

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 <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input checked="" type="checkbox"/> Seminar
Module Code	ENV311		
ECTS Credits	6		
SWL (hr/sem)	150		
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	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor	Duaa Abdul-Ghany Al-Hammadi	e-mail	duaa.abd@uomosul.edu.iq
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	None	Semester	-----
Co-requisites module	None	Semester	-----

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	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.
Module Learning Outcomes 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: Define of the air pollutants, their sources and effects in the atmosphere, (i) CLO-2: Knowing Air pollution legalization and amendments (i) CLO-3: Evaluating air quality for different pollutants using AQI (i) CLO-4: Predicting of atmospheric stability and plume patterns (ii). CLO-5: Analyze the data and solve problems to evaluate the emission limits from different sources and comparing the results with the locale standards. (ii) CLO-6: Reporting air pollutants data related to its sources, characteristics, and health effects (vii)</p>
Indicative Contents المحتويات الإرشادية	<p style="text-align: center;">Indicative content includes the following.</p> <p><u>Part A – Introduction to the atmosphere</u> 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)</p> <p><u>Part B – Air pollution and meteorology</u> Wind rose, pressure gradients, adiabatic lapse rate, atmospheric stability, radiation inversion, subsidence inversion, atmospheric stability and mixing depth, Smoke plumes patterns. (20 hrs)</p> <p><u>Part C – Dispersion Models</u> Mathematical Models: The point source Gaussian plume model, A line-source dispersion model, Area-source models, In -door air quality model. (28 hrs)</p>

Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	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.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.8
Total SWL (h/sem) 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	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

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

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

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (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 (0 – 49)	FX – Fail	راسب (فيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
<p>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.</p>				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Water networks		Module Delivery	
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar	
Module Code	ENV312			
ECTS Credits	7			
SWL (hr/sem)	175			
Module Level	3	Semester of Delivery		5
Administering Department	ENV8	College	ENG4	
Module Leader	Dr.Layth Abdulaleem		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	Hydraulic applications	Semester	4
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p>Module Objectives أهداف المادة الدراسية</p>	<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>
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<p style="color: red; text-align: center;">Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p>CLO-1: Recognizing the main parameters that must be available in the water supply network system to provide the required purpose of it (i).</p> <p>CLO-2: Understanding the major principles that can be used to simulate the water network in computer software (i).</p> <p>CLO-3: Understanding the major principles that can be used to solve the likely problems that may be occur in the network (ii).</p> <p>CLO-4: Applying the fundamentals of fluid mechanics in the analysis and design of the main components of the system (ii).</p> <p>CLO-5: Learning skills in the design and analysis of water network using computer software (i) and (iv).</p> <p>CLO-6: Learning the methods that can be used to rehabilitation and prolong the network life (i).</p>
<p>Indicative Contents المحتويات الإرشادية</p>	<p><u>Part A – Preliminary fundamentals:</u> 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> Sequences of analysis and design steps, design consideration, Hardy-Cross methods (12 h).</p> <p><u>Part C – Service tanks:</u> 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> Pipe material selection, types of valves, loads on buried pipes, bedding selection. (8 h)</p>
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	<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>

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	112	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	7.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

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 system: Basic types of demand, peaking factors, demand estimation, skeletonization, demand allocation.
Week 3	Distribution methods, configuration of distribution system.
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.
Week 7	Service storage tanks, types of tanks, storage volume components, methods of equalization volume computation.
Week 8	Examples on equalization volume computation, fire storage.
Week 9	Emergency storage, tank location, quality of water tank, tank maintenance.
Week 10	Pump stations, types of pumps, total dynamic head, system head curve, pump characteristics curves, selection of pumping units.
Week 11	Flow range of centrifugal pumps, pumps connection in series and parallel, examples.
Week 12	Cavitation phenomenon and net positive suction head, affinity laws, specific speed, examples.
Week 13	Computer software applications.
Week 14	Pipe material selection, advantages and disadvantages of different types of pipes, types of valves.
Week 15	Loads on buried pipes, Marston equation, bedding pipe selection, truck load, internal pressure, thrust forces, examples .
Week 16	

