learn how to analyze different water samples and will acquire the necessary expertise and skills to monitor and analyze water quality. This will be achieved through lectures, laboratories and tutorials.</p>                                                                                                                                                                                                        |
| <p><b>Module Learning Outcomes</b><br/>مخرجات التعلم للمادة الدراسية</p> | <p><b>CLO-1:</b> Identify Principal sources of water pollution (i).<br/> <b>CLO-2:</b> Describe the physical, chemical and biological characteristics of water quality and Water quality standards. (i).<br/> <b>CLO-3:</b> Apply the principle of mass balance to calculate DO Sag in river (ii).<br/> <b>CLO-4:</b> Apply the principle of mass balance of water quality modeling in lake (ii)<br/> <b>CLO-5:</b> Understand the Mechanism of pollutant Fate in the environment and Transport processes of pollutants (ii).<br/> <b>CLO-6:</b> Understand the modeling of water quality in rivers (i)<br/> <b>CLO-7:</b> Reporting information related to one of the topics of water quality (iv)<br/> <b>CLO-8:</b> Ability to perform and carryout proper measurement and tests. (iii)</p>                                                                                                                                                                                                                                                                                                                                                               |
| <p><b>Indicative Contents</b><br/>المحتويات الإرشادية</p>                | <p><u><b>Theoretical lectures</b></u></p> <p><u>Part A – Water resources and Sources of water pollution</u><br/> Surface water and Ground water, Point sources and non-point sources, Common impurities in water (6 hrs).</p> <p><u>Part B – Water quality standards and Regulations</u><br/> Physical, chemical and Biological characteristics; Criteria and standards; Law and Regulation clean water Act , Safe drinking water Act , Drinking-water standards(9 hrs)</p> <p><u>Part C - Water quality management in rivers</u><br/> Assimilative capacity , Waste discharges and receiving water ,Management of waste loads and assimilative capacity of receiving waters. DO Sag curve, Mass-Balance Approach, DO Sag Equations, Management Strategy of water quality (9 hrs).</p> <p><u>Part D - Water quality management in Lakes</u><br/> Thermal Stratification of lakes and turn over, Lake productivity, Eutrophication, Control of phosphorus in lakes; Water quality model in lake(6 hrs).</p> <p><u>Part E- Ground water quality</u><br/> Types of contaminants that can pollute an aquifer, Contaminant Migration in Groundwaters (3 hrs).</p> |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><u>Part F- Mechanism of pollutant Fate in the environment</u><br/>mechanisms responsible for transporting pollutants in the river; Transport processes; initial mixing; Longitudinal dispersion; Governing equation (6 hrs).</p> <p><u>Part G- Modeling of water quality in natural systems</u><br/>Types of water quality models, water quality modelling in riverine systems and Water quality index (6 hrs).</p> <p><u>Practical labs</u><br/> <u>Part A-</u> Introduction, sampling and River, lake and industrial waste samples collection (4 hrs).<br/> <u>Part B- Physical tests</u><br/>Total Solid, Dissolved Solid, Suspended Solid, PH-meter, Electrical Conductivity, Turbidity, (12 hrs).<br/> <u>Part C- Chemical tests</u><br/>Hardness, <math>\text{Ca}^{+2}</math>, and <math>\text{Mg}^{+2}</math> , Sulphates, Chlorides, Alkalinity, Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Biochemical oxygen Demand (BOD), Nitrate and Phosphate(14 hrs).</p> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | This will be achieved through lectures, labs, individual & group assignments and e-learning platforms and tutorials. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا       |            |                                                                           |     |
|--------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 78         | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 97         | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 6.5 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | <b>175</b> |                                                                           |     |

| Module Evaluation     |              |             |                  |                 |                                     |
|-----------------------|--------------|-------------|------------------|-----------------|-------------------------------------|
| تقييم المادة الدراسية |              |             |                  |                 |                                     |
|                       |              | Time/Number | Weight (Marks)   | Week Due        | Relevant Learning Outcome           |
| Formative assessment  | Quizzes      | 4           | 16 % (4)         | 2, 4, ,8 and 10 | CLO-1, CLO-2, CLO-3, CLO-4          |
|                       | Assignments  | 3           | 6 % (2)          | 3,8 and 11      | CLO-2, CLO-3, CLO-4, CLO-5and CLO-6 |
|                       | Lab.         | 1           | 15 % (15)        | 13              | All                                 |
|                       | Report       | 1           | 3 % (3)          |                 | All                                 |
| Summative assessment  | Midterm Exam | 2hr         | 10% (10)         | 10              | CLO-1, CLO -2 and CLO-3             |
|                       | Final Exam   | 3hr         | 50% (50)         | 16              | All                                 |
| Total assessment      |              |             | 100% (100 Marks) |                 |                                     |

| Delivery Plan (Weekly Syllabus) |                                                                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                                                                                                          |
|                                 | Material Covered                                                                                                                                                                         |
| Week 1                          | Water resources: Introduction, Surface water (rivers, lakes, reservoirs, streams) Ground water (wells, springs).                                                                         |
| Week 2                          | Sources of water pollution: Point sources and non-point sources, Common impurities in water.                                                                                             |
| Week 3                          | Physical, chemical and Biological characteristics, Criteria and standards.                                                                                                               |
| Week 4                          | Irrigation water quality of Criteria and standards, Radioactivity in water.                                                                                                              |
| Week 5                          | Law and Regulation, clean water Act, Safe drinking water Act, Drinking-water standards.                                                                                                  |
| Week 6                          | Management of waste loads and assimilative capacity of receiving waters. Effects of pollutant in rivers, Total maximum daily loads (TMDL), Effects of Oxygen –Demanding waste on rivers. |
| Week 7                          | Biochemical oxygen-demand, Chemical oxygen demand (COD), Laboratory measurement of biochemical oxygen demand, Addition notes on Biochemical Oxygen Demand, Nitrogen oxidation.           |
| Week 8                          | DO Sag curve, Mass-Balance Approach, DO Sag Equation, Management Strategy, Nitrogenous BOD, Effect of Nutrients on water quality in rivers.                                              |
| Week 9                          | Thermal Stratification of lakes and turn over, Biological zones, Lake productivity, Eutrophication, Algal growth requirement, Control of phosphorus in lakes.                            |
| Week 10                         | Water quality model in lake.                                                                                                                                                             |

|                |                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Week 11</b> | Ground water, Types of contaminants that can pollute an aquifer, Darcy equation, Contaminant Migration in Groundwaters.                                   |
| <b>Week 12</b> | Mechanism of pollutant Fate in the environment: mechanisms responsible for transporting pollutants in the river, Transport processes.                     |
| <b>Week 13</b> | Initial mixing, Turbulent Diffusion, Longitudinal Dispersion waste; Governing equation.                                                                   |
| <b>Week 14</b> | Modeling of water quality in natural systems: Types of water quality models, An elementary water quality model, water quality modelling in river systems. |
| <b>Week 15</b> | Water Quality Index, indices of pollution, Formulas use in Determination water quality index; classification of water quality index.                      |
| <b>Week 16</b> | <b>Preparatory week before the final Exam</b>                                                                                                             |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |                                                            |
|-------------------------------------------------------------------------|------------------------------------------------------------|
|                                                                         | <b>Material Covered</b>                                    |
| <b>Week 1</b>                                                           | Lab 1: Introduction, sampling.                             |
| <b>Week 2</b>                                                           | Lab 2: River, lake and industrial waste samples collection |
| <b>Week 3</b>                                                           | Lab 3: Total Solid.                                        |
| <b>Week 4</b>                                                           | Lab 4: Dissolved Solid, Suspended Solid.                   |
| <b>Week 5</b>                                                           | Lab 5: PH-meter, Electrical Conductivity                   |
| <b>Week 6</b>                                                           | Lab 6: Turbidity.                                          |
| <b>Week 7</b>                                                           | Lab 7: Hardness, $\text{Ca}^{+2}$ , and $\text{Mg}^{+2}$   |
| <b>Week 8</b>                                                           | Lab 8: Sulphates                                           |
| <b>Week 9</b>                                                           | Lab 9: Chlorides.                                          |
| <b>Week 10</b>                                                          | Lab 10: Alkalinity                                         |
| <b>Week 11</b>                                                          | Lab 11: Chemical Oxygen Demand (COD)                       |
| <b>Week 12</b>                                                          | Lab 12: Dissolved Oxygen (DO).                             |
| <b>Week 13</b>                                                          | Lab 13: Biochemical oxygen Demand (BOD).                   |
| <b>Week 14</b>                                                          | Lab 14: Nitrate.                                           |
| <b>Week 15</b>                                                          | Lab 15: Phosphate.                                         |

| Learning and Teaching Resources |                                                                                                                                                                                                                                                                                         |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                                                                                                                                                         |                           |
|                                 | Text                                                                                                                                                                                                                                                                                    | Available in the Library? |
| Required Texts                  | <ul style="list-style-type: none"> <li>Mackenzie L. Davis and Susan J.Masten "Principles of Environmental Engineering and Science", McGraw hill, USA, 3th,2004</li> <li>APHA, AWWA, WPCF "Standard method for the examination of water and wastewater", 1985.</li> </ul>                | Yes                       |
| Recommended Texts               | <ul style="list-style-type: none"> <li>David A. Chin "Water quality engineering in natural system", John Wiley &amp; Sons, Inc.,2006.</li> <li>عباوي , سعاد عبد و حسن , محمد سليمان "الهندسة العملية للبيئة -فحوصات الماء" دار ابن الاثير للطباعة للنشر -جامعة الموصل , 1990</li> </ul> | Yes                       |
| Websites                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a>                                                                                                                               |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                                           |                      |                                                                                                                                                                                                                                          |                                                                   |
|------------------------------------|-----------------------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                                           |                      |                                                                                                                                                                                                                                          |                                                                   |
| Module Title                       | Concrete & Building Technology                            |                      | Module Delivery                                                                                                                                                                                                                          |                                                                   |
| Module Type                        | Support                                                   |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                                                   |
| Module Code                        | ENV222                                                    |                      |                                                                                                                                                                                                                                          |                                                                   |
| ECTS Credits                       | 6                                                         |                      |                                                                                                                                                                                                                                          |                                                                   |
| SWL (hr/sem)                       | 150                                                       |                      |                                                                                                                                                                                                                                          |                                                                   |
| Module Level                       | 2                                                         | Semester of Delivery |                                                                                                                                                                                                                                          | 4                                                                 |
| Administering Department           | ENV8                                                      | College              | ENG4                                                                                                                                                                                                                                     |                                                                   |
| Module Leader                      | (1) Dr. Omar M. Abdulkareem<br>(2) Mohammed Hisham Shukur |                      | e-mail                                                                                                                                                                                                                                   | (1) omaralhakeem@uomosul.edu.iq<br>(2) M.h.alkafaf@uomosul.edu.iq |
| Module Leader's Acad. Title        | (1) Assistant Professor<br>(2) Lecturer                   |                      | Module Leader's Qualification                                                                                                                                                                                                            | (1) Ph.D.<br>(2) M. Sc.                                           |
| Module Tutor                       | -----                                                     |                      | e-mail                                                                                                                                                                                                                                   | E-mail                                                            |
| Peer Reviewer Name                 | -----                                                     |                      | e-mail                                                                                                                                                                                                                                   | E-mail                                                            |
| Scientific Committee Approval Date | 26/11/2024                                                |                      | Version Number                                                                                                                                                                                                                           | 1.0                                                               |

| Relation with other Modules       |      |  |          |
|-----------------------------------|------|--|----------|
| العلاقة مع المواد الدراسية الأخرى |      |  |          |
| Prerequisite module               | None |  | Semester |
| Co-requisites module              | None |  | Semester |

| Module Aims, Learning Outcomes and Indicative Contents   |                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                       |
| Module Objectives<br>أهداف المادة الدراسية               | <p>This course is aimed principally at university and college students who wish understand the concrete for the purpose of using it in professional practice. The students must take sufficient care to ensure the selection of correct ingredients, for concrete making to achieve a suitable mix, and to obtain a technically sound execution of concrete works. They must also</p> |

|                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                          | <p>have an intimate knowledge of the interaction between the different components that go into making concrete, whether in a fresh state or in a hardened state. This knowledge is necessary for students to be competent engineers in their dealings with the concrete and construction materials that go into their manufacture.</p> <p>Moreover, this course aims to introduce students to the principles of building systems, construction methods and techniques, starting from the idea, feasibility study, preparation of plans, methods of implementation, and excavation. Besides that, the equipment and methods of transporting and compacting of concrete with its determinants, and an explanation of masonry units with their properties and methods of construction with them. The course aims to get students familiarized with structural as well as finish works to be implemented in construction process for the floors, walls, ceilings, with the construction problems &amp; methods of treatment.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p><b>Module Learning Outcomes</b><br/>مخرجات التعلم للمادة الدراسية</p> | <p><b>CLO-1:</b> Identify the concrete composition, classification, characteristics, and mix proportioning (i).</p> <p><b>CLO-2:</b> Recognize the constituent materials (cement, water, fine and coarse aggregates, and admixtures) in concrete and evaluate how their engineering properties influence the behaviour and performance of the resulting concrete (i).</p> <p><b>CLO-3:</b> Able to determine the fresh and the hardened properties of the concrete, and understanding concrete performance as a good basics for the building construction and the structural design (ii).</p> <p><b>CLO-4:</b> Practicing laboratory experiments with execution, compilation and analysis on concrete and its ingredients in addition to the other construction materials (iii).</p> <p><b>CLO-5:</b> Identify the concepts and principles associated with the building, and technology of construction and be able to evaluate and interpret them using sketches, drawings or in written form (i).</p> <p><b>CLO-6:</b> Recognize building elements and components in specific situations; how, when and where they would be favoured; and the construction sequence for simple buildings (i).</p> <p><b>CLO-7:</b> Evaluate the appropriateness of different approaches, materials and construction in simple construction in accordance with building and technology theories and standards, in proportion to the requirements for the structural integrity of buildings (i).</p> |
| <p><b>Indicative Contents</b><br/>المحتويات الإرشادية</p>                | <p><b>1- Concrete Technology Topics:</b></p> <p><b>a- Topics of Theoretical Part:</b></p> <p>- Introduction to Concrete: Concrete definition, Concrete composition, Concrete classification, Concrete characteristics, Concrete mix ratios (Conservation of mix weight ratios to volume ratios, Rich and lean concrete mixes) (2 hrs).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

- Cement: Cement definition, Manufacture of Portland cement, Chemical composition of Portland cement clinker, Control Ratios, Phase composition of Portland cement clinker, Physical properties of cement (Compressive strength, Setting time, Early stiffening (False set and flash set), Particle size and fineness, Soundness, Consistency, Heat of hydration, Loss on ignition, Density and relative density (Specific gravity), Bulk density), Types of Portland cement (Main types, Blended cements, Special cements) (4 hrs).

- Mixing Water for Concrete: Introduction, Effects of impurities in mixing water on concrete properties (Alkali carbonate and bicarbonate, Chloride, Sulfates, Miscellaneous inorganic salts, Acid waters, Alkaline waters, suspended particles), Organic impurities (Waters carrying sanitary sewage, Sugar, Algae) (2 hrs).

- Aggregates in Concrete: Definition, Characteristics (Particle shape, Surface texture, Bulk density (unit weight) and voids, Relative density (Specific gravity), Absorption and moisture conditions, Alkali-silica reaction (ASR), Sampling, Grading) (4 hrs).

- Chemical Admixtures for Concrete: Definition, Reasons, Classes (Retarding admixtures, Accelerating admixtures, Water-reducing admixtures) (2 hrs).

- Fresh Properties of Concrete: Introduction, Fresh properties (Workability (Factors affecting, Measurement), Segregation, Bleeding, Plastic shrinkage), Composition of fresh concrete (Unit weight (Density), Yield, Cement factor) (6 hrs).

- Hardened Properties of Concrete: Strength (Compressive strength, Factors affecting compressive strength, Tensile strength, Flexure strength, Modulus of elasticity, Poisson's ratio, Shrinkage, Creep) (8 hrs).

#### **b- Topics of Experimental Part:**

- An exploratory tour of the construction materials testing laboratory to identify the devices and tests available there in, in addition to how to prepare the engineering report for the experiment according to the relevant structure (2 hrs).

- Standard consistency and initial setting time of the cement paste using Vicat apparatus (2 hrs).

- Compressive strength of the cement mortar cubes and tensile strength of the cement mortar brackets (2 hrs).

- Sieve analysis of the aggregate (Fine and Coarse) (2 hrs).

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <ul style="list-style-type: none"> <li>- Specific gravity, unit weight, surface moisture, and absorption capacity of the aggregate (4 hrs).</li> <li>- Properties of the fresh concrete (Workability, Proportion of sand, Unit weight) (2 hrs).</li> <li>- Capping, Relationship between the compressive strength of cubic specimen and compressive strength of cylindrical specimen (2 hrs).</li> <li>- Steel reinforcement test (2 hrs).</li> <li>- Masonry units tests (Red clay brick, Concrete block, Terrazzo, and Ceramic tiles) (4 hrs).</li> <li>- Non-destructive tests (Rebound hammer, Core test, Ultrasonic pulse velocity test, Load test) (6 hrs).</li> </ul> <p><b>2- Building Technology Topics:</b></p> <ul style="list-style-type: none"> <li>- General introduction of buildings, Stage of construction buildings, Steps to achieve any engineering project, Development of building construction, Definition and importance of feasibility study (2 hrs).</li> <li>- Earth excavations, Cracking rocks, Groundwater drainage, Soil fillings &amp; compaction (4 hrs).</li> <li>- Foundation depth, Soil &amp; foundation, Types of foundation, Settlement of foundation (4 hrs).</li> <li>- Concrete production: Mixing, Transporting, Placing, Compaction and finishing, Curing, Specifications and precautions (4 hrs).</li> <li>- Types of bricks, Manufacture of bricks, Blocks, Types of build in brick &amp; block, Types of binders (2 hrs).</li> <li>- Types of molds, Loads on mold, Types of scaffolding, Special types of molds (2 hrs).</li> <li>- Lintels, Type of lintels, Columns, Classification of columns (2 hrs).</li> <li>- Load on floors &amp; slabs, Finishing of floors &amp; slabs (2 hrs).</li> <li>- Moisture damages, Moisture proof materials, Treatment of moisture in old buildings (2 hrs).</li> <li>- Finishing of walls from inside &amp; outside, Paintings, General notes of finishing (2 hrs).</li> </ul> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |                                                              |
|--|--------------------------------------------------------------|
|  | - Stairs, types of stairs, Moving stairs, Elevators (2 hrs). |
|--|--------------------------------------------------------------|

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | This course has several components that include lectures, laboratory and field visits. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا       |            |                                                                           |     |
|--------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 78         | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 72         | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 4.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | <b>150</b> |                                                                           |     |

| <b>Module Evaluation</b><br>تقييم المادة الدراسية |                         |             |                |                                              |                           |
|---------------------------------------------------|-------------------------|-------------|----------------|----------------------------------------------|---------------------------|
|                                                   |                         | Time/Number | Weight (Marks) | Week Due                                     | Relevant Learning Outcome |
| <b>Formative assessment</b>                       | <b>Quizzes</b>          | 12          | 24% (2)        | 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, and 15 | All                       |
|                                                   | <b>Seminar</b>          | 1           | 3% (3)         | 10                                           | All                       |
|                                                   | <b>Lab./Report</b>      | 5           | 5% (1)         | 1,2,3,4,5,6, 7,8,9,10, 11,12,13,14, and 15   | All                       |
|                                                   | <b>Practical Report</b> | 8           | 8% (1)         | 1,2,3,4,5,6, 7,8,9,10, 11,12,13,14, and 15   | All                       |
| <b>Summative</b>                                  | <b>Midterm</b>          | 2hr         | 10% (10)       | 7                                            | CLO-1, CLO-2,             |

|                  |            |     |                  |    |              |
|------------------|------------|-----|------------------|----|--------------|
| assessment       | Exam       |     |                  |    | CLO-5, CLO-6 |
|                  | Final Exam | 3hr | 50% (50)         | 16 | All          |
| Total assessment |            |     | 100% (100 Marks) |    |              |

| Delivery Plan (Weekly Syllabus)      |                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري              |                                                                                                                                                                                                                                                                                                                      |
|                                      | Material Covered                                                                                                                                                                                                                                                                                                     |
| <b>Week 1</b><br>Concrete Technology | Introduction to Concrete: Concrete definition, Concrete composition, Concrete classification, Concrete characteristics, Concrete mix ratios (Conservation of mix weight ratios to volume ratios, Rich and lean concrete mixes).                                                                                      |
| <b>Week 1</b><br>Building Technology | General introduction of buildings, Stage of construction buildings, Steps to achieve any engineering project, Development of building construction, Definition and importance of feasibility study.                                                                                                                  |
| <b>Week 2</b><br>Concrete Technology | Cement: Cement definition, Manufacture of Portland cement, Chemical composition of Portland cement clinker, Control Ratios, Phase composition of Portland cement clinker, Physical properties of cement (Compressive strength, Setting time, Early stiffening (False set and flash set), Particle size and fineness. |
| <b>Week 2</b><br>Building Technology | Earth excavations, Cracking rocks.                                                                                                                                                                                                                                                                                   |
| <b>Week 3</b><br>Concrete Technology | Cement: Soundness, Consistency, Heat of hydration, Loss on ignition, Density and relative density (Specific gravity), Bulk density), Types of Portland cement (Main types, Blended cements, Special cements).                                                                                                        |
| <b>Week 3</b><br>Building Technology | Groundwater drainage, Soil fillings & compaction.                                                                                                                                                                                                                                                                    |
| <b>Week 4</b><br>Concrete Technology | Mixing Water for Concrete: Introduction, Effects of impurities in mixing water on concrete properties (Alkali carbonate and bicarbonate, Chloride, Sulfates, Miscellaneous inorganic salts, Acid waters, Alkaline waters, suspended particles), Organic impurities (Waters carrying sanitary sewage, Sugar, Algae).  |
| <b>Week 4</b><br>Building Technology | Foundation depth, Soil & foundation.                                                                                                                                                                                                                                                                                 |
| <b>Week 5</b><br>Concrete Technology | Aggregates in Concrete: Definition, Characteristics (Particle shape, Surface texture, Bulk density (unit weight) and voids, Relative density (Specific gravity).                                                                                                                                                     |
| <b>Week 5</b><br>Building Technology | Types of foundation, Settlement of foundation.                                                                                                                                                                                                                                                                       |
| <b>Week 6</b><br>Concrete Technology | Aggregates in Concrete: Absorption and moisture conditions, Alkali-silica reaction (ASR), Sampling, Grading.                                                                                                                                                                                                         |
| <b>Week 6</b><br>Building Technology | Concrete production: Mixing, Transporting, Placing.                                                                                                                                                                                                                                                                  |

|                                          |                                                                                                                                            |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Technology</b>                        |                                                                                                                                            |
| <b>Week 7</b><br>Concrete<br>Technology  | Chemical Admixtures for Concrete: Definition, Reasons, Classes (Retarding admixtures, Accelerating admixtures, Water-reducing admixtures). |
| <b>Week 7</b><br>Building<br>Technology  | Concrete production: Compaction and finishing, Curing, Specifications and precautions                                                      |
| <b>Week 8</b><br>Concrete<br>Technology  | Fresh Properties of Concrete: Introduction, Fresh properties (Workability (Factors affecting, Measurement).                                |
| <b>Week 8</b><br>Building<br>Technology  | Types of bricks, Manufacture of bricks, Blocks, Types of build in brick & block, Types of binders.                                         |
| <b>Week 9</b><br>Concrete<br>Technology  | Fresh Properties of Concrete: Segregation, Bleeding.                                                                                       |
| <b>Week 9</b><br>Building<br>Technology  | Types of molds, Loads on mold, Types of scaffolding, Special types of molds.                                                               |
| <b>Week 10</b><br>Concrete<br>Technology | Fresh Properties of Concrete: Plastic shrinkage, Composition of fresh concrete (Unit weight (Density), Yield, Cement factor).              |
| <b>Week 10</b><br>Building<br>Technology | Lintels, Type of lintels, Columns, Classification of columns.                                                                              |
| <b>Week 11</b><br>Concrete<br>Technology | Hardened Properties of Concrete: Strength (Compressive strength, Factors affecting compressive strength).                                  |
| <b>Week 11</b><br>Building<br>Technology | Load on floors & slabs, Finishing of floors & slabs.                                                                                       |
| <b>Week 12</b><br>Concrete<br>Technology | <b>Scientific Visit.</b>                                                                                                                   |
| <b>Week 12</b><br>Building<br>Technology |                                                                                                                                            |
| <b>Week 13</b><br>Concrete<br>Technology | Hardened Properties of Concrete: Tensile strength, Flexure strength, Modulus of elasticity, Poisson's ratio.                               |
| <b>Week 13</b><br>Building<br>Technology | Moisture damages, Moisture proof materials, Treatment of moisture in old buildings.                                                        |
| <b>Week 14</b><br>Concrete<br>Technology | Hardened Properties of Concrete: Shrinkage, Creep.                                                                                         |
| <b>Week 14</b><br>Building<br>Technology | Finishing of walls from inside & outside, Paintings, General notes of finishing.                                                           |
| <b>Week 15</b>                           | Hardened Properties of Concrete: Creep.                                                                                                    |

|                                       |                                                    |
|---------------------------------------|----------------------------------------------------|
| Concrete Technology                   |                                                    |
| <b>Week 15</b><br>Building Technology | Stairs, types of stairs, Moving stairs, Elevators. |
| <b>Week 16</b>                        | <b>Final Exam.</b>                                 |

| Delivery Plan (Weekly Lab. Syllabus) |                                                                                                                                                                                                                                                           |                           |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| المنهاج الاسبوعي للمختبر             |                                                                                                                                                                                                                                                           |                           |
|                                      | Material Covered                                                                                                                                                                                                                                          |                           |
| Week 1                               | An exploratory tour of the construction materials testing laboratory to identify the devices and tests available there in, in addition to how to prepare the engineering report for the experiment according to the relevant structure.                   |                           |
| Week 2                               | Standard consistency and initial setting time of the cement paste using Vicat apparatus.                                                                                                                                                                  |                           |
| Week 3                               | Compressive strength of the cement mortar cubes and tensile strength of the cement mortar brackets.                                                                                                                                                       |                           |
| Week 4                               | Sieve analysis of the aggregate (Fine and Coarse).                                                                                                                                                                                                        |                           |
| Week 5                               | Specific gravity, unit weight, surface moisture, and absorption capacity of the aggregate.                                                                                                                                                                |                           |
| Week 6                               |                                                                                                                                                                                                                                                           |                           |
| Week 7                               | Properties of the fresh concrete (Workability, Proportion of sand, Unit weight).                                                                                                                                                                          |                           |
| Week 8                               | Capping, Relationship between the compressive strength of cubic specimen and compressive strength of cylindrical specimen.                                                                                                                                |                           |
| Week 9                               | Steel reinforcement test.                                                                                                                                                                                                                                 |                           |
| Week 10                              | Masonry units tests (Red clay brick, Concrete block, Terrazzo, and Ceramic tiles).                                                                                                                                                                        |                           |
| Week 11                              |                                                                                                                                                                                                                                                           |                           |
| Week 12                              | Scientific Visit.                                                                                                                                                                                                                                         |                           |
| Week 13                              | Non-destructive tests (Rebound hammer test).                                                                                                                                                                                                              |                           |
| Week 14                              | Non-destructive tests (Core test).                                                                                                                                                                                                                        |                           |
| Week 15                              | Non-destructive tests (Ultrasonic pulse velocity test, Load test).                                                                                                                                                                                        |                           |
| Learning and Teaching Resources      |                                                                                                                                                                                                                                                           |                           |
| مصادر التعلم والتدريس                |                                                                                                                                                                                                                                                           |                           |
|                                      | Text                                                                                                                                                                                                                                                      | Available in the Library? |
| Required Texts                       | <ul style="list-style-type: none"><li>S. H. Kosmatka and M. L. Wilson, Design and Control of Concrete Mixtures, Portland Cement Association, Fifteenth Edition Print History, USA, 2011.</li><li>Z. Sacko and A. Levon, Buildings Construction,</li></ul> | Yes                       |

|                          |                                                                                                                                                                                                               |     |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                          | University of Baghdad, College of Engineering, Department of Civil Engineering, Iraq, 2007.                                                                                                                   |     |
| <b>Recommended Texts</b> | <ul style="list-style-type: none"> <li>G. Owens, Fulton's Concrete Technology, Cement &amp; Concrete Institute, Printing and Binding by Intrepid Printers (Pty) LTD, Midrand (South Africa), 2009.</li> </ul> | Yes |
| <b>Websites</b>          | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a>                                                     |     |

| <b>Grading Scheme</b><br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                       | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                                    |                               |                                                                                                                                                                                                                                                     |
|------------------------------------|----------------------------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                                    |                               |                                                                                                                                                                                                                                                     |
| Module Title                       | Survey Applications and GIS                        |                               | Module Delivery                                                                                                                                                                                                                                     |
| Module Type                        | S                                                  |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV223                                             |                               |                                                                                                                                                                                                                                                     |
| ECTS Credits                       | 6                                                  |                               |                                                                                                                                                                                                                                                     |
| SWL (hr/sem)                       | 150                                                |                               |                                                                                                                                                                                                                                                     |
| Module Level                       | LEVEL 2                                            | Semester of Delivery          | 4                                                                                                                                                                                                                                                   |
| Administering Department           | ENV8                                               | College                       | ENG4                                                                                                                                                                                                                                                |
| Module Leader                      | Dr. Kaythar A. Ibrahim                             | e-mail                        | Kaythar6871@uomosul.edu.iq                                                                                                                                                                                                                          |
| Module Leader's Acad. Title        | Assistant Profissor                                | Module Leader's Qualification | Ph.D.                                                                                                                                                                                                                                               |
| Module Tutor                       | Prof. Sabah Hussein Ali<br>Mr. Ahmed Yassen Shehab | e-mail                        | sabah196004@uomosul.edu.iq                                                                                                                                                                                                                          |
| Peer Reviewer Name                 |                                                    | e-mail                        |                                                                                                                                                                                                                                                     |
| Scientific Committee Approval Date | 1/10/2025                                          | Version Number                | 1                                                                                                                                                                                                                                                   |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | The semester aims to teach students how to deal with an ArcGIS10.6 program So that the student can open the windows of the program, import spatial and vector data, and editing this data, as well as adding and updating new field data. In addition, semester aims to teach students global position systems (GIS). The course also aims to teach students how to use the total station device to upload surveys and drop maps |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <b>CLO-1</b> Learning maps modeling through the elements of the arcgis10.6 program<br><b>CLO-2</b> Learning how to adjust the geodes system of maps and site using GPS<br><b>CLO-3</b> Using Total Station in surveying works.                                                                                                                                                                                                   |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | GIS was created to solve problems. Using GIS in education helps students frame, visualize, and grapple with problems. It even enables students to create solutions to those problems, whether they are about natural hazards, climate, urban greenways, litter, energy, social inequity, or other complex issues of our day                                                                                                      |

| Learning and Teaching Strategies |                                                                                                                        |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------|
| استراتيجيات التعلم والتعليم      |                                                                                                                        |
| <b>Strategies</b>                | This course has several components that include classes & lecture exams. The Arabic language is adopted in this course |

| Student Workload (SWL)                                                         |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا                                        |     |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 78  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 5.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 72  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 4.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | 150 |                                                                           |     |

| Module Evaluation     |                     |             |                  |          |                           |
|-----------------------|---------------------|-------------|------------------|----------|---------------------------|
| تقييم المادة الدراسية |                     |             |                  |          |                           |
|                       |                     | Time/Number | Weight (Marks)   | Week Due | Relevant Learning Outcome |
| Formative assessment  | Quizzes             | 2           | 10% (10)         |          | CLO-1, CLO-2              |
|                       | Online assignments  | 2           | 10%( 10)         |          | CLO-1, CLO-2              |
|                       | On site assignments | 0           |                  |          |                           |
|                       | Projects / Lab.     | 5           | 20% (20)         |          | ALL                       |
| Summative assessment  | Midterm Exam        |             | 10% (10)         |          | CLO-1, CLO-2              |
|                       | Final Exam          |             | 50%(50)          |          | All                       |
| Total assessment      |                     |             | 100% (100 Marks) |          |                           |

| Delivery Plan (Weekly Syllabus) |                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                    |
|                                 | Material Covered (Surveying Application)                                                           |
| Week 1-2                        | Introduction to the total station. How to calculate coordinates and Total Station                  |
| Week 3-4                        | Explaining the main components of Total station and how to prepare it for work                     |
| Week 5-6                        | Setting up the total station through the station's coordinates and angle.                          |
| Week 7-8                        | Setting up the total station through the station's coordinates and another point                   |
| Week 9-10                       | Setting up the total station through required point and angle (Local Resection)                    |
| Week 11-12                      | Setting up the total station through two points coordinates (Resection)<br>Surveying & setting out |
| Week 13-15                      | Surveying & setting out                                                                            |

| Delivery Plan (Weekly Syllabus) |                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                   |
|                                 | Material Covered (GIS)                                                                            |
| Week 1-2                        | Introduction to GIS What's GIS, the historical development, the application and Importance of GIS |
| Week 3-4                        | Difference between Raster and vector                                                              |
| Week 5-6                        | Review of the ArcGIS10.6 windows and the installation methods                                     |

|                   |                                                                        |
|-------------------|------------------------------------------------------------------------|
| <b>Week 7-8</b>   | Created shape files of line, polyline and polygon for wells and towers |
| <b>Week 9-10</b>  | Spatial and attribute tables                                           |
| <b>Week 11-12</b> | How to add field to attribute tables                                   |
| <b>Week 13-15</b> | GPS and geodetic system                                                |
| <b>Week 16</b>    | Preparatory week before the final Exam                                 |

| <b>Learning and Teaching Resources</b><br><b>مصادر التعلم والتدريس</b> |                                                                                                |                                  |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------|
|                                                                        | <b>Text</b>                                                                                    | <b>Available in the Library?</b> |
| <b>Required Texts</b>                                                  | Geographical Information System ( Arabia Saudi ).<br>Leica FlexLine TS02/TS06/TS09 User manual |                                  |
| <b>Recommended Texts</b>                                               | GIS and Remote sensing .. principle and application                                            |                                  |
| <b>Websites</b>                                                        | <a href="https://www.facebook.com/Hatem.Tarek.G">https://www.facebook.com/Hatem.Tarek.G</a>    |                                  |