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	McGhee, T. G., 1991, Water Supply and Sewerage, 6 th ed., McGraw-Hill, Inc.	Yes
Recommended Texts	Mays, L. W. (Editor), 2000, Water Distribution Systems Handbook, McGraw-Hill, Inc.	No
Websites	https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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

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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 <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar	
Module Code	ENV313			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	3	Semester of Delivery		6
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	None		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p>Module Objectives أهداف المادة الدراسية</p>	<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>
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<p style="text-align: center;">Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p>CLO-1: Explain municipal solid waste management systems with respect to its physical properties, and associated critical considerations. (i) CLO-2: Outline sources, types and composition of solid waste with methods of handling, sampling and storage of solid waste. (i) CLO-3: Select the appropriate method for solid waste collection, transportation, redistribution and disposal. (i) CLO-4: Describe methods of disposal of hazardous solid waste. (i) CLO-5: Design the collection systems of solid waste of a town. (ii) CLO-6: Design treatment of municipal solid waste and landfill. (ii) CLO-7: Design a composting facility. (ii) CLO-8: All student make a project in design of solid waste collection system. (vii)</p>
<p>Indicative Contents المحتويات الإرشادية</p>	<p style="text-align: center;">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) . <u>Part B</u> – Study the physical, chemical, biological properties of solid waste (6 hrs) <u>Part C Hazardous Wastes Found in Municipal Solid Waste:</u> study its sources, types, and properties (6 hrs) Part D – solid waste generation, and waste handling at the source (6 hrs) Part E – Collection of solid waste (18 hrs) Part F – Transfer and Transport (4 hrs) Part G – Separation and Processing and Transformation of Solid Waste (14 hrs) Part H – Disposal of Solid Wastes and Residual Matter (15 hrs)</p>

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.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) 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	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
Week 1	Objectives, Evolution of Solid-Waste Management
Week 2	Legislative Trends and Impacts
Week 3	Sources, Types, and Composition of Municipal Solid Wastes
Week 4	Application examples about composition of solid waste
Week 5	Physical Properties of Municipal Solid Waste
Week 6	Chemical Properties of Municipal Solid Waste
Week 7	Biological Properties of Municipal Solid Waste
Week 8	Sources, Types, and Properties of Hazardous Wastes Found in Municipal Solid Waste
Week 9	Solid Waste Generation and Collection Rate
Week 10	Waste Handling and Separation, Storage, and Processing at the Source
Week 11	Collection of Solid Waste
Week 12	Mid-Term Exam - Time-cost trade-off.
Week 13	Transfer and Transport
Week 14	Separation and Processing and Transformation of Solid Waste
Week 15	Disposal of Solid Wastes and Residual Matter
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	George Tchobanoglous "Integrated Solid Waste Management", McGraw hill ,new york, 1993.	Non
Recommended Texts	Michael D. LaGrega "Hazardous Waste Management", McGraw hill ,new york, 2001.	Non
Websites	https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Noise and Thermal Pollution		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ENV314		
ECTS Credits	3		
SWL (hr/sem)	48		
Module Level	3	Semester of Delivery	
Administering Department	ENV8	College	ENG4
Module Leader	Dr.Ammar	e-mail	Dr.ammarthamir@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	12/06/2023	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 أهداف المادة الدراسية	With increasing noise pollution nationally and globally, it is necessary to be familiar with basic information regarding noise pollution to allow proper assessment of impacts arising from the various projects or activities and devising appropriate mitigation or control measures. In this respect, the Noise Pollution course covers sources, characteristics and effects of industrial, transportation and urban noise; measurement, assessment and evaluation of noise; control of noise and protection of recipients. Student also will learn the different Sources of Thermal Pollution: Coal-fired Power Plants, Industrial Effluents, sewage effluent and their effects on human and environment, detailed design of cooling ponds and towers.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	CLO-1: Identify the sources of noise pollution (i) CLO-2: Describe the physical properties of sound (i) CLO-3: Understand the factors affecting noise propagation outdoor (i) CLO-4: Compare between the concepts involved in noise control technologies (i) CLO-5: Advise on methods of noise reduction and sound insulation for a range of situations (ii) CLO-6: Design Road way barrier used to reduce noise level produced by transportation (ii) CLO-7: Submit a report on noise prediction in a specified road way configuration (Case study) (iv) CLO-8: Identify the sources of thermal pollution and its ecological effects(i) CLO-9: Submit a report on thermal pollution prediction in a specified power plant (Case study) (iv) CLO-10: Design the cooling ponds and towers (ii)
Indicative Contents المحتويات الإرشادية	Part A – Introduction to physics of sound (9 hrs.) Part B – Effects of noise on people and criteria (6 hrs.) Part C – Noise transmission outdoor, traffic noise prediction (6 hrs.) Part D – Noise control techniques (9 hrs.) Part E – Sources of thermal Pollution and ecological effects (9 hrs.) Part F – Controlling thermal Pollution (6 hrs.)