| <b>Grading Scheme</b><br><b>مخطط الدرجات</b>                                                                                                                                                                                                                                                                                                                                         |                         |                     |                |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------------|---------------------------------------|
| <b>Group</b>                                                                                                                                                                                                                                                                                                                                                                         | <b>Grade</b>            | <b>التقدير</b>      | <b>Marks %</b> | <b>Definition</b>                     |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A - Excellent</b>    | امتياز              | 90 - 100       | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B - Very Good</b>    | جيد جدا             | 80 - 89        | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C - Good</b>         | جيد                 | 70 - 79        | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D - Satisfactory</b> | متوسط               | 60 - 69        | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E - Sufficient</b>   | مقبول               | 50 - 59        | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                       | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)        | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F – Fail</b>         | راسب                | (0-44)         | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |                |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |                |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                                                                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                      |
|------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                                                                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                      |
| Module Title                       | Microbiology                                                                               | Module Delivery                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                      |
| Module Type                        | Support                                                                                    | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                                                                                                                                                                                                                                                                                                      |
| Module Code                        | ENV224                                                                                     |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                      |
| ECTS Credits                       | 6                                                                                          |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                      |
| SWL (hr/sem)                       | 150                                                                                        |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                      |
| Module Level                       | 2                                                                                          |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                      |
| Administering Department           | ENV8                                                                                       | College                                                                                                                                                                                                                                  | ENG4                                                                                                                                                                                                                                                                                                                 |
| Module Leader                      | Dr. Shafaq Tariq Burhan                                                                    | e-mail                                                                                                                                                                                                                                   | <a href="mailto:Shasbio108@uomosul.edu.iq">Shasbio108@uomosul.edu.iq</a>                                                                                                                                                                                                                                             |
| Module Leader's Acad. Title        | Lecturer                                                                                   | Module Leader's Qualification                                                                                                                                                                                                            | PhD                                                                                                                                                                                                                                                                                                                  |
| Module Tutor                       | Waad Mohammed Ali Abbas<br>Nadia Afram Yaqoob<br>Aya Thamer Ibrahim<br>Aisha Mohanad Yahya | e-mail                                                                                                                                                                                                                                   | <a href="mailto:waadd1976@uomosul.edu.iq">waadd1976@uomosul.edu.iq</a><br><a href="mailto:n.alrhmany@uomosul.edu.iq">n.alrhmany@uomosul.edu.iq</a><br><a href="mailto:aya.thamer@uomosul.edu.iq">aya.thamer@uomosul.edu.iq</a><br><a href="mailto:aisha.almokhtar@uomosul.edu.iq">aisha.almokhtar@uomosul.edu.iq</a> |
| Peer Reviewer Name                 | -----                                                                                      | e-mail                                                                                                                                                                                                                                   | E-mail                                                                                                                                                                                                                                                                                                               |
| Scientific Committee Approval Date | 12/10/2024                                                                                 | Version Number                                                                                                                                                                                                                           | 1.0                                                                                                                                                                                                                                                                                                                  |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b> أهداف<br>المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br>أهداف المادة الدراسية                                                                         | In Environmental Microbiology, initially students will learn how to deal with different types of microorganisms and it's useful in designing wastewater and water treatment plant .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية                                                          | <p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p>CLO-1: How classify the microorganism.</p> <p>CLO-2: The structure of microorganism.</p> <p>CLO-3: Bacterial Morphologies.</p> <p>CLO-4: Identification of microorganisms and their activities.</p> <p>CLO-5: How to disinfect drinking water from pathogens.</p> <p>CLO-6: How to induce water pollution by pathogens.</p> <p>CLO-7: How waste water is treated biologically using microorganisms.</p> <p>CLO-8: Factors affecting on microorganisms.</p> <p>CLO-9: Learning everything regarding microorganisms that may be need them in other environmental engineering subjects in next stages.</p> <p>CLO-10: How to use the microscope.</p> <p>CLO-11: How to test the pollution indicators in water.</p> <p>CLO-12: How to test E. Coli in water samples.</p> <p>CLO-13: Gram staining procedure.</p> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                                                                         | <p style="color: red;">Indicative content includes the following.</p> <p><b>Part A:</b> Introduction to Microbiology as a science<br/> Microorganisms as cells<br/> Microorganisms and their natural environments<br/> Impact of microorganisms on humans<br/> A brief history of microbiology and recent advances.</p> <p><b>Part B:</b> The scope of microbial diversity is enormous and microorganisms have exploited every means of making a living consistent with the laws of chemistry and physics</p> <p><b>Part C:</b> The “Central Dogma” relates how biological information flows through a cell by a series of macromolecules that are governed by chemical actions.</p> <p><b>Part D:</b> Microbial ecology – study of the interaction of microorganisms with each other and their environment .</p>                                                                                                      |

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | To enhance the understanding of microbial function in engineering system, initially students must be learned how to deal with different types of microorganisms and it's useful in designing wastewater and water treatment plant. Also microorganisms play an important role in the protection of humans, animals, plants, air, soil, and engineer in systems from chemical or biological pollution, deterioration, and corrosion, and in the restoration polluted and degraded environments. |

| Student Workload (SWL)                                                  |     |                                                                    |     |
|-------------------------------------------------------------------------|-----|--------------------------------------------------------------------|-----|
| الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا                                 |     |                                                                    |     |
| Structured SWL (h/sem)<br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 63  | Structured SWL (h/w)<br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 4.2 |
| Unstructured SWL (h/sem)<br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 87  | Unstructured SWL (h/w)<br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 4.1 |
| Total SWL (h/sem)<br>الحمل الدراسي الكلي للطالب خلال الفصل              | 150 |                                                                    |     |

| Module Evaluation     |                 |             |                  |                    |                                   |
|-----------------------|-----------------|-------------|------------------|--------------------|-----------------------------------|
| تقييم المادة الدراسية |                 |             |                  |                    |                                   |
|                       |                 | Time/Number | Weight (Marks)   | Week Due           | Relevant Learning Outcome         |
| Formative assessment  | Quizzes         | 4           | 16 % (16)        | 2, 3, ,12 and 14   | CLO-1, CLO-2, CLO-3, CLO-5        |
|                       | Assignments     | 5           | 10 % (10)        | 2, 3, 4, 6, and 10 | CLO-2, CLO-2, CLO-3, CLO-2, CLO-3 |
|                       | Projects / Lab. | 6           | 10% (10)         | 13                 | CLO-2 to CLO-6                    |
|                       | Report          | 1           | 4 % (4)          |                    | All                               |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 7                  | CLO-1, CLO -2 and CLO-3           |
|                       | Final Exam      | 3hr         | 50% (50)         | 16                 | All                               |
| Total assessment      |                 |             | 100% (100 Marks) |                    |                                   |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                   | <b>Material Covered</b>                                                                                                                                                                                                                                    |
| <b>Week 1&amp;2</b>                                               | <b>Introduction to Microbiology</b><br>Why we are concerning for studying Environmental Microbiology, and Germ theory.                                                                                                                                     |
| <b>Week 3</b>                                                     | <b>Classification the microorganisms</b><br>Studying different types of classifications of microorganisms and Bacterial morphologies.                                                                                                                      |
| <b>Week 4&amp;5</b>                                               | <b>Bacterial cell chemistry</b><br>Studying microorganisms cell structure and cell chemistry.                                                                                                                                                              |
| <b>Week 6&amp;7</b>                                               | <b>Bacterial growth in batch system and continuous flow system</b><br>Expecting the number of generated bacteria and effect of reactor type on it, also substrate and other components effects on the microorganism's activities, as well as mass balance. |
| <b>Week 8</b>                                                     | <b>Microorganisms in water and bacterial content</b><br>The types of pathogens and its indicators, standards specifications of drinking water.                                                                                                             |
| <b>Week 9</b>                                                     | <b>Detection of evidence of water contamination</b> Coliform and fecal bacteria, viruses.                                                                                                                                                                  |
| <b>Week 10&amp;11</b>                                             | <b>Use the microscope and prepare the slides for examination</b> Laboratory lectures for practical testing.                                                                                                                                                |
| <b>Week 12</b>                                                    | <b>Most probability number test for coiform bacteria</b><br>The most important test for environmental engineers for pollution indicators                                                                                                                   |
| <b>Week 13&amp;14</b>                                             | <b>Biological treatment</b><br>Role of microorganisms in biological treatment of wastewater and the factors that effect on microorganisms activities in wastewater.                                                                                        |
| <b>Week 15</b>                                                    | <b>Review before the final Exam</b>                                                                                                                                                                                                                        |

| Delivery Plan (Weekly Lab. Syllabus) |                                                                                                                                                                                                           |                           |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| المنهاج الاسبوعي للمختبر             |                                                                                                                                                                                                           |                           |
|                                      | Material Covered                                                                                                                                                                                          |                           |
| Week 1                               | Laboratory Safety                                                                                                                                                                                         |                           |
| Week 2                               | Sterilization and Disinfection                                                                                                                                                                            |                           |
| Week 3                               | The microscope                                                                                                                                                                                            |                           |
| Week 4 & 5                           | Shapes of bacteria                                                                                                                                                                                        |                           |
| Week 6 & 7                           | Gram staining procedure                                                                                                                                                                                   |                           |
| Week 8 & 9                           | Handling of bacteria cultures                                                                                                                                                                             |                           |
| Week 10 & 11                         | Examination of indicator organisms in water                                                                                                                                                               |                           |
| Week 12 & 13                         | Final exam                                                                                                                                                                                                |                           |
| Learning and Teaching Resources      |                                                                                                                                                                                                           |                           |
| مصادر التعلم والتدريس                |                                                                                                                                                                                                           |                           |
|                                      | Text                                                                                                                                                                                                      | Available in the Library? |
| Required Texts                       | ● Environmental Microbiology for Engineers’ by Volodymyr Ivanov.                                                                                                                                          | Yes                       |
| Recommended Texts                    | ● Environmental microbiology-Academic Press (2014), by Ian L Pepper, Charles P Gerba and Terry J Gentry<br>● Principles of Environmental Engineering and Science, Mackenzie L. Davis and Susan J. Masten. | Yes                       |
|                                      | APHA, AWWA, WPCF “Standard method for the examination of water and wastewater”, 1985.                                                                                                                     |                           |
|                                      | Laboratory Exercises in Microbiology , Joan Petersen and Susan McLaughlin, City University of New York, CUNY Academic Works , 2016                                                                        |                           |
|                                      | "Practical Microbial physiology", Nawal M. Otba and et. al., Department of Biology, College of Science, University of Baghdad, 2021.                                                                      |                           |
| Websites                             |                                                                                                                                                                                                           |                           |

| <b>Grading Scheme</b><br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group (50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                      | <b>A – Excellent</b>    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B - Very Good</b>    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C – Good</b>         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D - Satisfactory</b> | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E – Sufficient</b>   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group (0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                           | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F – Fail</b>         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

Environmental Engineering

3rd Stage

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                             |                      |                                                                                                                                                                                                                                                     |                         |
|------------------------------------|-----------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| معلومات المادة الدراسية            |                             |                      |                                                                                                                                                                                                                                                     |                         |
| Module Title                       | Principles of Air Pollution |                      | Module Delivery                                                                                                                                                                                                                                     |                         |
| Module Type                        | Core                        |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input checked="" type="checkbox"/> Seminar |                         |
| Module Code                        | ENV311                      |                      |                                                                                                                                                                                                                                                     |                         |
| ECTS Credits                       | 5                           |                      |                                                                                                                                                                                                                                                     |                         |
| SWL (hr/sem)                       | 125                         |                      |                                                                                                                                                                                                                                                     |                         |
| Module Level                       | 3                           | Semester of Delivery |                                                                                                                                                                                                                                                     | 5                       |
| Administering Department           | ENV8                        | College              | ENG4                                                                                                                                                                                                                                                |                         |
| Module Leader                      | Dr. Mohammed Salim Shihab   |                      | e-mail                                                                                                                                                                                                                                              | Shihab77@uomosul.edu.iq |
| Module Leader's Acad. Title        | Asst. Prof.                 |                      | Module Leader's Qualification                                                                                                                                                                                                                       | Ph.D.                   |
| Module Tutor                       | _____                       |                      | e-mail                                                                                                                                                                                                                                              | _____                   |
| Peer Reviewer Name                 | -----                       |                      | e-mail                                                                                                                                                                                                                                              | E-mail                  |
| Scientific Committee Approval Date | 12/09/2025                  |                      | Version Number                                                                                                                                                                                                                                      | 1.0                     |

| Relation with other Modules       |      |          |       |
|-----------------------------------|------|----------|-------|
| العلاقة مع المواد الدراسية الأخرى |      |          |       |
| Prerequisite module               | None | Semester | ----  |
| Co-requisites module              | None | Semester | ----- |

| Module Aims, Learning Outcomes and Indicative Contents   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Module Objectives<br>أهداف المادة الدراسية               | <p>The aim of this course is to define the atmosphere and air pollution effects. The course will cover classification of air pollutants, their sources and concentrations, Relationship between air pollution and meteorology, mathematical models of dispersion (Gaussian Plume Dispersion model, point source, line source, area (box) model). Furthermore, indoor air quality model, its sources and emission modeling (radon model). Upon completion of this course student will be able to: Knowing the air pollution origins, types, causes, dispersion, and modeling.</p> |

|                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Learning Outcomes</b><br><br>مخرجات التعلم للمادة الدراسية | Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.<br><b>CLO-1:</b> Define of the air pollutants, their sources and effects in the atmosphere, (i)<br><b>CLO-2:</b> Knowing Air pollution legalization and amendments (i)<br><b>CLO-3:</b> Evaluating air quality for different pollutants using AQI (i)<br><b>CLO-4:</b> Predicting of atmospheric stability and plume patterns (i).<br><b>CLO-5:</b> Analyze the data and solve problems to evaluate the emission limits from different sources and comparing the results with the locale standards. (i)<br><b>CLO-6:</b> Reporting air pollutants data related to its sources, characteristics, and health effects (i)                                                                                                |
| <b>Indicative Contents</b><br><br>المحتويات الإرشادية                | Indicative content includes the following.<br><u>Part A – Introduction to the atmosphere</u><br>Definition, layers of the atmosphere, air pollution effects, Types of air pollutants, their sources and concentrations, classification of air pollutants, Air pollution legalization and amendments, Concentration Units and Air Quality Index (AQI) (12 hrs)<br><br><u>Part B – Air pollution and meteorology</u><br>Wind rose, pressure gradients, adiabatic lapse rate, atmospheric stability, radiation inversion, subsidence inversion, atmospheric stability and mixing depth, Smoke plumes patterns. (20 hrs)<br><br><u>Part C – Dispersion Models</u><br>Mathematical Models: The point source Gaussian plume model, A line-source dispersion model, Area-source models, In -door air quality model. (28 hrs) |

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | This course has several components that include lectures, individual assignments, and e-learning platforms. Exercises involving problems and tutorial sheets. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا       |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 48  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 2.6 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 77  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 1.6 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 125 |                                                                           |     |

| Module Evaluation     |                 |             |                  |                     |                                   |
|-----------------------|-----------------|-------------|------------------|---------------------|-----------------------------------|
| تقييم المادة الدراسية |                 |             |                  |                     |                                   |
|                       |                 | Time/Number | Weight (Marks)   | Week Due            | Relevant Learning Outcome         |
| Formative assessment  | Quizzes         | 5           | 15 % (15)        | 2, 6, ,8 ,12 and 14 | CLO-1, CLO-2, CLO-4, CLO-5, CLO-5 |
|                       | Assignments     | 3           | 15 % (15)        | 5, 8, and 12        | CLO-3, CLO-4, CLO-5               |
|                       | Projects / Lab. | ----        | -----            | -----               | -----                             |
|                       | Report          | 1           | 10 % (10)        |                     | CLO-1, CLO-2, CLO-6               |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 10                  | CLO-1, CLO-2, CLO-3, CLO-4        |
|                       | Final Exam      | 3hr         | 50% (50)         | 16                  | CLO-1, CLO-2, CLO-3, CLO-4, CLO-5 |
| Total assessment      |                 |             | 100% (100 Marks) |                     |                                   |

| Delivery Plan (Weekly Syllabus) |                                                                                                 |
|---------------------------------|-------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                 |
|                                 | Material Covered                                                                                |
| Week 1                          | Introduction to the atmosphere: Definition, layers of the atmosphere, and air pollution effects |
| Week 2                          | Types of air pollutants, their sources and concentrations, classification of air pollutants,    |
| Week 3                          | Air pollution legalization and amendments                                                       |
| Week 4                          | Concentration Units and Air Quality Index (AQI)                                                 |
| Week 5                          | Air pollution and meteorology:                                                                  |
| Week 6                          | Wind rose, pressure gradients,                                                                  |
| Week 7                          | Adiabatic lapse rate and atmospheric stability                                                  |
| Week 8                          | Radiation inversion and subsidence inversion,                                                   |
| Week 9                          | Atmospheric stability and mixing depth,                                                         |
| Week 10                         | Smoke plumes patterns.                                                                          |
| Week 11                         | Mathematical dispersion Models:                                                                 |
| Week 12                         | The point source Gaussian plume model,                                                          |
| Week 13                         | A line-source dispersion model,                                                                 |
| Week 14                         | Area-source models                                                                              |
| Week 15                         | In -door air quality model                                                                      |
| Week 16                         | Preparatory week before the final Exam                                                          |

| Learning and Teaching Resources |                                                                                                                                                                                                                                                                                                                                                                                    |                           |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                                                                                                                                                                                                                                                    |                           |
|                                 | Text                                                                                                                                                                                                                                                                                                                                                                               | Available in the Library? |
| Required Texts                  | <ul style="list-style-type: none"> <li>Mackenzie A. Davis, Davis A. Cornwel , Introduction to Environmental Engineering ,Chapter (9) , Air pollution ,6th ed. McGraw-Hill, ISBN 978-007-125922-4, 2023.</li> <li>Masters, GM, Introduction to Environmental Engineering and Science, Chapter (7) , Air pollution, 3rd ed. Prentice Hall, ISBN 0 – 13 – 155384 – 4,2014.</li> </ul> | Yes                       |
| Recommended Texts               | <ul style="list-style-type: none"> <li>Wark, K, Warner, CF and Davis, WT, Air Pollution – its origin and control. Addison-Wesley ISBN 0-673-99416-3, 1998.</li> </ul>                                                                                                                                                                                                              | Yes                       |
| Websites                        |                                                                                                                                                                                                                                                                                                                                                                                    |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                              |                  |                     |          |                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                                |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                       | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                                 | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                             | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                             | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                             | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                             | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                                      | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                             | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
| <p><b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.</p> |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                       |                               |                                                                                                                                                                                                                                          |
|------------------------------------|-----------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                       |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Water supply networks |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Core                  |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV312                |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 5                     |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 125                   |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 3                     | Semester of Delivery          | 5                                                                                                                                                                                                                                        |
| Administering Department           | ENV8                  | College                       | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Dr. Layth Abdalaleem  | e-mail                        | laythabdulaleem@uomosul.edu.iq                                                                                                                                                                                                           |
| Module Leader's Acad. Title        | Lecturer              | Module Leader's Qualification | Ph.D.                                                                                                                                                                                                                                    |
| Module Tutor                       | ----                  | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Peer Reviewer Name                 | -----                 | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Scientific Committee Approval Date | 12/06/2023            | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |                  |          |   |
|-----------------------------------|------------------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                  |          |   |
| Prerequisite module               | Fluids Mechanics | Semester | 4 |
| Co-requisites module              | None             | Semester |   |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br>أهداف المادة الدراسية                                                                         | <p>The course aim to describe the main components of water supply network system including water pipes network, pump station, and service storage tanks, also it describes all parameters that correlate with network such as valves, pipe materials, loads exerted on pipes. The course covers the methods that used to analysis and design of the main components of water supply network system, and learns the necessary principles of network maintenance and rehabilitation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية                                                          | <p><b>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</b></p> <p><b>CLO-1:</b> Recognizing the main parameters that must be available in the water supply network system to provide the required purpose of it (i).</p> <p><b>CLO-2:</b> Understanding the major principles that can be used to simulate the water network in computer software (i).</p> <p><b>CLO-3:</b> Understanding the major principles that can be used to solve the likely problems that may be occur in the network (ii).</p> <p><b>CLO-4:</b> Applying the fundamentals of fluid mechanics in the analysis and design of the main components of the system (ii).</p> <p><b>CLO-5:</b> Learning skills in the design and analysis of water network using computer software (i) and (iv).</p> <p><b>CLO-6:</b> Learning the methods that can be used to rehabilitation and prolong the network life (i).</p> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                                                                         | <p><u>Part A – Preliminary fundamentals:</u></p> <p>Hazen Williams equation and its applications, equivalent pipe principle, demand estimation, skeletonization, demand allocation, network configurations (12 h).</p> <p><u>Part B – Design and analysis of water network:</u></p> <p>Sequences of analysis and design steps, design consideration, Hardy-Cross methods (12 h).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                   | <p><u>Part C – Service tanks:</u></p> <p>Types of tanks, Storage volume components, methods of equalization volume computation, tank location, quality of water tank (12 h)</p> <p><u>Part D – Pump stations:</u></p> <p>Total dynamic head, system head curve, Selection of pumping units, pumps in parallel and series, Net positive suction head, Affinity laws (12 h).</p> <p><u>Part E – Computer software:</u> (4 h)</p> <p><u>Part F – Pipes:</u></p> <p>Pipe material selection, types of valves, loads on buried pipes, bedding selection. (8 h)</p> |
| <p><b>Learning and Teaching Strategies</b></p> <p>استراتيجيات التعلم والتعليم</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Strategies</b>                                                                 | <p>The course will be covered by class room lectures; three hours each week for explaining the materials with giving examples, and one hour for tutorials problems.</p> <p>Explanation on necessary computer software will be given and a project on an actual network will be submitted by one student or group.</p>                                                                                                                                                                                                                                         |

| <p><b>Student Workload (SWL)</b></p> <p>الحمل الدراسي للطلاب محسوب ل ١٥ اسبوعا</p>        |            |                                                                                      |     |
|-------------------------------------------------------------------------------------------|------------|--------------------------------------------------------------------------------------|-----|
| <p><b>Structured SWL (h/sem)</b></p> <p>الحمل الدراسي المنتظم للطلاب خلال الفصل</p>       | 63         | <p><b>Structured SWL (h/w)</b></p> <p>الحمل الدراسي المنتظم للطلاب أسبوعيا</p>       | 4.2 |
| <p><b>Unstructured SWL (h/sem)</b></p> <p>الحمل الدراسي غير المنتظم للطلاب خلال الفصل</p> | 62         | <p><b>Unstructured SWL (h/w)</b></p> <p>الحمل الدراسي غير المنتظم للطلاب أسبوعيا</p> | 4.1 |
| <b>Total SWL (h/sem)</b>                                                                  | <b>125</b> |                                                                                      |     |
| الحمل الدراسي الكلي للطلاب خلال الفصل                                                     |            |                                                                                      |     |

| Module Evaluation     |                 |             |                  |                           |                                                        |
|-----------------------|-----------------|-------------|------------------|---------------------------|--------------------------------------------------------|
| تقييم المادة الدراسية |                 |             |                  |                           |                                                        |
|                       |                 | Time/Number | Weight (Marks)   | Week Due                  | Relevant Learning Outcome                              |
| Formative assessment  | Quizzes         | 8           | 33 % (33)        | 2,,3, 5, 7,9,11,13 and 14 | CLO-1, CLO-2, CLO-2, CLO-3, CLO-4, CLO-4, CLO-4, CLO-6 |
|                       | Assignments     | 0           | 0 % (0)          |                           |                                                        |
|                       | Projects / Lab. | 1           | 7 % (7)          | 13                        | CLO-5                                                  |
|                       | Report          | 0           | 0 % (0)          |                           |                                                        |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 7                         | All except CLO-5                                       |
|                       | Final Exam      | 3hr         | 50% (50)         | 16                        | All except CLO-5                                       |
| Total assessment      |                 |             | 100% (100 Marks) |                           |                                                        |

| Delivery Plan (Weekly Syllabus) |                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                                            |
|                                 | Material Covered                                                                                                           |
| Week 1                          | Hazen Williams equation and its applications, equivalent pipe principle.,                                                  |
| Week 2                          | Water distribution network: Basic types of demand, peaking factors, demand estimation, skeletonization, demand allocation. |
| Week 3                          | Distribution methods, configuration of distribution networks.                                                              |
| Week 4                          | Design and analysis of water networks, sequences of analysis and design steps, design consideration.                       |
| Week 5                          | Examples on analysis and design of branched network.                                                                       |
| Week 6                          | Hardy-Cross method, example on looped network analysis.                                                                    |

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Week 7</b>  | Service storage tanks, types of tanks, storage volume components, methods of equalization volume computation.                  |
| <b>Week 8</b>  | Examples on equalization volume computation, fire storage.                                                                     |
| <b>Week 9</b>  | Emergency storage, tank location, quality of water tank, tank maintenance.                                                     |
| <b>Week 10</b> | Pump stations, types of pumps, total dynamic head, system head curve, pump characteristics curves, selection of pumping units. |
| <b>Week 11</b> | Flow range of centrifugal pumps, pumps connection in series and parallel, examples.                                            |
| <b>Week 12</b> | Cavitation phenomenon and net positive suction head, affinity laws, specific speed, examples.                                  |
| <b>Week 13</b> | Computer software applications.                                                                                                |
| <b>Week 14</b> | Pipe material selection, advantages and disadvantages of different types of pipes, types of valves.                            |
| <b>Week 15</b> | Loads on buried pipes, Marston equation, bedding pipe selection, truck load, internal pressure, thrust forces, examples .      |
| <b>Week 16</b> |                                                                                                                                |

| Learning and Teaching Resources |                                                                                                                                                           |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                           |                           |
|                                 | Text                                                                                                                                                      | Available in the Library? |
| <b>Required Texts</b>           | McGhee, T. G., 1991, Water Supply and Sewerage, 6 <sup>th</sup> ed., McGraw-Hill, Inc.                                                                    | Yes                       |
| <b>Recommended Texts</b>        | Mays, L. W. (Editor), 2000, Water Distribution Systems Handbook, McGraw-Hill, Inc.                                                                        | No                        |
| <b>Websites</b>                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                         |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group</b><br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                   | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group</b><br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                        | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                         |                               |                                                                                                                                                                                                                                          |
|------------------------------------|-------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                         |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Solid Waste Engineering |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Core                    |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV313                  |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 5                       |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 125                     |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 3                       | Semester of Delivery          | 5                                                                                                                                                                                                                                        |
| Administering Department           | ENV8                    | College                       | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Dr. Anas Fakhry Qassid  | e-mail                        | anasfq@uomosul.edu.iq                                                                                                                                                                                                                    |
| Module Leader's Acad. Title        | Lecturer                | Module Leader's Qualification | Ph.D.                                                                                                                                                                                                                                    |
| Module Tutor                       |                         | e-mail                        |                                                                                                                                                                                                                                          |
| Peer Reviewer Name                 |                         | e-mail                        |                                                                                                                                                                                                                                          |
| Scientific Committee Approval Date | 12/06/2023              | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |                                        |          |   |
|-----------------------------------|----------------------------------------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                                        |          |   |
| Prerequisite module               | None                                   | Semester |   |
| Co-requisites module              | Principal of Environmental Engineering | Semester | 2 |

| Learning and Teaching Strategies |                                                                                                                                                                                                                                                                                       |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| استراتيجيات التعلم والتعليم      |                                                                                                                                                                                                                                                                                       |
| Strategies                       | This course has several components that include lectures, assignments, exams. Exercises design the solid waste collection for each student. The course will be taught in Arabic, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |
|                                  |                                                                                                                                                                                                                                                                                       |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <p>The course would cover-general introduction including definition of municipal solid waste; legal issues and requirements for solid waste management; sampling and characterization of solid waste; analysis of solid waste constituents; health and environmental issues related to solid waste management; steps in solid waste management including solid waste reduction at source, collection techniques, materials and resource recovery/recycling, transport, optimization of solid waste transport, treatment and disposal techniques (composting, incineration, refuse derived fuels, landfilling).</p>                                                                                                                                                                                                                                                                                                                                            |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p><b>CLO-1:</b> Explain municipal solid waste management systems with respect to its physical properties, and associated critical considerations. (i)</p> <p><b>CLO-2:</b> Outline sources, types and composition of solid waste with methods of handling, sampling and storage of solid waste. (i)</p> <p><b>CLO-3:</b> Select the appropriate method for solid waste collection, transportation, redistribution and disposal. (i)</p> <p><b>CLO-4:</b> Describe methods of disposal of hazardous solid waste. (i)</p> <p><b>CLO-5:</b> Design the collection systems of solid waste of a town. (ii)</p> <p><b>CLO-6:</b> Design treatment of municipal solid waste and landfill. (ii)</p> <p><b>CLO-7:</b> Design a composting facility. (ii)</p> <p><b>CLO-8:</b> All student make a project in design of solid waste collection system. (vii)</p> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p>Indicative content includes the following.</p> <p><u>Part A</u> – Introduction to integrated solid waste management, Legislative Trends and Impacts, Sources, Types, and Composition of Municipal Solid Wastes (6 hrs).</p> <p><u>Part B</u> – Study the physical, chemical, biological properties of solid waste (6 hrs)</p> <p><u>Part C Hazardous Wastes Found in Municipal Solid Waste:</u> study its sources, types, and properties (6 hrs)</p> <p>Part D – solid waste generation, and waste handling at the source (6 hrs)</p> <p>Part E – Collection of solid waste (18 hrs)</p> <p>Part F – Transfer and Transport (4 hrs)</p>                                                                                                                                                                                                                                                                                                                    |
|                                                                  | <p>Part G – Separation and Processing and Transformation of Solid Waste (14 hrs)</p> <p>Part H – Disposal of Solid Wastes and Residual Matter (15 hrs)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

| Student Workload (SWL)                                                         |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا                                        |     |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 63  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 4.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 62  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 4.1 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 125 |                                                                           |     |

| Module Evaluation     |                 |             |                |                                  |                                                                |
|-----------------------|-----------------|-------------|----------------|----------------------------------|----------------------------------------------------------------|
| تقييم المادة الدراسية |                 |             |                |                                  |                                                                |
|                       |                 | Time/Number | Weight (Marks) | Week Due                         | Relevant Learning Outcome                                      |
| Formative assessment  | Quizzes         | 5           | 20%            | 5, 8, 10, 14, and 15             | 1 (CLO-1, CLO -2), 2 (CLO-2), 3 (CLO-2, CLO-3), 4(All), 5(All) |
|                       | Assignments     | 5           | 10%            | 6, 9, 10, 14, and 15             | 1 (CLO-1, CLO -2), 2 (CLO-2), 3 (CLO-4, CLO-5), 4(All), 5(All) |
|                       | Projects / Lab. | 1           | 10%            | 8, 9, 10, 11, 12, 13, 14, and 15 | (CLO-5 and CLO-8)                                              |
|                       | Report          | 0           | 0              |                                  |                                                                |
| Summative assessment  | Midterm Exam    | 2hr         | 10%            | 12                               | (CLO-1, CLO-2, CLO-3, CLO-4, CLO-5)                            |
|                       | Final Exam      | 3hr         | 50%            | 16                               | All                                                            |
| Total assessment      |                 |             | 100%           |                                  |                                                                |

### Delivery Plan (Weekly Syllabus)

#### المنهاج الاسبوعي النظري

|                | Material Covered                                                                  |
|----------------|-----------------------------------------------------------------------------------|
| <b>Week 1</b>  | Objectives, Evolution of Solid-Waste Management                                   |
| <b>Week 2</b>  | Legislative Trends and Impacts                                                    |
| <b>Week 3</b>  | Sources, Types, and Composition of Municipal Solid Wastes                         |
| <b>Week 4</b>  | Application examples about composition of solid waste                             |
| <b>Week 5</b>  | Physical Properties of Municipal Solid Waste                                      |
| <b>Week 6</b>  | Chemical Properties of Municipal Solid Waste                                      |
| <b>Week 7</b>  | Biological Properties of Municipal Solid Waste                                    |
| <b>Week 8</b>  | Sources, Types, and Properties of Hazardous Wastes Found in Municipal Solid Waste |
| <b>Week 9</b>  | Solid Waste Generation and Collection Rate                                        |
| <b>Week 10</b> | Waste Handling and Separation, Storage, and Processing at the Source              |
| <b>Week 11</b> | Collection of Solid Waste                                                         |
| <b>Week 12</b> | Mid-Term Exam - Time-cost trade-off.                                              |
| <b>Week 13</b> | Transfer and Transport                                                            |
| <b>Week 14</b> | Separation and Processing and Transformation of Solid Waste                       |
| <b>Week 15</b> | Disposal of Solid Wastes and Residual Matter                                      |
| <b>Week 16</b> | <b>Preparatory week before the final Exam</b>                                     |

| Learning and Teaching Resources |                                                                                                                                                           |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                           |                           |
|                                 | Text                                                                                                                                                      | Available in the Library? |
| <b>Required Texts</b>           | George Tchobanoglous "Integrated Solid Waste Management", McGraw hill ,new york, 1993.                                                                    | Non                       |
| <b>Recommended Texts</b>        | Michael D. LaGrega "Hazardous Waste Management", McGraw hill ,new york, 2001.                                                                             | Non                       |
| <b>Websites</b>                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| <b>Success Group</b><br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                   | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group</b><br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                        | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                             |                      |                                                                                                                                                                                                                                          |                                 |
|------------------------------------|-----------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| معلومات المادة الدراسية            |                             |                      |                                                                                                                                                                                                                                          |                                 |
| Module Title                       | Unit Operations & Processes |                      | Module Delivery                                                                                                                                                                                                                          |                                 |
| Module Type                        | Core                        |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                 |
| Module Code                        | ENV314                      |                      |                                                                                                                                                                                                                                          |                                 |
| ECTS Credits                       | 5                           |                      |                                                                                                                                                                                                                                          |                                 |
| SWL (hr/sem)                       | 125                         |                      |                                                                                                                                                                                                                                          |                                 |
| Module Level                       | 3                           | Semester of Delivery |                                                                                                                                                                                                                                          | 5                               |
| Administering Department           | ENV8                        | College              | ENG4                                                                                                                                                                                                                                     |                                 |
| Module Leader                      | Dr. Abdullah Ismael Ibrahim |                      | e-mail                                                                                                                                                                                                                                   | abdullah.ibrahim@uomosul.edu.iq |
| Module Leader's Acad. Title        | Assist. Prof.               |                      | Module Leader's Qualification                                                                                                                                                                                                            |                                 |
| Module Tutor                       | -----                       |                      | e-mail                                                                                                                                                                                                                                   | E-mail                          |
| Peer Reviewer Name                 | -----                       |                      | e-mail                                                                                                                                                                                                                                   | E-mail                          |
| Scientific Committee Approval Date | 9/4/2026                    | Version Number       | 1.0                                                                                                                                                                                                                                      |                                 |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | This course aims to introduce the students to the area of wastewater treatment process. The course will cover fundamentals of physical, chemical, biological wastewater treatment process. At the end of the course the students will have a knowledge of the wastewater treatment process and operation that qualify them to perform a complete wastewater treatment process.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | CLO-1: Recognize the common physical, chemical and biological unit operations encountered in treatment processes (i)<br>CLO-2: Apply the basic concepts of sciences and engineering to solve issues associated with the treatment of wastewater (i)<br>CLO-3: Formulate a preliminary concepts of wastewater treatment process including batch, complete mix, and plug flow reactors (ii)<br>CLO-4: Develop and solve design problems and analyze the data to evaluate the feasibility of a components of the wastewater treatment plant (ii).<br>CLO-5: Report the data obtained from the site visits to WWTP that will be organized during the course (iv)<br>CLO-6: Demonstrate the ability to lead and productively participate in group situations via assigning multidisciplinary design projects for specific wastewater unit processes and operation (vii)                                                                                             |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | Part A–Wastewater characteristics and flowrate: Physical, Chemical and Biological characteristics of wastewater, Component of wastewater flows, Selection of design flowrates and mass loadings (15 hrs).<br>Part B – Reaction kinetics and reactors: Reactions types, Reaction order, Reaction rates, Types of reactors, The mass balance principle, Modeling treatment process kinetics, Treatment process involving mass transfer, Gas-Liquid mass transfer, Two film theory Liquid-Solid mass transfer (15 hrs).<br>Part C– Physical & Chemical unit operations: Mixing and flocculation, Energy dissipation in mixing, Types of mixers, Oxygen transfer, Determination of oxygen transfer coefficient. Chemical Coagulation, Colloidal destabilization, Chemical oxidation (15 hrs).<br>Part D- Biological unit operations: Microbial metabolism, Microbial growth kinetics, Aerobic biological oxidation, Anaerobic fermentation and oxidation (15 hrs). |

| <b>Learning and Teaching Strategies</b><br><b>استراتيجيات التعلم والتعليم</b> |               |
|-------------------------------------------------------------------------------|---------------|
| <b>Strategies</b>                                                             | محاضرات نظرية |

| <b>Student Workload (SWL)</b><br><b>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا</b> |    |                             |     |
|---------------------------------------------------------------------------------|----|-----------------------------|-----|
| <b>Structured SWL (h/sem)</b>                                                   | 78 | <b>Structured SWL (h/w)</b> | 5.2 |

|                                                                                |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي المنتظم للطلاب خلال الفصل                                        |     | الحمل الدراسي المنتظم للطلاب أسبوعيا                                      |     |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 47  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 3.1 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 125 |                                                                           |     |