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	This course has several components that include lectures, individual & group assignments, e-learning platforms. Exercises involving the use of computer applications tools to understand different techniques used in control of Noise and thermal Pollution. The course will be taught in English, and all mandatory assignments have to be submitted within the deadlines to be admitted to the exams.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (15)	1, 10, ,14	CLO-2, CLO-4, and CLO-10
	Assignments	2	15% (15)	2, 6	CLO-2, CLO-3
	Report	3	10 % (10)		CLO-7, CLO-10
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 الأسبوعي النظري

	Material Covered
Week 1	Properties of sound waves, sound power and intensity
Week 2	Sound pressure level and the decibel, characterization of noise
Week 3	Rating systems: the Ln concept, the L _{eq} concept
Week 4	Effects of noise on people and criteria: Hearing Impairment, Damage-Risk Criteria,
Week 5	Speech Interference, Annoyance, Sleep Interference, Effects on Performance, Noise Standards
Week 6	Transmission of sound outdoors: Inverse Square Law, Radiation Fields of a Sound Source, Directivity, Airborne Transmission
Week 7	Traffic noise prediction

Week 8	Source-Path-Receiver Concept, Control of Noise Source by Design
Week 9	Noise Control in the Transmission Path,
Week 10	Control of Noise Source by Redress, Protect the Receiver
Week 11	Sources of Thermal Pollution: Coal-fired Power Plants, Industrial Effluents
Week 12	Atomic power plants, Domestic Sewage
Week 13	Ecological Effects of thermal pollution: Aquatic life, Water salinity, shoreline deforestation, soil erosion
Week 14	Controlling Thermal Pollution: Design of Cooling Ponds
Week 15	Design of Cooling Towers
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Introduction to Environmental Engineering "Chapter -10" by Mackenzie Davis, 5 th ed. (2013)	Yes
Recommended Texts	<ul style="list-style-type: none"> Engineering noise control, theory and practice by Bies and Hansen, 4th ed. (2009) 	No
Websites	https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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

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	Soil mechanics		Module Delivery	
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar	
Module Code	ENV315			
ECTS Credits	6			
SWL (hr/sem)	90			
Module Level	3	Semester of Delivery		5
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	12/06/2023	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	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	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.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. CLO-1: The students will learn how to find an analysis of the soil properties and solve some engineering properties of soil (i) CLO-2: 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) CLO-3: Carry out suitable measurements and tests of soil properties and analyze the results to get some values used in soil problems. (iii) CLO-4: the students will be able to communicate and cooperate with others to conduct soil investigation reports (v) CLO-5: Report the data obtained from the selective topics of soil topics given and organized during the course (iv) CLO-6: Creating some opinions about the emerging soil mechanics issues and trying to give some solutions compatible with the problems related to surveying aspects (vii)
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A Introduction</u> Physio-mechanical properties of soil, Soil classification (10 hrs) <u>Part B Hydraulic properties of soil</u> The capillary property of soil, Hydraulic conductivity in the soil (12hrs) <u>Part C – Hydromechanical properties of soil</u> Stresses in soil, consolidation, bearings, coordinates (20hrs) <u>Part D – Soil mechanics topics</u> Soil improvement, Shear stress, soil investigation (18 hrs)