| Module Evaluation<br>تقييم المادة الدراسية |                     |             |                  |                |                                   |
|--------------------------------------------|---------------------|-------------|------------------|----------------|-----------------------------------|
|                                            |                     | Time/Number | Weight (Marks)   | Week Due       | Relevant Learning Outcome         |
| Formative assessment                       | Quizzes             | 4           | 10%              | 2,6,10, and 12 | CLO-1, CLO-1, CLO-2, CLO-2        |
|                                            | Online assignments  | 4           | 10%              | 2,5,10, and 14 | CLO-2, CLO-2, CLO-3, CLO-2, CLO-3 |
|                                            | On site assignments | 4           | 10%              | 1,3,9, and 13  | CLO-2 to CLO-6                    |
|                                            | Projects / Lab.     | 1           | 10%              | 10             | All                               |
| Summative assessment                       | Midterm Exam        | 1           | 10%              | 8              | CLO-1, CLO -2 and CLO-3           |
|                                            | Final Exam          | 1           | 50%              | 16             | All                               |
| Total assessment                           |                     |             | 100% (100 Marks) |                |                                   |

| Delivery Plan (Weekly Syllabus)<br>المنهاج الاسبوعي النظري |                                                                                               |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|                                                            | Material Covered                                                                              |
| Week 1-2                                                   | Wastewater characteristics and flowrate                                                       |
| Week 3-4                                                   | Reaction kinetics and reactors                                                                |
| Week 4-5                                                   | Physical unit operations                                                                      |
| Week 6-7                                                   | Chemical unit operations                                                                      |
| Week 8                                                     | Midterm Exam                                                                                  |
| Week 9-10                                                  | Microbial growth kinetics, Aerobic biological oxidation, Anaerobic fermentation and oxidation |

|            |                            |
|------------|----------------------------|
| Week 11-12 | Biological unit process    |
| Week 13-15 | Biological unit operations |
| Week 16    | Final Exam                 |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |                  |
|-------------------------------------------------------------------------|------------------|
|                                                                         | Material Covered |
| Week 1-2                                                                |                  |
| Week 5-6                                                                |                  |
| Week 7-8                                                                |                  |
| Week 9-10                                                               |                  |
| Week 10-11                                                              |                  |
| Week 13-14                                                              |                  |

| <b>Learning and Teaching Resources</b><br>مصادر التعلم والتدريس |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                                 | Text                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Available in the Library? |
| <b>Required Texts</b>                                           | Tchobanoglous, G., F. L. Burton, and H. D. Stensel. <i>Wastewater Engineering: Treatment and Resource Recovery</i> . 5 <sup>th</sup> ed. Metcalf and Eddy Inc., New York, NY: McGraw-Hill, 2003. ISBN: 978-0-07-340118-8.                                                                                                                                                                                                                                                                                                                                       | Yes                       |
| <b>Recommended Texts</b>                                        | <p>Qasim , Syed R., Guang Zh. <i>Wastewater Treatment and Reuse, Theory and Design Examples, Volume 1: Principles and Basic Treatment</i>, 1<sup>st</sup> ed. Taylor &amp; Francis Group, LLC, 2018. ISBN:13: 978-1-138-30089-7</p> <p>Viessman, W., Jr., and M. J. Hammer. <i>Water Supply and Pollution Control</i>. 7th ed. Pearson Education, Inc., Upper Saddle River, NJ: Pearson Prentice Hall, 2005. ISBN: 0131409700.</p> <p>Mara, D. <i>Domestic Wastewater Treatment in Developing Countries</i>. London, UK: Earthscan, 2003. ISBN: 1844070190.</p> | Yes                       |

|                 |                                                                                                                                                           |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Websites</b> | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|

| <b>Grading Scheme</b><br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                       | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                            |                      |                                                                                                                                                                                                                               |                             |
|------------------------------------|----------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| معلومات المادة الدراسية            |                            |                      |                                                                                                                                                                                                                               |                             |
| Module Title                       | Sustainability Engineering |                      | Module Delivery                                                                                                                                                                                                               |                             |
| Module Type                        | Core                       |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                             |
| Module Code                        | ENV315                     |                      |                                                                                                                                                                                                                               |                             |
| ECTS Credits                       | 4                          |                      |                                                                                                                                                                                                                               |                             |
| SWL (hr/sem)                       | 100                        |                      |                                                                                                                                                                                                                               |                             |
| Module Level                       | 3                          | Semester of Delivery |                                                                                                                                                                                                                               | 5                           |
| Administering Department           | ENV8                       | College              | ENG4                                                                                                                                                                                                                          |                             |
| Module Leader                      | Dr. Omar M. Abdulkareem    |                      | e-mail                                                                                                                                                                                                                        | omaralhakeem@uomosul.edu.iq |
| Module Leader's Acad. Title        | Assistant Professor        |                      | Module Leader's Qualification                                                                                                                                                                                                 | Ph.D.                       |
| Module Tutor                       | -----                      |                      | e-mail                                                                                                                                                                                                                        | E-mail                      |
| Peer Reviewer Name                 | -----                      |                      | e-mail                                                                                                                                                                                                                        | E-mail                      |
| Scientific Committee Approval Date | 25/11/2025                 |                      | Version Number                                                                                                                                                                                                                | 1.0                         |

| Relation with other Modules       |      |  |          |
|-----------------------------------|------|--|----------|
| العلاقة مع المواد الدراسية الأخرى |      |  |          |
| Prerequisite module               | None |  | Semester |
| Co-requisites module              | None |  | Semester |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <p>This course aims to introduce the students to the sustainability concept, and the principles of sustainable development. Also how they can exchange the different activities within sustainability concept !! Also this course deals with the environmental impact of the concrete from a variety of viewpoints: the concrete constituents themselves, the application of wastes and by-products, and the use of natural materials of low environmental impact. It thus provides a sound basis for developing and application of ecologically friendly concretes. Another purpose of this course is to make the students aware of the technical possibilities for recycling of demolished concrete and masonry. This course as well exposes students to a broader range of types of new and renewable energies as sun energy (photocells, heating, salt lagoon), wind energy, waterfalls energy, gravity energy, the practical methods to use.</p>         |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p><b>CLO-1:</b> Learn about the principles, indicators and general concept of climate change, and urban resilience, and sustainability (i).</p> <p><b>CLO-2:</b> Get a useful acquaintance about the features of sustainable buildings in accordance with the sustainable concept (i).</p> <p><b>CLO-3:</b> Apprehend the local, regional and global impacts of unsustainable designs, products and processes (i).</p> <p><b>CLO-4:</b> Explore the types of new and renewable energies, and have in-depth knowledge about the eutrophication (i).</p> <p><b>CLO-5:</b> Use the mathematical expressions to evaluate the environmental impacts in terms of GHG emissions, particulate matters and solid wastes of the cement industry (ii).</p> <p><b>CLO-6:</b> Use the mathematical principles with the sustainability concepts in engineering such as the estimation of needs, consumption, and cost of the renewable energy source in the city (ii).</p> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <ul style="list-style-type: none"> <li>- Climate change, Global warming, Greenhouse gasses (GHG) emissions, Combating climate change, Carbon-Neutrality (2 hrs).</li> <li>- Carbon offset, Climate governance, Urbanization &amp; climate change, Sustainability (definition, strategies, pillars), 3R concept - How to preserve resources, Sustainable development (2 hrs).</li> <li>- Urban resilience: Urban planning, Urban development and sustainability, Resilient urban planning concepts and strategies, Climate change adaptation &amp;</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>climate change mitigation, Life cycle assessment (LCA) and life cycle cost (LCC) (2 hrs).</p> <ul style="list-style-type: none"> <li>- Sustainable buildings: Sustainable thinking – Integrative design of buildings, Successful integrative design requirement, Multifunctionality, Green roofs, Regenerative systems (Characteristics, Biomass energy, Canopy trees &amp; green walls to biomass energy, Water treatment Network) (4 hrs).</li> <li>- Rating systems of green buildings: LEED, BREEAM, Envision, Edge, Green Surge, WELL, Site sustainability (Main issues) (2 hrs).</li> <li>- Sustainability of concrete: Negative environmental effects of cement and concrete industries, Environmental concerns, Ten qualifications of concrete sustainability (2 hrs).</li> <li>- Environmental impacts of Portland cement production: Introduction, Description of cement production process, Main impacts, Environmental sustainability, Social sustainability, Economic sustainability, Future trends (4 hrs).</li> <li>- Sustainable ready mix plant-Case study: Introduction, Transportation of materials, Example of sustainable ready-mix plant, Conclusion (2 hrs).</li> <li>- Environmental calculations in the cement manufacture: Particulate concentration of gases, Dust loss, Gaseous emissions (Products of combustion, Weight of gases from the feed, Total weight of kiln exit gases, The true CO<sub>2</sub> content in the exit gases) (2 hrs).</li> <li>- Noise control in the cement manufacture: Introduction, Sources of noise in cement works, Harm of noise in cement plant, Basic principles of noise control, Noise abatement in cement plant (2 hrs).</li> <li>- Concrete with construction and demolition wastes (CWD): Introduction, Construction &amp; demolition wastes uses, Construction &amp; demolition wastes sources, Construction &amp; demolition wastes classification, Construction &amp; demolition wastes composition, Construction &amp; demolition wastes management, Construction &amp; demolition wastes reuses (2 hrs).</li> </ul> |
|  | <ul style="list-style-type: none"> <li>- Renewable Energy, New and renewable energy, Sun energy, Wind energy, Waterfalls energy, etc., Applications, How to use (2 hrs).</li> <li>- Eutrophication in surface water, Types of algae, causes, their results on water quality, treatment plants, modeling of nutrients cycles (2 hrs).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Learning and Teaching Strategies<br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                               | This course has two components that include lectures, and individual & group assignments. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| Student Workload (SWL)<br>الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا              |            |                                                                           |     |
|--------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 33         | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 2.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 67         | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 4.5 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | <b>100</b> |                                                                           |     |

| Module Evaluation<br>تقييم المادة الدراسية |                        |             |                  |                    |                                   |
|--------------------------------------------|------------------------|-------------|------------------|--------------------|-----------------------------------|
|                                            |                        | Time/Number | Weight (Marks)   | Week Due           | Relevant Learning Outcome         |
| <b>Formative assessment</b>                | <b>Quizzes</b>         | 8           | 30 % (30)        | 2, 5, 8, 11 and 13 | CLO-2, CLO-2, CLO-3, CLO-5, CLO-6 |
|                                            | <b>Assignments</b>     | 2           | 10 % (10)        | 9, 10, 11 and 12   | CLO-4, CLO-4                      |
|                                            | <b>Projects / Lab.</b> |             |                  |                    |                                   |
|                                            | <b>Report</b>          |             |                  |                    |                                   |
| <b>Summative assessment</b>                | <b>Midterm Exam</b>    | 2hr         | 10% (10)         | 6 and 11           | CLO-1, CLO -2, CLO-3, CLO-5, CLO6 |
|                                            | <b>Final Exam</b>      | 3hr         | 50% (50)         | 16                 | All                               |
| <b>Total assessment</b>                    |                        |             | 100% (100 Marks) |                    |                                   |

| Delivery Plan (Weekly Syllabus) |                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                                                                                                                                                                                                                                                             |
|                                 | Material Covered                                                                                                                                                                                                                                                                                                                            |
| Week 1                          | Climate change, Global warming, Greenhouse gasses (GHG) emissions, Combating climate change, Carbon-Neutrality.                                                                                                                                                                                                                             |
| Week 2                          | Carbon offset, Climate governance, Urbanization & climate change, Sustainability (definition, strategies, pillars), 3R concept - How to preserve resources, Sustainable development.                                                                                                                                                        |
| Week 3                          | Urban resilience: Urban planning, Urban development and sustainability, Resilient urban planning concepts and strategies, Climate change adaptation & climate change mitigation, Life cycle assessment (LCA) and life cycle cost (LCC).                                                                                                     |
| Week 4                          | Sustainable buildings: Sustainable thinking – Integrative design of buildings, Successful integrative design requirement.                                                                                                                                                                                                                   |
| Week 5                          | Multifunctionality, Green roofs, Regenerative systems (Characteristics, Biomass energy, Canopy trees & green walls to biomass energy, Water treatment Network).                                                                                                                                                                             |
| Week 6                          | Rating systems of green buildings: LEED, BREEAM, Envision, Edge, Green Surge, WELL, Site sustainability (Main issues).                                                                                                                                                                                                                      |
| Week 7                          | Sustainability of concrete: Negative environmental effects of cement and concrete industries, Environmental concerns, Ten qualifications of concrete sustainability.                                                                                                                                                                        |
| Week 8                          | Environmental impacts of Portland cement production: Introduction, Description of cement production process.                                                                                                                                                                                                                                |
| Week 9                          | Main environmental impacts of Portland cement production, Environmental sustainability, Social sustainability, Economic sustainability, Future trends.                                                                                                                                                                                      |
| Week 10                         | Sustainable ready mix plant-Case study: Introduction, Transportation of materials, Example of sustainable ready-mix plant, Conclusion.                                                                                                                                                                                                      |
| Week 11                         | Environmental calculations in the cement manufacture: Particulate concentration of gases, Dust loss, Gaseous emissions (Products of combustion, Weight of gases from the feed, Total weight of kiln exit gases, The true CO <sub>2</sub> content in the exit gases).                                                                        |
| Week 12                         | Noise control in the cement manufacture: Introduction, Sources of noise in cement works, Harm of noise in cement plant, Basic principles of noise control, Noise abatement in cement plant.                                                                                                                                                 |
| Week 13                         | Concrete with construction and demolition wastes (CWD): Introduction, Construction & demolition wastes uses, Construction & demolition wastes sources, Construction & demolition wastes classification, Construction & demolition wastes composition, Construction & demolition wastes management, Construction & demolition wastes reuses. |
| Week 14                         | Renewable Energy, New and renewable energy, Sun energy, Wind energy, Waterfalls energy, etc., Applications, How to use.                                                                                                                                                                                                                     |
| Week 15                         | Eutrophication in surface water, Types of algae, causes , their results on water quality, treatment plants, modeling of nutrients cycles.                                                                                                                                                                                                   |
| Week 16                         | Preparatory week before the final exam.                                                                                                                                                                                                                                                                                                     |

| Learning and Teaching Resources |                                                                                                                                                           |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                           |                           |
|                                 | Text                                                                                                                                                      | Available in the Library? |
| <b>Required Texts</b>           | P-C, Aitcin and S. Mindess, Sustainability of concrete - Modern concrete technology series 17, 1st edition, Spon Press, Taylor & Francis Group, 2011.     | Yes                       |
| <b>Recommended Texts</b>        | G. M. Sabnis, Green building with concrete- Sustainable design and construction, CRC Press, Taylor & Francis Group, 2012.                                 | Yes                       |
| <b>Websites</b>                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| <b>Success Group</b><br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                   | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group</b><br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                        | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                               |                      |                                                                                                                                                                                                                                                                   |                                                                                  |
|------------------------------------|-------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                               |                      |                                                                                                                                                                                                                                                                   |                                                                                  |
| Module Title                       | Engineering Safety and ethics |                      | Module Delivery                                                                                                                                                                                                                                                   |                                                                                  |
| Module Type                        | Core                          |                      | <input checked="" type="checkbox"/> Theory<br><input checked="" type="checkbox"/> electronic<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input checked="" type="checkbox"/> Practical<br><input checked="" type="checkbox"/> seminar |                                                                                  |
| Module Code                        | ENV316                        |                      |                                                                                                                                                                                                                                                                   |                                                                                  |
| ECTS Credits                       | 3                             |                      |                                                                                                                                                                                                                                                                   |                                                                                  |
| SWL (hr/sem)                       | 75                            |                      |                                                                                                                                                                                                                                                                   |                                                                                  |
| Module Level                       | 3                             | Semester of Delivery |                                                                                                                                                                                                                                                                   | 5                                                                                |
| Administering Department           | ENG4                          | College              | ENV8                                                                                                                                                                                                                                                              |                                                                                  |
| Module Leader                      | Hanan Haqi Ismaeel            |                      | e-mail                                                                                                                                                                                                                                                            | <a href="mailto:hanan.eng2014@uomosul.edu.iq">hanan.eng2014@uomosul.edu.iq</a>   |
| Module Leader's Acad. Title        | Lecturer                      |                      | Module Leader's Qualification                                                                                                                                                                                                                                     | M.Sc.                                                                            |
| Module Tutor                       | Thura Azzam Abed              |                      | e-mail                                                                                                                                                                                                                                                            | <a href="mailto:Thura.azzam@uomosul.edu.iq">Thura.azzam@uomosul.edu.iq</a>       |
| Peer Reviewer Name                 | Amar Thamer                   |                      | e-mail                                                                                                                                                                                                                                                            | <a href="mailto:Dr.ammarthamir@uomosul.edu.iq">Dr.ammarthamir@uomosul.edu.iq</a> |
| Scientific Committee Approval Date | 1/9/2025                      | Version Number       | 1                                                                                                                                                                                                                                                                 |                                                                                  |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br>أهداف المادة الدراسية                                                                         | <p>This course aims to introduce engineers to the concept of public safety and its role in the system of:</p> <ul style="list-style-type: none"> <li>• Human development and public life</li> <li>• Public safety and its relationship to public health and occupational safety</li> <li>• The objectives, laws, and regulations of public safety</li> <li>• Understanding the outcomes of work in public safety</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية                                                          | <p>In this course, students will learn:</p> <p>CLO1: Engineering Ethics.</p> <p>CLO2: The Professional Obligations of Engineers.</p> <p>CLO3: Identifying the most important safety procedures to be followed in the workplace.</p> <p>CLO4: Identifying the most important legislation and public safety laws that define the responsibilities of employers and employees and the relationship between them.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                                                                         | <p>A. The concept of professional ethics, linguistically and technically, and the principles of engineering ethics. CLO1</p> <p>B. Engineering ethics and its sources. CLO1</p> <p>C. The professional obligations of the engineer. CLO2</p> <p>D. Codes of conduct, regulations, and official undertakings in engineering work. CLO2</p> <p>C. Introduction: Understanding the concept of safety and its relationship to public and occupational health. CLO3</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                           | <p>R. An overview of OSHA: Understanding the most important legislation and public safety laws in defining the responsibilities of employers and employees and the relationship between them. CLO4</p> <p>G. General Management: Demonstrating leadership skills and participating productively in group situations. Understanding the roles of the health supervisor and the occupational physician, in addition to the duties of the engineer, the contractor, and the supervisor. CLO4</p> <p>Management Functions: Detailed knowledge of key management functions. CLO4</p> <p>n. Adaptation Engineering: Knowledge of the objectives and scope of adaptation engineering, and the national public safety culture and strategy. CLO4</p> <p>f. Work Environment: Knowledge of a suitable work environment that meets occupational safety and health requirements. CLO3</p> <p>y. Physical and Chemical Hazards: Knowledge of physical and chemical hazards and the resulting damage and injuries.(CLO3)</p> |