Learning and Teaching Strategies

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.
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Student Workload (SWL)

الحمل الدراسي للطلاب محسوب ل ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	108	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	7.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	42	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	2.8
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	150		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	25 % (25)	3, 6, 9 and 12	CLO-1, CLO-1, CLO-2, CLO-4
	Assignments	7	5%(5)		All
	Projects / Lab.				
	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)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction
Week 2	Physio-mechanical properties of soil
Week 3	Physio-mechanical properties of soil
Week 4	Soil classification
Week 5	Soil classification
Week 6	Hydraulic properties of soil
Week 7	Hydraulic properties of soil
Week 8	Hydraulic properties of soil

Week 9	Soil improvement
Week 10	Stresses in soil
Week 11	Stresses in soil
Week 12	Hydromechanical properties of soil
Week 13	Hydromechanical properties of soil
Week 14	Shear stress
Week 15	Soil investigation
Week 16	The preparatory week before the Final Exam

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	B.M. Das, principles of geotechnical engineering(2006)	yes

Recommended Texts	B.M. Das, principles of geotechnical engineering(2014)	No
Websites	https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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
<p>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.</p>				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Air Pollution Control		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input checked="" type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ENV321		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	3	Semester of Delivery	
Administering Department	ENV8	College	ENG4
Module Leader	Dr. Mohammed Salim Shihab	e-mail	Shihab77@uomosul.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor	Nada Abd Al-Razzaq Al-Dulaimi	e-mail	nada.abd@uomosul.edu.iq
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	Principle of air pollution	Semester	5
Co-requisites module	None	Semester	-----

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The aim of this course will cover air pollution equipment's control. Initially students will learn how to apply the basic principles of sciences and engineering to solve issues associated with air pollution basics and control. Upon completion of this course students will be able to: Apply the treatment practices and devices due to the types of pollutants; Understand the design procedures for any type of air pollutant through assignments that demonstrate accomplishment of this outcome, and test problems and tutorials.
Module Learning Outcomes 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: Apply the basic principles of engineering and sciences to solve issues associated with air pollution basics and control. (i)</p> <p>CLO-2: Knowing the air pollution control techniques and types; (i)</p> <p>CLO-3: Apply the control practices and devices according to the types of pollutants;(i)</p> <p>CLO-4: Design procedures for controlling equipment of particulates air pollutants. (ii).</p> <p>CLO-5: Design procedures for controlling equipment of gaseous air pollutants. (ii)</p> <p>CLO-6: Design project for specific air pollutants control device,(vii)</p>
Indicative Contents المحتويات الإرشادية	<p style="text-align: center;">Indicative content includes the following.</p> <p><u>Part A – Classification of air pollution control equipment.</u> Definition of particulates matter, Classification and characteristics (5 hrs)</p> <p><u>Part B – Particles separation technique</u> gravity chamber, centrifugal separators (cyclones), filter baghouse, electrostatics precipitators. (25 hrs)</p> <p><u>Part C – Gaseous pollutants control technique</u> Wet scrubber (Venture scrubbers), Absorption, Adsorption, (DeSOx) Flue Gas Desulfurization, Control Technologies for Nitrogen Oxides (DeNOx) (30 hrs)</p>