| <b>Learning and Teaching Strategies</b><br><b>استراتيجيات التعلم والتعليم</b> |                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                             | This course will include numerous in-person and online lectures. Students will also be assigned homework and reports. Field visits to environmental projects will be conducted for students. The language of instruction will be Arabic, and Arabic textbooks will be used. |

| <b>Student Workload (SWL)</b><br><b>الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا</b> |    |                                                                           |     |
|---------------------------------------------------------------------------------|----|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل        | 48 | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 3.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل  | 17 | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 1.1 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل               | 75 |                                                                           |     |

| <b>Module Evaluation</b><br><b>تقييم المادة الدراسية</b> |                            |             |                  |           |                           |
|----------------------------------------------------------|----------------------------|-------------|------------------|-----------|---------------------------|
|                                                          |                            | Time/Number | Weight (Marks)   | Week Due  | Relevant Learning Outcome |
| <b>Formative assessment</b>                              | <b>Quizzes</b>             | 3           | 15%              | 4-8-10-12 |                           |
|                                                          | <b>Homework</b>            | 2           | 10%              | 5-7-9-11  |                           |
|                                                          | <b>On site assignments</b> | 1           | 5%               | 4-12      |                           |
|                                                          | <b>Report / Lab.</b>       | 2           | 10%              | 1-13      |                           |
| <b>Summative assessment</b>                              | <b>Midterm Exam</b>        | 1.5hr       | 10%              | 6         |                           |
|                                                          | <b>Final Exam</b>          | 3hr         | 50% (50)         | 16        |                           |
| <b>Total assessment</b>                                  |                            |             | 100% (100 Marks) |           | All                       |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                   | Material Covered                                                                                                                                                                                                                                                                                                                                            |
| Week 1                                                            | Vocabulary of the Professional Ethics Curriculum - The concept of professional ethics in language and terminology, and the principles of engineering professional ethics, which include identifying general ethical principles and principles of practicing the engineering profession.                                                                     |
| Week 2                                                            | Sources of professional ethics, which include the values that define ethical behavior and sources of positive behavior – ethics of professional practice, which includes two basic principles: the code and the ethical system.                                                                                                                             |
| Week 3                                                            | The personal obligations of the engineer under the ethics of engineering practice and the societal obligations of engineering practitioners.                                                                                                                                                                                                                |
| Week 4                                                            | Documents of honor, regulations and official undertakings in engineering work and the engineer's obligations towards the environment.                                                                                                                                                                                                                       |
| Week 5                                                            | Exam1                                                                                                                                                                                                                                                                                                                                                       |
| Week 6                                                            | Public Safety: Introduction, which includes an overview of the concept of safety and its role in the human development system and public life, and a definition of public and occupational safety and its relationship to public and occupational health.                                                                                                   |
| Week 7                                                            | An overview of OSHA's occupational safety and health management, its goals and legislation in defining the responsibilities of employers and employees, and introducing them to the work environment, the worker, and the relationship between them.                                                                                                        |
| Week 8                                                            | Defining the general administration and its five functions, and public safety management. Identifying public safety committees and their tasks, the tasks of the health and safety supervisor, the tasks of the site physician, the safety procedures to be followed in project implementation, and the duties of the engineer, contractor, and supervisor. |
| Week 9                                                            | Defining the general administration and its five functions, and public safety management. Identifying public safety committees and their tasks, the tasks of the health and safety supervisor, the tasks of the site physician, the safety procedures to be followed in project implementation, and the duties of the engineer, contractor, and supervisor. |
| Week 10                                                           | Exam 2                                                                                                                                                                                                                                                                                                                                                      |
| Week 11                                                           | Human Factors Adaptation Engineering<br><br>1. Its Objectives and Areas<br><br>2. The National Strategy for Public Safety and Occupational Health and Workplace Safety<br><br>3. Public Safety Culture, its Success and Failure Factors, and its Impact on Individual and Community Behavior.                                                               |
| Week 12                                                           | A Suitable Work Environment<br><br>1. Key Factors Affecting the Work Environment and its Components                                                                                                                                                                                                                                                         |

|                  |                                                                                                                                                                                                                                                                                                                                                    |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | <b>2. Responsibility for Implementing the Occupational Safety and Health Program in the Workplace</b><br><b>3. Employer and Employee Responsibilities: An Overview Workplace Injuries</b>                                                                                                                                                          |
| <b>Week13,14</b> | <b>Physical and Chemical Hazards</b><br><b>1. An introduction to physical hazards, their causes, and the resulting damage and injuries.</b><br><b>2. Safety procedures in laboratories, workshops, mechanical equipment, and factories.</b><br><b>3. An introduction to chemical hazards, their causes, and the resulting damage and injuries.</b> |
| <b>Week15</b>    | <b>Exam3</b>                                                                                                                                                                                                                                                                                                                                       |
| <b>Week 16</b>   | <b>Preparing for the final exam</b>                                                                                                                                                                                                                                                                                                                |

| <b>Learning and Teaching Resources</b><br><b>مصادر التعلم والتدريس</b> |                                                                                                                                                                                                                                 |                                  |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
|                                                                        | <b>Text</b>                                                                                                                                                                                                                     | <b>Available in the Library?</b> |
| <b>Required Texts</b>                                                  | مدونة السلامة العامة في تنفيذ المشاريع الانشائية (كود البناء العراقي)<br>الصادر عن وزارة الاعمار<br>Public Safety Code for Construction Project Implementation<br>(Iraqi Building Code) issued by the Ministry of Construction. | yes                              |
| <b>Recommended Texts</b>                                               | مدونة اخلاقيات ممارسة المهنة الهندسية<br>Code of Ethics for the Practice of Engineering                                                                                                                                         | Yes                              |
| <b>Websites</b>                                                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a>                                                                       |                                  |

| <b>Grading Scheme</b><br><b>مخطط الدرجات</b>                                                                                                                                                                                                                                                                                                                                         |                         |                     |                |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------------|---------------------------------------|
| <b>Group</b>                                                                                                                                                                                                                                                                                                                                                                         | <b>Grade</b>            | <b>التقدير</b>      | <b>Marks %</b> | <b>Definition</b>                     |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A - Excellent</b>    | امتياز              | 90 - 100       | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B - Very Good</b>    | جيد جدا             | 80 - 89        | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C - Good</b>         | جيد                 | 70 - 79        | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D - Satisfactory</b> | متوسط               | 60 - 69        | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E - Sufficient</b>   | مقبول               | 50 - 59        | Work meets minimum criteria           |
| <b>Fail Group</b>                                                                                                                                                                                                                                                                                                                                                                    | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)        | More work required but credit awarded |
| <b>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                                      | <b>F – Fail</b>         | راسب                | (0-44)         | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |                |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |                |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                        |                               |                                                                                                                                                                                                                                          |
|------------------------------------|------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                        |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Differential Equations |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Support                |                               | <input checked="" type="checkbox"/> Theory<br><input checked="" type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV317                 |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 3                      |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 75                     |                               |                                                                                                                                                                                                                                          |
| Module Level                       | UGIII                  | Semester of Delivery          | Five                                                                                                                                                                                                                                     |
| Administering Department           | Type Dept. Code        | College                       | Type College Code                                                                                                                                                                                                                        |
| Module Leader                      | Dr. Salim Yousif Awad  | e-mail                        | Sua@uomosul.edu.iq                                                                                                                                                                                                                       |
| Module Leader's Acad. Title        | Lecturer               | Module Leader's Qualification | Ph.D.                                                                                                                                                                                                                                    |
| Module Tutor                       |                        | e-mail                        |                                                                                                                                                                                                                                          |
| Peer Reviewer Name                 |                        | e-mail                        |                                                                                                                                                                                                                                          |
| Scientific Committee Approval Date | 01/06/2025             | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |                         |          |   |
|-----------------------------------|-------------------------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                         |          |   |
| Prerequisite module               | Engineering Mathematics | Semester | 2 |
| Co-requisites module              | None                    | Semester |   |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <p>Differential equations have wide applications in various engineering and science disciplines. In general, modelling variations of a physical quantity, such as temperature, pressure, displacement, velocity, stress, strain, or the concentration of a pollutant, with respect to time <math>t</math> or location <math>(x, y, z)</math>, or both, would require differential equations. Similarly, studying the variation of a physical quantity with respect to other physical quantities would lead to differential equations.</p> <p>Engineers need to model physical problems using mathematical equations and then solve them to study the underlying concerns.</p> |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p><b>CLO-1:</b> Recognize the common types of differential equations, classification of differential equations, and methods of solving them (i)</p> <p><b>CLO-2:</b> Apply the basic concepts of sciences and engineering to solve nonlinear equation of single variable, solving system of linear Algebraic equations associated with the engineering problems (i)</p> <p><b>CLO-3:</b> Formulate and modeling of engineering problems in terms of differential equations (ii)</p>                                                                                                                                                                                          |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p>Indicative content includes the following.</p> <p>Part A – ordinary differential equations (60 hrs)</p> <p>1-Introduction.</p> <p>2- First Order Ordinary Differential Equations.</p> <p>3- Applications on First Order Ordinary Differential Equations.</p> <p>4- Second and Higher Order Ordinary Differential Equations.</p> <p>5- Applications on Second and Higher Order Ordinary Differential Equations.</p> <p>6- Simultaneous Linear Ordinary Differential Equations.</p> <p>Part B – partial differential equations (PDEs) (15 hrs)</p> <p>1-Introduction.</p> <p>2- classification of PDEs</p> <p>3- Method of Separation of Variables</p>                       |
|                                                                  | <p>4- Laplace Equation (steady state in two-dimensional domain)</p> <p>5-Heat equation (Transient condition)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Learning and Teaching Strategies |                                                                                                                                                                                                                                                                     |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| استراتيجيات التعلم والتعليم      |                                                                                                                                                                                                                                                                     |
| <b>Strategies</b>                | <p>This course has several components, including lectures, individual &amp; group assignments, and e-learning platforms. Exercises involving the use of computer application tools to understand specific unit processes. The course will be taught in English.</p> |

| Student Workload (SWL)                                                         |    |                                                                           |     |
|--------------------------------------------------------------------------------|----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا                                        |    |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 33 | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 2.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 42 | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 2.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 75 |                                                                           |     |

| Module Evaluation     |                 |             |                  |                  |                            |
|-----------------------|-----------------|-------------|------------------|------------------|----------------------------|
| تقييم المادة الدراسية |                 |             |                  |                  |                            |
|                       |                 | Time/Number | Weight (Marks)   | Week Due         | Relevant Learning Outcome  |
| Formative assessment  | Quizzes         | 4           | 30 % (40)        | 1, 5, ,12 and 14 | CLO-1, CLO-1, CLO-2, CLO-2 |
|                       | Assignments     | 2           | 10 % (40)        | 1, 8             | CLO-1, CLO-1, CLO-2, CLO-2 |
|                       | Projects / Lab. |             |                  |                  |                            |
|                       | Report          |             |                  |                  |                            |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 8                | CLO-1, CLO -2 and CLO-3    |
|                       | Final Exam      | 3hr         | 50% (50)         | 16               | All                        |
| Total assessment      |                 |             | 100% (100 Marks) |                  |                            |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |                                           |
|-------------------------------------------------------------------|-------------------------------------------|
|                                                                   | Material Covered                          |
| Week 1                                                            | Introduction to Differential Equations    |
| Week 2                                                            | First Order ODEs – Separable              |
| Week 3                                                            | Linear First Order Equations              |
| Week 4                                                            | Exact Equations                           |
| Week 5                                                            | Applications (Growth/Decay)               |
| Week 6                                                            | Second Order ODEs                         |
| Week 7                                                            | Midterm Exam                              |
| Week 8                                                            | Non-homogeneous Equations                 |
| Week 9                                                            | Undetermined Coefficients                 |
| Week 10                                                           | Variation of Parameters                   |
| Week 11                                                           | Euler Cauchy<br>Differential<br>Equations |
| Week 12                                                           | Second Order ODEs<br>Applications         |
| Week 13                                                           | Systems of Equations                      |
| Week 14                                                           | Term project                              |
| Week 15                                                           | Review                                    |
| Week 16                                                           | Final Preparation                         |

| <b>Learning and Teaching Resources</b><br>مصادر التعلم والتدريس |                                                                                                                                                                                                                                                                                                    |                           |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                                 | Text                                                                                                                                                                                                                                                                                               | Available in the Library? |
| Required Texts                                                  | ERWIN KREYSZIG "Advanced Engineering Mathematics",<br>JOHN WILEY & SONS, INC., 2011                                                                                                                                                                                                                | Yes                       |
| Recommended Texts                                               | Wei-Chau Xie "Differential Equations for Engineers",<br>CAMBRIDGE UNIVERSITY PRESS, 2010                                                                                                                                                                                                           | Yes                       |
| Websites                                                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a><br><a href="https://classroom.google.com/c/ODE00TAyMjMxNDQy">https://classroom.google.com/c/ODE00TAyMjMxNDQy</a><br>Class code: d5zx4x6e |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                         |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group</b><br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                   | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group</b><br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                        | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                         |                               |                                                                                                                                                                                                                                          |
|------------------------------------|-------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                         |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Hydraulics Applications |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Core                    |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV321                  |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 5                       |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 125                     |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 3                       | Semester of Delivery          | 6                                                                                                                                                                                                                                        |
| Administering Department           | ENV8                    | College                       | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Mohammed salim Mahmood  | e-mail                        | Mohammedsalim@uomosul.edu.iq                                                                                                                                                                                                             |
| Module Leader's Acad. Title        | Assist. Lecture         | Module Leader's Qualification | Ms.C                                                                                                                                                                                                                                     |
| Module Tutor                       | Aaisha Mohanad          | e-mail                        | aaisha.almokhtar@uomosul.edu.iq                                                                                                                                                                                                          |
| Peer Reviewer Name                 | Ammar Thamir            | e-mail                        | dr.ammarthamir@uomosul.edu.iq                                                                                                                                                                                                            |
| Scientific Committee Approval Date | 1/10/2024               | Version Number                | 3                                                                                                                                                                                                                                        |

| Relation with other Modules       |                  |          |   |
|-----------------------------------|------------------|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                  |          |   |
| Prerequisite module               | Fluids Mechanics | Semester | 3 |
| Co-requisites module              | None             | Semester |   |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <p>The aim of this course is to introduce the students to the applications of hydraulics in environmental engineering . The course will cover the Open channel flow , Non-uniform flow in open channels, Flow measurement and hydraulic control points, Pressure Surges "Water Hammer", and similarity, At the end of the course the students will be able to use the hydraulic principles to solve problems associated with environmental engineering and design of unit processes for water and wastewater treatment plants</p>                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p><b>CLO-1:</b> Recognize the common hydraulic Applications encountered in environmental engineering (i)</p> <p><b>CLO-2:</b> Apply knowledge of hydraulics and fluid mechanics to the analysis and design of hydraulic structures and river flows (ii)</p> <p><b>CLO-3:</b> An ability to create and carry out proper measurement, analyze and interpret results, and utilize engineering judgment to make inferences. (iii)</p> <p><b>CLO-4:</b> Improve communication skills by contributing to the preparation of comprehensive reports and an oral presentation (iv).</p> <p><b>CLO-5:</b> Report the data obtained from the site visits to WWTP or WTP that will be organized during the course (vi)</p> <p><b>CLO-6:</b> Demonstrate the ability to lead and productively participate in group situations via assigning design projects for specific water or wastewater unit processes (vii)</p>                         |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p><u>Part A – Open channel flow and Non-uniform flow in open channels</u><br/> interpret and illustrate the main concepts of Open channels flow classifications, Development of uniform flow and its formulas (Chezy's and -Manning formulas), Velocity distribution over cross-section of an open channel. (15 hrs)</p> <p><u>Part B – Classification of surface profiles and Flow measurement and hydraulic control points</u><br/> Direct step method gradually varied flow, Sharp crested weirs, orifices, time for emptying tank through orifices, flow between two vessels. (15 hrs)</p> <p><u>Part C – Pressure Surges "Water Hammer" and Multiport diffuser outfalls</u><br/> Propagation of disturbances in fluids, Gradual closure and Instantaneous closure of valves on elastic and rigid pipes, Calculation of water hammer, Damping devices. (15 hrs)</p> <p><u>Part D- hydraulic similarity</u><br/> (15 hrs)</p> |
| Learning and Teaching Strategies                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| استراتيجيات التعلم والتعليم                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Strategies</b>                                                | <p>This course has several components that include lectures, individual &amp; group assignments, and e-learning platforms. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

| Student Workload (SWL)                                                         |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطلاب محسوب لـ ١٥ أسبوعا                                        |     |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 63  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 4.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 62  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 4.1 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 125 |                                                                           |     |

| Module Evaluation     |                 |             |                  |                |                                   |
|-----------------------|-----------------|-------------|------------------|----------------|-----------------------------------|
| تقييم المادة الدراسية |                 |             |                  |                |                                   |
| As                    |                 | Time/Number | Weight (Marks)   | Week Due       | Relevant Learning Outcome         |
| Formative assessment  | Quizzes         | 4           | 20 % (20)        | 3,6,10 and 14  | CLO-1, CLO-1, CLO-2, CLO-2        |
|                       | Assignments     | 3           | 15 % (15)        | 2, , 6, and 10 | CLO-2, CLO-2, CLO-3, CLO-2, CLO-3 |
|                       | Projects / Lab. | 1           | 5 % (5)          |                | All                               |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 8              | CLO-2 to CLO-4                    |
|                       | Final Exam      | 3hr         | 50% (50)         | 16             | All                               |
| Total assessment      |                 |             | 100% (100 Marks) |                |                                   |