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course has several components that include lectures, individual and group assignments, field visit, 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.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	15 % (15)	2, 4,6,and 9	CLO-1, CLO-3, CLO-4, CLO-5
	Assignments	4	15 % (15)	3, 5, 9and 12	CLO-3, CLO-4, CLO-4 CLO-5
	Projects / Lab.	1	10 % (10)	14	All
	Report	----	-----	-----	-----
Summative assessment	Midterm Exam	2hr	10% (10)	10	CLO-1, CLO-2, CLO-3, CLO-4, CLO-5
	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	Classification of air pollution control equipment.
Week 2	Particles separation technique
Week 3	Gravity settling chamber,
Week 4	Centrifugal separators (cyclones), types and concept
Week 5	Centrifugal separators (cyclones), design procedures
Week 6	Filter baghouse,
Week 7	Electrostatics precipitators.
Week 8	Electrostatics precipitators.
Week 9	Gaseous pollutants control technique
Week 10	Wet scrubber (Venture scrubbers),
Week 11	Absorption,
Week 12	Adsorption.
Week 13	(DeSO _x) Flue Gas Desulfurization
Week 14	Control Technologies for Nitrogen Oxides (DeNO _x)
Week 15	Control Technologies for Nitrogen Oxides (DeNO _x)
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

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

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (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 (0 - 49)	FX – Fail	راسب (فيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
<p>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.</p>				

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 <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar	
Module Code	ENV322			
ECTS Credits	7			
SWL (hr/sem)	175			
Module Level	3	Semester of Delivery		6
Administering Department	ENV8	College	ENG4	
Module Leader	Dr.Layth Abdulaleem		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	Hydraulic applications	Semester	4
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p>Module Objectives أهداف المادة الدراسية</p>	<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>
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<p>CLO-1: Describing the different properties of wastewater in addition to its flow rate (i). CLO-2: Describing the main appurtenances of sewers networks system in addition to domestic plumbing networks (i). CLO-3: Describing the properties of storm water and learning the method used in the quantity determination (i) and (ii). CLO-4: Learning the engineering methods used in the analysis and design of sanitary and storm sewers networks (ii). CLO-5: Learning skills in the design and analysis of sewers network using computer software (i) and (iv). CLO-6: Learning the engineering methods used in the analysis and design of sanitary networks, storm networks, and water supply networks of domestic plumbing (ii).</p>
<p>Indicative Contents المحتويات الإرشادية</p>	<p><u>Part A – Wastewater describing:</u> Physical, chemical, and biological properties of wastewater, components of wastewater flow (15 h).</p> <p><u>Part B – Design of wastewater network:</u> Sewers design activities, sequences of design requirements (10 h).</p> <p><u>Part C – Design of storm water networks:</u> Types of storm water networks, runoff water flow rate estimation. (10 h)</p> <p><u>Part D – Sewers network appurtenances:</u> 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>

	Part F – Plumbing networks: Water supply networks, sanitary drainage network, storm drainage network (15 h).
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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) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	97	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

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)		
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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	Selection of design flow rate and mass loadings.
Week 4	Sewers systems types, sanitary sewers design activities, sanitary sewer types.
Week 5	Sanitary sewers design: flow rate estimation, pipe material selection, design criteria definition, design equation selection, design execution and maps preparation, examples.
Week 6	Types of storm water networks, rational method for runoff water flow rate estimation.
Week 7	Examples
Week 8	Sewers network appurtenances: manholes, inverted siphon, outlets and outfalls, alternative sewers systems, lift stations.
Week 9	Inlets: gutter, types of inlets: grate inlet, curb inlet, combination inlet,
Week 10	Inlets in sag location, inlets spacing.
Week 11	Sanitary sewers software applications.
Week 12	Storm sewers software applications.
Week 13	Plumbing: plumbing code, fixture types, fixture unit, water supply network.
Week 14	Sanitary drainage network.
Week 15	Storm drainage network.
Week 16	