| Delivery Plan (Weekly Syllabus) |                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                                                             |
| Week                            | Material Covered                                                                                                                            |
| Week 1                          | Open channel flow                                                                                                                           |
| Week 2                          | Development of uniform flow and its formulas (Chezy's and -Manning formulas). & Velocity distribution over cross-section of an open channel |
| Week 3                          | Non-uniform flow in open channels                                                                                                           |
| Week 4                          | Hydraulic gradient and total energy lines, Energy of flowing liquid in open channel, Specific energy of a channel's cross-section.          |
| Week 5                          | Specific energy curve, Critical depth, Determination of critical depth for rectangular channel.                                             |
| Week 6                          | Determination of critical depth for rectangular channel.                                                                                    |
| Week 7                          | Froude number, Classification of slopes.                                                                                                    |
| Week 8                          | Classification of surface profiles in gradually varied flow, Direct step method.                                                            |
| Week 9                          | Flow measurement and hydraulic control points, Sharp crested weirs                                                                          |
| Week 10                         | Flow measurement using Orifices                                                                                                             |
| Week 11                         | Time for emptying tank through orifice                                                                                                      |
| Week 12                         | Pressure Surges "Water Hammer", Propagation of disturbances in fluids,                                                                      |
| Week 13                         | Calculation of water hammer ,Damping devices                                                                                                |
| Week 14                         | Multiport diffuser outfalls, Types of outfalls, Hydraulics of multiport diffusers.                                                          |
| Week 15                         | Example of multiport diffusers pipe calculation                                                                                             |
| Week 16                         | Preparatory week before the final Exam                                                                                                      |

| Learning and Teaching Resources |                                                                                                                                                           |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                           |                           |
|                                 | Text                                                                                                                                                      | Available in the Library? |
| Required Texts                  | Andrew Chadwick, John Morfett and Martin Borthwick<br>"Hydraulics in Civil And Environmental Engineering",<br>Taylor & Francis Group, 2013                | Yes                       |
| Recommended Texts               | Larry D. Benfield "Treatment Plant Hydraulics for<br>Environmental Engineers", Prentice Hall, New Jersey, 1984,                                           | Yes                       |
| Websites                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A – Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C – Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D – Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E – Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                    |                               |                                                                                                                                                                                                                                          |
|------------------------------------|--------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                    |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Sewers networks    |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Core               |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | ENV322             |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 6                  |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 150                |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 3                  | Semester of Delivery          | 6                                                                                                                                                                                                                                        |
| Administering Department           | ENV8               | College                       | ENG4                                                                                                                                                                                                                                     |
| Module Leader                      | Dr.Layth Abdulaeem | e-mail                        | laythabdulaeem@uomosul.edu.iq                                                                                                                                                                                                            |
| Module Leader's Acad. Title        | Lecturer           | Module Leader's Qualification | Ph.D.                                                                                                                                                                                                                                    |
| Module Tutor                       | -----              | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Peer Reviewer Name                 | -----              | e-mail                        | E-mail                                                                                                                                                                                                                                   |
| Scientific Committee Approval Date | 28/01/2026         | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | Non  | Semester |  |
| Co-requisites module              | None | Semester |  |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <p>The course aim to describe the quantity and quality properties of wastewater and storm water, and learns the engineering methods used in the analysis and design of sanitary sewers networks, storm sewers networks, and plumbing networks. The course covers describing the main appurtenances of sewers networks system in addition to domestic plumbing system.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p><b>CLO-1:</b> Describing the different properties of wastewater in addition to its flow rate (i).</p> <p><b>CLO-2:</b> Describing the main appurtenances of sewers networks system in addition to domestic plumbing networks (i).</p> <p><b>CLO-3:</b> Describing the properties of storm water and learning the method used in the quantity determination (i) and (ii).</p> <p><b>CLO-4:</b> Learning the engineering methods used in the analysis and design of sanitary and storm sewers networks (ii).</p> <p><b>CLO-5:</b> Learning skills in the design and analysis of sewers network using computer software (i) and (iv).</p> <p><b>CLO-6:</b> Learning the engineering methods used in the analysis and design of sanitary networks, storm networks, and water supply networks of domestic plumbing (ii).</p> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p><u>Part A – Wastewater describing:</u></p> <p>Physical, chemical, and biological properties of wastewater, components of wastewater flow (15 h).</p> <p><u>Part B – Design of wastewater network:</u></p> <p>Sewers design activities, sequences of design requirements (10 h).</p> <p><u>Part C – Design of storm water networks:</u></p> <p>Types of storm water networks, runoff water flow rate estimation. (10 h)</p> <p><u>Part D – Sewers network appurtenances:</u></p> <p>Manholes, inverted siphon, outlets and outfalls, alternative sewers systems, lift stations, inlets. (15 h).</p> <p><u>Part E – Computer software:</u> (10 h)</p> <p><u>Part F – Plumbing networks:</u></p> <p>Water supply networks, sanitary drainage network, storm drainage network (15 h).</p>                                   |

| Learning and Teaching Strategies |                                                                                                                                                                                                                                                                                                                      |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| استراتيجيات التعلم والتعليم      |                                                                                                                                                                                                                                                                                                                      |
| Strategies                       | <p>The course will be covered by class room lectures; four hours each week for explaining the materials with giving examples, and one hour for tutorials problems.</p> <p>Explanation on necessary computer software will be given and a project on an actual network will be submitted by one student or group.</p> |

| Student Workload (SWL)                      |                 |             |                                          |                           |                                                        |
|---------------------------------------------|-----------------|-------------|------------------------------------------|---------------------------|--------------------------------------------------------|
| الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا     |                 |             |                                          |                           |                                                        |
| Structured SWL (h/sem)                      |                 | 63          | Structured SWL (h/w)                     |                           | 4.2                                                    |
| الحمل الدراسي المنتظم للطالب خلال الفصل     |                 |             | الحمل الدراسي المنتظم للطالب أسبوعيا     |                           |                                                        |
| Unstructured SWL (h/sem)                    |                 | 87          | Unstructured SWL (h/w)                   |                           | 5.8                                                    |
| الحمل الدراسي غير المنتظم للطالب خلال الفصل |                 |             | الحمل الدراسي غير المنتظم للطالب أسبوعيا |                           |                                                        |
| Total SWL (h/sem)                           |                 | 150         |                                          |                           |                                                        |
| الحمل الدراسي الكلي للطالب خلال الفصل       |                 |             |                                          |                           |                                                        |
| Module Evaluation                           |                 |             |                                          |                           |                                                        |
| تقييم المادة الدراسية                       |                 |             |                                          |                           |                                                        |
|                                             |                 | Time/Number | Weight (Marks)                           | Week Due                  | Relevant Learning Outcome                              |
| Formative assessment                        | Quizzes         | 8           | 25 % (25)                                | 2,,3, 5, 7,9,11,13 and 14 | CLO-1, CLO-2, CLO-2, CLO-3, CLO-4, CLO-4, CLO-4, CLO-6 |
|                                             | Assignments     | 0           | 0 % (0)                                  |                           |                                                        |
|                                             | Projects / Lab. | 1           | 11 % (11)                                | 13                        | CLO-5                                                  |
|                                             | Report          | 0           | 4 % (4)                                  |                           |                                                        |
|                                             | Midterm Exam    | 2hr         | 10% (10)                                 | 7                         | All except CLO-5                                       |
| Summative assessment                        | Final Exam      | 3hr         | 50% (50)                                 | 16                        | All except CLO-5                                       |
| Total assessment                            |                 |             | 100% (100 Marks)                         |                           |                                                        |

### Delivery Plan (Weekly Syllabus)

#### المنهاج الاسبوعي النظري

|         | Material Covered                                                                                                                                                                      |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Week 1  | Physical, chemical, and biological properties of wastewater.                                                                                                                          |
| Week 2  | Components of wastewater flow and wastewater flow rate.                                                                                                                               |
| Week 3  | Sewers systems types, sanitary sewers design activities, sanitary sewer types.                                                                                                        |
| Week 4  | Sanitary sewers design: flow rate estimation, pipe material selection, design criteria definition, design equation selection, design execution and maps preparation                   |
| Week 5  | Sanitary sewer analysis, crown corrosion. Examples                                                                                                                                    |
| Week 6  | Examples                                                                                                                                                                              |
| Week 7  | (SewerCAD) software applications.                                                                                                                                                     |
| Week 8  | (SewerCAD) software applications.                                                                                                                                                     |
| Week 9  | Sewers network appurtenances: manholes, inverted siphon, outlets and outfalls, inlets, alternative sewers systems, catch basin and inlet basin, sand and grease traps, lift stations. |
| Week 10 | Types of storm water control systems, rational method for runoff water flow rate estimation.                                                                                          |
| Week 11 | Time of concentration, frequency of rainfall intensity, effects of urbanization, storm sewer design: basic stages of design, design criteria.                                         |
| Week 12 | Examples                                                                                                                                                                              |
| Week 13 | Plumbing: plumbing code, fixture types, fixture unit, water supply network.                                                                                                           |
| Week 14 | Sanitary drainage network.                                                                                                                                                            |
| Week 15 | Storm drainage network.                                                                                                                                                               |
| Week 16 |                                                                                                                                                                                       |

| Learning and Teaching Resources |                                                                                                                                                           |                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                           |                           |
|                                 | Text                                                                                                                                                      | Available in the Library? |
| Required Texts                  | McGhee, T. G., 1991, Water Supply and Sewerage, 6 <sup>th</sup> ed., McGraw-Hill, Inc.                                                                    | Yes                       |
| Recommended Texts               | Larry W. M. (editor), 2001, Stormwater collection systems design handbook. McGraw-Hill, Inc.                                                              | No                        |
| Websites                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                       |                  |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                          | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                               | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                  |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                   |                      |                                                                                                                                                                                                                                          |                                |
|------------------------------------|-------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| معلومات المادة الدراسية            |                   |                      |                                                                                                                                                                                                                                          |                                |
| Module Title                       | Soil mechanics    |                      | Module Delivery                                                                                                                                                                                                                          |                                |
| Module Type                        | Core              |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                |
| Module Code                        | ENV324            |                      |                                                                                                                                                                                                                                          |                                |
| ECTS Credits                       | 6                 |                      |                                                                                                                                                                                                                                          |                                |
| SWL (hr/sem)                       | 150               |                      |                                                                                                                                                                                                                                          |                                |
| Module Level                       | 3                 | Semester of Delivery |                                                                                                                                                                                                                                          | 6                              |
| Administering Department           | ENV8              | College              | ENG4                                                                                                                                                                                                                                     |                                |
| Module Leader                      | Dr. Mohammed      |                      | e-mail                                                                                                                                                                                                                                   | mohammed1979eng@uomosul.edu.iq |
| Module Leader's Acad. Title        | Assist. Professor |                      | Module Leader's Qualification                                                                                                                                                                                                            | Ph.D.                          |
| Module Tutor                       | -----             |                      | e-mail                                                                                                                                                                                                                                   | E-mail                         |
| Peer Reviewer Name                 | -----             |                      | e-mail                                                                                                                                                                                                                                   | E-mail                         |
| Scientific Committee Approval Date | 12/01/2026        | Version Number       | 1.0                                                                                                                                                                                                                                      |                                |

| Relation with other Modules       |                                              |  |          |      |
|-----------------------------------|----------------------------------------------|--|----------|------|
| العلاقة مع المواد الدراسية الأخرى |                                              |  |          |      |
| Prerequisite module               | Environmental Geology, Engineering Mechanics |  | Semester | 2, 2 |
| Co-requisites module              | None                                         |  | Semester |      |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Objectives</b><br><b>أهداف المادة الدراسية</b>                                                                         | <p>This course aims to introduce the students to the category of Soil mechanics, which is the application of laws of mechanics and hydraulics to engineering problems dealing with sediments and other unconsolidated accumulations of solid particles produced by the mechanical and chemical disintegration of rocks, regardless of whether or not they contain an admixture of the organic constituent. This will be achieved through descriptive lectures.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <p>Important: Write at least 6 Learning Outcomes; it is better to equal the number of study weeks.</p> <p><b>CLO-1:</b> The students will learn how to find an analysis of the soil properties and solve some engineering properties of soil (i)</p> <p><b>CLO-2:</b> Use the properties of soil to classify the soils, calculate the seepage of soil, consolidation, shear strength, soil stabilization, and deal with other problems of soil. (ii)</p> <p><b>CLO-3:</b> Carry out suitable measurements and tests of soil properties and analyze the results to get some values used in soil problems. (iii)</p> <p><b>CLO-4:</b> the students will be able to communicate and cooperate with others to conduct soil investigation reports (v)</p> <p><b>CLO-5:</b> Report the data obtained from the selective topics of soil topics given and organized during the course (iv)</p> <p><b>CLO-6:</b> Creating some opinions about the emerging soil mechanics issues and trying to give some solutions compatible with the problems related to soil mechanics aspects (vii)</p> |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p>Indicative content includes the following.</p> <p><u>Part A Introduction</u></p> <p>Physio-mechanical properties of soil, Soil classification (10 hrs)</p> <p><u>Part B Hydraulic properties of soil</u></p> <p>The capillary property of soil, Hydraulic conductivity in the soil (12hrs)</p> <p><u>Part C – Hydromechanical properties of soil</u></p> <p>Stresses in soil, consolidation, bearings, coordinates (20hrs)</p> <p><u>Part D – Soil mechanics topics</u></p> <p>Soil improvement, Shear stress, soil investigation (18 hrs)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Learning and Teaching Strategies<br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategies                                                      | This course has several components that include lectures, individual or group assignments, a soil mechanics lab, and e-learning platforms. The course will be taught in Arabic and English, and all mandatory reports have to be submitted within the deadlines. |

| Student Workload (SWL)<br>الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا       |     |                                                                    |     |
|-------------------------------------------------------------------------|-----|--------------------------------------------------------------------|-----|
| Structured SWL (h/sem)<br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 93  | Structured SWL (h/w)<br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 6.2 |
| Unstructured SWL (h/sem)<br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 57  | Unstructured SWL (h/w)<br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 3.8 |
| Total SWL (h/sem)<br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 150 |                                                                    |     |

| Module Evaluation<br>تقييم المادة الدراسية |                 |             |                  |                |                            |
|--------------------------------------------|-----------------|-------------|------------------|----------------|----------------------------|
|                                            |                 | Time/Number | Weight (Marks)   | Week Due       | Relevant Learning Outcome  |
| Formative assessment                       | Quizzes         | 3           | 21 % (21)        | 3, 6, 9 and 12 | CLO-1, CLO-1, CLO-2, CLO-4 |
|                                            | Assignments     | 2           | 4% (4)           |                | All                        |
|                                            | Projects / Lab. | 1           | 5% (5)           |                | All                        |
|                                            | Report          | 10          | 10 % (10)        |                | All                        |
| Summative assessment                       | Midterm Exam    | 2hr         | 10% (10)         | 7              | CLO-1, CLO -2 and CLO-3    |
|                                            | Final Exam      | 3hr         | 50% (50)         | 16             | All                        |
| Total assessment                           |                 |             | 100% (100 Marks) |                |                            |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |                                                   |
|-------------------------------------------------------------------|---------------------------------------------------|
|                                                                   | <b>Material Covered</b>                           |
| <b>Week 1</b>                                                     | Introduction                                      |
| <b>Week 2</b>                                                     | Physio-mechanical properties of soil              |
| <b>Week 3</b>                                                     | Physio-mechanical properties of soil              |
| <b>Week 4</b>                                                     | Soil classification                               |
| <b>Week 5</b>                                                     | Soil classification                               |
| <b>Week 6</b>                                                     | Hydraulic properties of soil                      |
| <b>Week 7</b>                                                     | Hydraulic properties of soil                      |
| <b>Week 8</b>                                                     | Hydraulic properties of soil                      |
| <b>Week 9</b>                                                     | Soil improvement                                  |
| <b>Week 10</b>                                                    | Stresses in soil                                  |
| <b>Week 11</b>                                                    | Stresses in soil                                  |
| <b>Week 12</b>                                                    | Hydromechanical properties of soil                |
| <b>Week 13</b>                                                    | Hydromechanical properties of soil                |
| <b>Week 14</b>                                                    | Shear stress                                      |
| <b>Week 15</b>                                                    | Soil investigation                                |
| <b>Week 16</b>                                                    | <b>The preparatory week before the Final Exam</b> |

| <b>Learning and Teaching Resources</b><br>مصادر التعلم والتدريس |                                                                                                                                                           |                                  |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
|                                                                 | <b>Text</b>                                                                                                                                               | <b>Available in the Library?</b> |
| <b>Required Texts</b>                                           | B.M. Das, principles of geotechnical engineering( 2006 )                                                                                                  | yes                              |
| <b>Recommended Texts</b>                                        | B.M. Das, principles of geotechnical engineering( 2014 )                                                                                                  | No                               |
| <b>Websites</b>                                                 | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a> |                                  |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br><b>المنهاج الاسبوعي للمختبر</b> |                                       |
|--------------------------------------------------------------------------------|---------------------------------------|
|                                                                                | <b>Material Covered</b>               |
| <b>Week 1</b>                                                                  | Introduction                          |
| <b>Week 2</b>                                                                  | Index properties                      |
| <b>Week 3</b>                                                                  | Specific gravity                      |
| <b>Week 4</b>                                                                  | Atterbuge limits                      |
| <b>Week 5</b>                                                                  | Soil classification                   |
| <b>Week 6</b>                                                                  | Hydrometer test                       |
| <b>Week 7</b>                                                                  | Permeability test                     |
| <b>Week 8</b>                                                                  | Compaction test                       |
| <b>Week 9</b>                                                                  | Filed density test (Sand cone test)   |
| <b>Week 10</b>                                                                 | Filed density test (core cutter test) |
| <b>Week 11</b>                                                                 | Consolidation test                    |
| <b>Week 12</b>                                                                 | Swelling test                         |
| <b>Week 13</b>                                                                 | Shear test                            |
| <b>Week 14</b>                                                                 | unconfined compressive strength       |
| <b>Week 15</b>                                                                 | Soil chemical test                    |