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	

Week 6	
Week 7	

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

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (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 (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
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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 <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ENV323		
ECTS Credits	6		
SWL (hr/sem)	78		
Module Level	3	Semester of Delivery	
Administering Department	ENV8	College	ENG4
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
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	Environmental Chemistry, Microbiology	Semester	3,4
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p>Module Objectives أهداف المادة الدراسية</p>	<p>The emphasis in lectures is on the chemical, physical, and biological unit processes that used in the professional practice of environmental engineering (water treatment, wastewater treatment, and soil remediation). The study of various physical, chemical and biological operations and processes Topics covered will be selected from areas such as reactor hydrodynamics, oxidation-reduction, coagulation-flocculation, chemical precipitation, ion exchange, adsorption process, biological oxidation, anaerobic digestion, activated sludge. The course will emphasize incorporating sustainability into design, with emphasis on reducing energy consumption and environmental impacts while increasing operations ease. The emphasis in homework assignments is for students to appreciate the role of each treatment unite in treatment train and then to recommend specific design criteria given different treatment goals and challenges. Upon completion, students should be able to describe the purpose and major design elements of each step of a conventional water and wastewater treatment plant. Students should also be able to compile basic knowledge about unit operation processes and to evaluate new technologies and make critical judgments as to their application and sustainability based on gained knowledge.</p>
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<p>CLO-1: To understand the historical purpose of municipal wastewater treatment and to describe the need for moving beyond treatment toward resource recovery. (i) CLO-2: To describe the composition and characteristics of municipal wastewater and to specify what treatment process is required for each constituent. (i) CLO-3: To describe the relationship between biological competition of specific species and effluent clarity and quality. CLO-4: To discuss the relationship between wastewater composition, microbial growth rate, and biosolids management. (i) CLO-5: To describe the common measurements for treatment plant performance , develop, solve design problems and analyze the data to evaluate the feasibility of the main components of water and wastewater treatment plants (ii). CLO-6: Report the data obtained from the site visits to WTP and WWTP that will be organized during the course (iv) CLO-7: Formulate the mass balance principles, and applying Modeling for treatment process kinetics involving mass transfer and Gas-Liquid mass transfer. (ii).</p>
<p>Indicative Contents المحتويات الإرشادية</p>	<p style="text-align: center;"><u>Part A –unit operation and processes</u></p> <p>Introduction to unit operation and processes in water and wastewater , combination of unit operation and processes in treatment process train .(5 hrs)</p>

	<p><u>Part B – Physical unit operation:</u> screening, comminutors , grit removal, mixing & flocculation , energy dissipation in mixing, type of mixers, sedimentation flotation, oxygen transfer , membranes processes , Reverse osmosis , ion exchanges, Adsorption & absorption fundamental , filtration.(20 hrs)</p> <p><u>Part C – Chemical unit operations.:-</u> Chemical unit operations.:- Chemical Coagulation, Colloidal destabilization, Chemical precipitation, ,disinfection, (10hr)</p> <p><u>Part D – Reaction kinetics and reactors:</u> Reactions types, Reaction order, Reaction rates, Types of reactors, ,mass balance principle, Modeling treatment process kinetics, Treatment process involving mass transfer, Gas-Liquid mass transfer, Two film theory Liquid-Solid mass, Introduction of activated sludge process & kinetics , trickling filter , rotary biological disc , Phosphorus removal , nitrification & denitrification. (25 hrs)</p> <p><u>Part D - Biological unit operations</u> Microbial metabolism, Microbial growth kinetics, Aerobic biological oxidation, Anaerobic fermentation and oxidation Aerobic biological oxidation, Anaerobic fermentation and oxidation . (15hr)</p>
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course has several components that include lectures, individual & group assignments, 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) الحمل الدراسي للطالب محسوب ل ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	156		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	16 % (16)	1, 5, ,12 and 14	CLO-2, CLO-2, CLO-4, CLO-5
	Assignments	4	16% (16)	2, 3, 4, and 6	CLO-2, CLO-2, CLO-5 CLO-5,
	Lab.				
	Report	1	8% (8)		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 to unit operations and processes in water and wastewater , combination of unit operations and processes in treatment process train .
Week 2	<u>Physical unit operations:</u> screening , ,comminutors , grit removal
Week 3	mixing & flocculation , energy dissipation in mixing, type of mixers, sedimentation & flotation , oxygen transfer
Week 4	Membranes processes ,Reverse osmosis , ion exchanges
Week 5	Adsorption & absorption fundamental ., filtration
Week 6	<u>Chemical unit operations.:-</u> Chemical Coagulation, Colloidal destabilization,
Week 7	Chemical precipitation, ,disinfection
Week 8	Reaction kinetics and reactors : Reactions types, Reaction order, Reaction rates, Types of reactors,
Week 9	mass balance principle, Modeling treatment process kinetics,
Week 10	Treatment process involving mass transfer, Gas-Liquid mass transfer, Two film theory Liquid-Solid mass