| <b>Grading Scheme</b><br><b>مخطط الدرجات</b>                                                                                                                                                                                                                                                                                                                                          |                         |                     |                |                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------------|---------------------------------------------|
| <b>Group</b>                                                                                                                                                                                                                                                                                                                                                                          | <b>Grade</b>            | <b>التقدير</b>      | <b>Marks %</b> | <b>Definition</b>                           |
| <b>Success Group</b><br><b>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                             | <b>A - Excellent</b>    | امتياز              | 90 - 100       | Outstanding Performance                     |
|                                                                                                                                                                                                                                                                                                                                                                                       | <b>B - Very Good</b>    | جيد جدا             | 80 - 89        | Above average with some errors              |
|                                                                                                                                                                                                                                                                                                                                                                                       | <b>C - Good</b>         | جيد                 | 70 - 79        | Sound work with notable errors              |
|                                                                                                                                                                                                                                                                                                                                                                                       | <b>D - Satisfactory</b> | متوسط               | 60 - 69        | Fair but with major shortcomings            |
|                                                                                                                                                                                                                                                                                                                                                                                       | <b>E - Sufficient</b>   | مقبول               | 50 - 59        | Work meets minimum criteria                 |
| <b>Fail Group</b><br><b>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>FX – Fail</b>        | راسب (قيد المعالجة) | (45-49)        | More work is required but credit is awarded |
|                                                                                                                                                                                                                                                                                                                                                                                       | <b>F – Fail</b>         | راسب                | (0-44)         | A considerable amount of work required      |
|                                                                                                                                                                                                                                                                                                                                                                                       |                         |                     |                |                                             |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example, a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |                |                                             |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                       |                               |                                             |  |
|------------------------------------|-----------------------|-------------------------------|---------------------------------------------|--|
| معلومات المادة الدراسية            |                       |                               |                                             |  |
| Module Title                       | Numerical Analysis    |                               | Module Delivery                             |  |
| Module Type                        | Support               |                               | <input checked="" type="checkbox"/> Theory  |  |
| Module Code                        | ENV326                |                               | <input checked="" type="checkbox"/> Lecture |  |
| ECTS Credits                       | 3                     |                               | <input checked="" type="checkbox"/> Lab     |  |
| SWL (hr/sem)                       | 75                    |                               | <input type="checkbox"/> Tutorial           |  |
|                                    |                       |                               | <input type="checkbox"/> Practical          |  |
|                                    |                       |                               | <input type="checkbox"/> Seminar            |  |
| Module Level                       | UGIII                 | Semester of Delivery          | Six                                         |  |
| Administering Department           | ENV8                  | College                       | ENG4                                        |  |
| Module Leader                      | Dr. Salim Yousif Awad | e-mail                        | Sua@uomosul.edu.iq                          |  |
| Module Leader's Acad. Title        | Lecturer              | Module Leader's Qualification | Ph.D.                                       |  |
| Module Tutor                       |                       | e-mail                        |                                             |  |
| Peer Reviewer Name                 |                       | e-mail                        |                                             |  |
| Scientific Committee Approval Date | 01/10/2025            | Version Number                | 1.0                                         |  |

| Relation with other Modules       |      |          |  |
|-----------------------------------|------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |      |          |  |
| Prerequisite module               | None | Semester |  |
| Co-requisites module              | None | Semester |  |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <ul style="list-style-type: none"> <li>• Introduce fundamental concepts of numerical methods.</li> <li>• Develop computational problem-solving skills.</li> <li>• Approximate solutions to mathematical problems.</li> <li>• Analyze errors and convergence of methods.</li> <li>• Apply numerical techniques using software (MATLAB/Excel).</li> <li>• Prepare students for advanced computational courses.</li> </ul>                                                                                                                                                                              |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p>By the end of the module, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Analyze and classify numerical problems.</li> <li>2. Solve nonlinear equations using numerical methods.</li> <li>3. Perform interpolation and curve fitting.</li> <li>4. Apply numerical differentiation and integration.</li> <li>5. Solve systems of linear equations numerically.</li> <li>6. Solve ordinary differential equations using numerical techniques.</li> <li>7. Evaluate errors and stability of methods.</li> <li>8. Implement algorithms using computational tools.</li> </ol> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p>Indicative content includes the following.</p> <ul style="list-style-type: none"> <li>• <b>Part A:</b> Errors and approximations</li> <li>• <b>Part B:</b> Solutions of nonlinear equations</li> <li>• <b>Part C:</b> Interpolation and polynomial approximation</li> <li>• <b>Part D:</b> Numerical differentiation and integration</li> <li>• <b>Part E:</b> Systems of linear equations</li> <li>• <b>Part F:</b> Numerical solution of differential equations</li> <li>• <b>Revision sessions</b></li> </ul>                                                                                  |

| Learning and Teaching Strategies |                                                                                                                                                                                                        |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| استراتيجيات التعلم والتعليم      |                                                                                                                                                                                                        |
| <b>Strategies</b>                | <ul style="list-style-type: none"> <li>• Interactive lectures</li> <li>• Problem-solving tutorials</li> <li>• Laboratory sessions (MATLAB / Excel)</li> <li>• Assignments and mini-projects</li> </ul> |

| Student Workload (SWL)                                                         |    |                                                                           |     |
|--------------------------------------------------------------------------------|----|---------------------------------------------------------------------------|-----|
| الحمل الدراسي للطلاب محسوب ل ١٥ اسبوعا                                         |    |                                                                           |     |
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 48 | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 3.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 27 | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 1.8 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 75 |                                                                           |     |

| Module Evaluation     |                 |             |                  |                 |                            |
|-----------------------|-----------------|-------------|------------------|-----------------|----------------------------|
| تقييم المادة الدراسية |                 |             |                  |                 |                            |
|                       |                 | Time/Number | Weight (Marks)   | Week Due        | Relevant Learning Outcome  |
| Formative assessment  | Quizzes         | 4           | 10 % (40)        | 1, 5, 12 and 14 | CLO-1, CLO-1, CLO-2, CLO-2 |
|                       | Assignments     | 2           | 10 % (40)        | 1, 8            | CLO-1, CLO-1, CLO-2, CLO-2 |
|                       | Projects / Lab. | 2           | 10 % (40)        | 1, 8            | CLO-1, CLO-1, CLO-2, CLO-2 |
|                       | Report          | 2           | 10 % (40)        | 1, 8            | CLO-1, CLO-1, CLO-2, CLO-2 |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 8               | CLO-1, CLO -2 and CLO-3    |
|                       | Final Exam      | 3hr         | 50% (50)         | 16              | All                        |
| Total assessment      |                 |             | 100% (100 Marks) |                 |                            |

| Delivery Plan (Weekly Syllabus) |                                              |
|---------------------------------|----------------------------------------------|
| المنهاج الاسبوعي النظري         |                                              |
|                                 | Material Covered                             |
| Week 1                          | Introduction & Errors                        |
| Week 2                          | Taylor Series & Error Analysis               |
| Week 3                          | Bisection Method                             |
| Week 4                          | False Position Method                        |
| Week 5                          | Newton-Raphson Method                        |
| Week 6                          | Fixed Point Iteration                        |
| Week 7                          | Midterm Exam                                 |
| Week 8                          | Interpolation (Newton & Lagrange)            |
| Week 9                          | Least Squares Regression                     |
| Week 10                         | Numerical Differentiation                    |
| Week 11                         | Numerical Integration (Trapezoidal, Simpson) |
| Week 12                         | Systems of Linear Equations (Gauss, LU)      |
| Week 13                         | Iterative Methods (Jacobi, Gauss-Seidel)     |
| Week 14                         | Numerical ODEs (Euler, Runge-Kutta)          |
| Week 15                         | Review                                       |
| Week 16                         | Final Preparation                            |

| Learning and Teaching Resources |                                                                                                                                                                                                                                                                                                   |                           |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                                                                                                                                                                   |                           |
|                                 | Text                                                                                                                                                                                                                                                                                              | Available in the Library? |
| Required Texts                  | <ul style="list-style-type: none"> <li><b>Required:</b> Numerical Analysis – Burden &amp; Faires</li> </ul>                                                                                                                                                                                       | Yes                       |
| Recommended Texts               | <ul style="list-style-type: none"> <li><b>Recommended:</b> Applied Numerical Methods – Chapra</li> </ul>                                                                                                                                                                                          | Yes                       |
| Websites                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a><br><a href="https://classroom.google.com/c/ODQzNjc3MzlxNTMz">https://classroom.google.com/c/ODQzNjc3MzlxNTMz</a><br>Class code: owxd5pd |                           |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |                                   |
|-------------------------------------------------------------------------|-----------------------------------|
|                                                                         | Material Covered                  |
| <b>Week 1</b>                                                           | Introduction & Errors             |
| <b>Week 2</b>                                                           | Taylor Series & Error Analysis    |
| <b>Week 3</b>                                                           | Bisection Method                  |
| <b>Week 4</b>                                                           | False Position Method             |
| <b>Week 5</b>                                                           | Newton-Raphson Method             |
| <b>Week 6</b>                                                           | Fixed Point Iteration             |
| <b>Week 7</b>                                                           | Midterm Exam                      |
| <b>Week 8</b>                                                           | Interpolation (Newton & Lagrange) |
| <b>Week 9</b>                                                           | Finite Differences                |
| <b>Week 10</b>                                                          | Numerical Differentiation         |

| <b>Grading Scheme</b><br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group</b><br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                   | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group</b><br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                        | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |                         |                     |          |                                       |

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                     |                      |                                                                                                                                                                                                                                          |                         |
|------------------------------------|---------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| معلومات المادة الدراسية            |                     |                      |                                                                                                                                                                                                                                          |                         |
| Module Title                       | Reinforced Concrete |                      | Module Delivery                                                                                                                                                                                                                          |                         |
| Module Type                        | Core                |                      | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                         |
| Module Code                        | ENV327              |                      |                                                                                                                                                                                                                                          |                         |
| ECTS Credits                       | 4                   |                      |                                                                                                                                                                                                                                          |                         |
| SWL (hr/sem)                       | 100                 |                      |                                                                                                                                                                                                                                          |                         |
| Module Level                       | 3                   | Semester of Delivery |                                                                                                                                                                                                                                          | 6                       |
| Administering Department           | ENV8                | College              | ENG4                                                                                                                                                                                                                                     |                         |
| Module Leader                      | Rana Burhan         |                      | e-mail                                                                                                                                                                                                                                   | rn.burha@uomosul.edu.iq |
| Module Leader's Acad. Title        | Assistant professor |                      | Module Leader's Qualification                                                                                                                                                                                                            | MSc.                    |
| Module Tutor                       | -----               |                      | e-mail                                                                                                                                                                                                                                   | E-mail                  |
| Peer Reviewer Name                 | -----               |                      | e-mail                                                                                                                                                                                                                                   | E-mail                  |
| Scientific Committee Approval Date | 11/10/2025          | Version Number       | 1.0                                                                                                                                                                                                                                      |                         |

| Relation with other Modules       |                       |  |          |   |
|-----------------------------------|-----------------------|--|----------|---|
| العلاقة مع المواد الدراسية الأخرى |                       |  |          |   |
| Prerequisite module               | Strength of materials |  | Semester | 3 |
| Co-requisites module              | None                  |  | Semester |   |

| Module Aims, Learning Outcomes and Indicative Contents           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <p>This course is an introduction to the analysis and design of reinforced concrete structural members. Topics covered will include working stress and ultimate strength methods for beams subjected to flexural bending and shear stresses, detailing of flexural and shear reinforcement in beams and short columns subjected to axial load and bending.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p><b>CLO-1:</b> Explain the basic material properties of concrete and reinforcement and their role in the behavior of reinforced concrete structures. (i).</p> <p><b>CLO-2:</b> Apply fundamental mechanics and codified approaches (ACI 318) to the design of reinforced concrete beams at the serviceability limit state (ii).</p> <p><b>CLO-3:</b> Check the safety of the beams to support the applied loads at the serviceability limit state according to ACI 318 specification (i)</p> <p><b>CLO-4:</b> Apply fundamental mechanics and codified approaches (ACI 318) to the design of reinforced concrete beams at the ultimate limit state (ii).</p> <p><b>CLO-5:</b> Check the safety of the beams to support the applied loads according to ACI 318 specification at the ultimate limit state (i)</p> <p><b>CLO-6:</b> Apply fundamental mechanics and codified approaches (ACI 318) to the design of shear reinforcement of rectangular beam (ii).</p> <p><b>CLO-7:</b> Check the safety of the short columns to support the applied loads and moment according to ACI 318 specification (i)</p> <p><b>CLO-8:</b> Apply fundamental mechanics and codified approaches (ACI 318) to evaluate the suitable dimensions of short columns (ii).</p> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p>Indicative content includes the following.</p> <p><u>Part A – Flexural Analysis of Beams (working stress method)</u></p> <p>Analysis and design of rectangular beam using working stress method (9 hrs)</p> <p><u>Part B – Flexural Analysis of Beams (ultimate stress method)</u></p> <p>Flexural analysis of rectangular beams, Analysis and design of doubly reinforced beams, Analysis and design of T,L beams (18 hrs)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|  |                                                                                                                                                                                                                                                                                                                     |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><u>Part C – Shear stresses in concrete beams</u></p> <p>Shear stresses in concrete beams; design for shear (3 hrs)</p> <p><u>Part D - Columns</u></p> <p>design of short columns subject to axial load and bending , Design and analysis of eccentrically loaded columns using interaction diagrams (15 hrs)</p> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b>                                                      | This course has several components that include lectures, individual & group assignments, field visits and e-learning platforms. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams. |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا       |     |                                                                           |     |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطلاب خلال الفصل       | 48  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطلاب أسبوعيا       | 3.2 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطلاب خلال الفصل | 52  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطلاب أسبوعيا | 3.5 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطلاب خلال الفصل              | 100 |                                                                           |     |

| Module Evaluation     |                 |             |                  |                     |                                  |
|-----------------------|-----------------|-------------|------------------|---------------------|----------------------------------|
| تقييم المادة الدراسية |                 |             |                  |                     |                                  |
|                       |                 | Time/Number | Weight (Marks)   | Week Due            | Relevant Learning Outcome        |
| Formative assessment  | Quizzes         | 5           | 5 % (25)         | 4, 8, 10,11 and 14  | CLO-2,3, CLO-4,5, CLO-6, CLO-7,8 |
|                       | Assignments     | 5           | 2 % (10)         | 3, 7, 9, 10, and 14 | CLO-2,3, CLO-4,5, CLO-6, CLO-7,8 |
|                       | Projects / Lab. | 0           | 0% (0)           |                     |                                  |
|                       | Report          | 1           | 5 % (5)          |                     | CLO-2,3, CLO-4,5                 |
| Summative assessment  | Midterm Exam    | 2hr         | 10% (10)         | 13                  | CLO-2, CLO-3, CLO-4, CLO5, CLO6  |
|                       | Final Exam      | 3hr         | 50% (50)         | 16                  | All                              |
| Total assessment      |                 |             | 100% (100 Marks) |                     |                                  |

| Delivery Plan (Weekly Syllabus) |                                                                                              |
|---------------------------------|----------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                              |
|                                 | Material Covered                                                                             |
| Week 1                          | Introduction to Reinforced Concrete                                                          |
| Week 2                          | Flexural Analysis of Beams (working stress method)                                           |
| Week 3                          | Flexural Analysis of Beams (working stress method) ( H.W+ quiz)                              |
| Week 4                          | Flexural Analysis of Beams (Ultimate) According to ACI Code+ quiz                            |
| Week 5                          | Flexural Analysis of Beams (Ultimate) According to ACI Code                                  |
| Week 6                          | Analysis and Design of Doubly Reinforced Beams                                               |
| Week 7                          | Analysis and Design of Doubly Reinforced Beams ( H.W+ quiz)                                  |
| Week 8                          | Analysis and Design of T Beams L Beams                                                       |
| Week 9                          | Analysis and Design of T Beams L Beams ( H.W+ quiz)                                          |
| Week 10                         | Shear Stresses in Concrete Beams; Design for Shear. ( H.W+ quiz)                             |
| Week 11                         | Columns                                                                                      |
| Week 12                         | Design of Short Columns Subject to Axial Load and Bending                                    |
| Week 13                         | Design and Analysis of Eccentrically Loaded Columns + Term exam                              |
| Week 14                         | Design and Analysis of Eccentrically Loaded Columns Using Interaction Diagrams+ ( H.W+ quiz) |
| Week 15                         | Design and Analysis of Eccentrically Loaded Columns Using Interaction Diagrams               |
| Week 16                         | Preparatory week before the final Exam                                                       |

| Learning and Teaching Resources |                                                                                                                                                                                                                                                                                 |                           |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| مصادر التعلم والتدريس           |                                                                                                                                                                                                                                                                                 |                           |
|                                 | Text                                                                                                                                                                                                                                                                            | Available in the Library? |
| Required Texts                  | <ul style="list-style-type: none"> <li>Nilson A., Darwin D., Dolan C. (2004) "Design of concrete structures ", 30 th ed., McGraw Higher Education</li> </ul>                                                                                                                    | Yes                       |
| Recommended Texts               | <ul style="list-style-type: none"> <li>Ibrahim A., Mahmood M. (2008) "Design of reinforced concrete structure", 1st ed. Diyala University.</li> <li>Aghayere, A. O., Limbrunner, George F. (2014) "Design of reinforced concrete", 8th ed. Library of Congress, USA.</li> </ul> | Yes                       |
| Websites                        | <a href="https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/">https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/</a>                                                                                                                       |                           |

| Grading Scheme                                                                                                                                                                                                                                                                                                                                                                              |                  |                     |          |                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|----------|---------------------------------------|
| مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                                                |                  |                     |          |                                       |
| Group                                                                                                                                                                                                                                                                                                                                                                                       | Grade            | التقدير             | Marks %  | Definition                            |
| Success Group<br>(50 - 100)                                                                                                                                                                                                                                                                                                                                                                 | A - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                             | B - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                             | C - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                             | D - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                             | E - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| Fail Group<br>(0 – 49)                                                                                                                                                                                                                                                                                                                                                                      | FX – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                             | F – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                             |                  |                     |          |                                       |
| <p><b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.</p> |                  |                     |          |                                       |