Week 11	Introduction of activated sludge process & kinetics , trickling filter , rotary biological disc ,
Week 12	Phosphorus removal , nitrification & denitrification
Week 13	<u>Biological unit operations</u> Microbial metabolism, Microbial growth kinetics, Aerobic biological oxidation, Anaerobic fermentation and oxidation
Week 14	Aerobic biological oxidation, Anaerobic fermentation and oxidation
Week 15	
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	<ul style="list-style-type: none"> • Metcalf and Eddy "Wastewater engineering, treatment and resource recovery", McGraw hill, New York, 2014 	Yes
Recommended Texts	<ul style="list-style-type: none"> • S. Qasim and G. Zhu "Wastewater Treatment and Reuse Theory and Design Examples Volume 1: Principles and Basic Treatment" , Taylor & Francis Group, 2018 	Yes
Websites	https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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

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	Sustainability Engineering		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ENV324		
ECTS Credits	4		
SWL (hr/sem)	101		
Module Level	3	Semester of Delivery	
Administering Department	ENV8	College	ENG4
Module Leader	Dr. Omar M. Abdulkareem	e-mail	omaralhakeem@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	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p>Module Objectives أهداف المادة الدراسية</p>	<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>
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<p>CLO-1: Learn about the principles, indicators and general concept of sustainability (i). CLO-2: Get a useful acquaintance about the features of sustainable concrete in accordance with the sustainable concept through identifying the ecological impacts of cement and concrete production (i). CLO-3: Apprehend the local, regional and global impacts of unsustainable designs, products and processes (i). CLO-4: Explore the types of new and renewable energies, and have in-depth knowledge about the eutrophication (i). CLO-5: Use the mathematical expressions to evaluate the environmental impacts in terms of GHG emissions, particulate matters and solid wastes of the cement industry (ii). CLO-6: 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>
<p>Indicative Contents المحتويات الإرشادية</p>	<ul style="list-style-type: none"> - Sustainability and sustainable development, Conceptions, Development & applications (3 hrs). - Sustainability of concrete: Introduction, Negative environmental effects of cement and concrete industries, Environmental concerns, Ten qualifications of concrete sustainability (6 hrs). - Environmental impacts of Portland cement production: Introduction, Description of cement production process, Main impacts, Environmental sustainability, Social sustainability, Economic sustainability, Future trends (6 hrs). - Sustainable ready mix plant-Case study: Introduction, Transportation of materials, Example of sustainable ready-mix plant, Conclusion (3hrs). - 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 CO₂ content in the exit gases) (3 hrs). - 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 (3 hrs). - Concrete with construction and demolition wastes (CWD): Introduction, Construction & demolition wastes uses, Construction & demolition wastes sources, Construction &

	<p>demolition wastes classification, Construction & demolition wastes composition, Construction & demolition wastes management, Construction & demolition wastes reuses (6 hrs).</p> <p>- Renewable Energy, New and renewable energy, Sun energy, Wind energy, Waterfalls energy, etc., Applications, How to use (9 hrs).</p> <p>- Eutrophication in surface water, Types of algae, causes , their results on water quality, treatment plants, modeling of nutrients cycles (6 hrs).</p>
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	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) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) 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	30 % (30)	2, 4, 6, 8 and 12	CLO-2, CLO-2, CLO-3, CLO-5,CLO-6
	Assignments	2	10 % (10)	9, and 12	CLO-4, CLO-4
	Projects / Lab.				
	Report				
Summative	Midterm Exam	2hr	10% (10)	7	CLO-1, CLO -2, CLO-3,

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

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Sustainability and sustainable development, Conceptions, Development & applications.
Week 2	Sustainability of concrete: Introduction, Negative environmental effects of cement and concrete industries, Environmental concerns.
Week 3	Ten qualifications of concrete sustainability.
Week 4	Environmental impacts of Portland cement production: Introduction, Description of cement production process, Main impacts, Environmental sustainability.
Week 5	Social sustainability, Economic sustainability, Future trends.
Week 6	Sustainable ready mix plant-Case study: Introduction, Transportation of materials, Example of sustainable ready-mix plant, Conclusion.
Week 7	Environmental calculation 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 ₂ content in the exit gases).
Week 8	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 9	Concrete with construction and demolition wastes (CWD): Introduction, Construction & demolition wastes uses, Construction & demolition wastes sources, Construction & demolition wastes classification.
Week 10	Construction & demolition wastes composition, Construction & demolition wastes management, Construction & demolition wastes reuses.
Week 11	Renewable Energy, New and renewable energy, Types of renewable energy (Sun energy).
Week 12	Types of renewable energy (Wind energy, Waterfalls energy, etc.).
Week 13	Applications of renewable energy, How to use.
Week 14	Eutrophication in surface water, Types of algae, causes, their results on water quality, treatment plants.
Week 15	Modeling of nutrients cycles.
Week 16	Preparatory week before the final exam.

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
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Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

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

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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

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	Hazardous Waste Management		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ENV325		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	3	Semester of Delivery	6
Administering Department	ENV 8	College	ENG 4
Module Leader	Dr.Anas Fakhry Qassid Dr.Hamid Adrees Al-Khashab	e-mail	anasfq@uomosul.edu.iq hamidalkhashab@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	14/06/2023	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 أهداف المادة الدراسية	This course provides an in-depth understanding of solid and hazardous waste characteristics and management. Some basics of radioactive waste characterization and handling are also provided. It is involving the study of the source, generation rates, and characteristics of hazardous wastes and their regulation, handling, treatment, and disposal. The course will emphasize on engineering process design, analysis and evaluation of different hazardous waste treatment technologies. Students will have the opportunity to study issues, processes, and problems involved in current hazardous waste treatment and management systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	<p>CLO-1: Familiarize students with laws and regulations governing hazardous waste storage, transport and treatment</p> <p>CLO-2: Provide an introduction to different pollution prevention and waste minimization opportunities for hazardous waste</p> <p>CLO-3: Identify environmental concerns for hazardous waste on water, land and air</p> <p>CLO-4: Offer necessary equations and design examples to evaluate the effectiveness of different physicochemical, biological and thermal treatment technologies for hazardous waste</p> <p>CLO-5: Identify containment technologies and land treatment techniques for hazardous waste</p> <p>CLO-6: Provide experiences in realistic civil and environmental engineering design and construction practice</p> <p>CLO-7: Evaluate risks associated with exposure to different sources of hazardous wastes</p> <p>CLO-8: Develop a term project analyzing a case study or a treatment process in hazardous waste treatment</p>
Indicative Contents المحتويات الإرشادية	<p><u>Part A</u> Provide background material for a complete understanding of hazardous waste (15 hr.).</p> <p><u>Part B</u> Examines the methods currently used by management in industry to understand the magnitude of hazardous waste problems (15 hr.).</p> <p><u>Part C</u> Selection of treatment and disposal methods (15 hr.).</p>

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	This course has several components that include lectures, 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.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	12% (12)	3, 7, 10 and 12	CLO-1, CLO-3, All, All
	Assignments	4	12% (12)	2, 8, 10 and 11	CLO-2, CLO-4, All, All
	Projects / Lab.	1	16% (16)	13	All
	Report	0	0	0	-----
Summative assessment	Midterm Exam	2hr	10% (10)	7	All
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المناهج الاسبوعي النظري

	Material Covered
Week 1	Hazardous Waste Management – Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects
Week 2	Process fundamentals. Fate and transport of contaminants
Week 3	Facility development and operations. Waste minimization and resource recovery, waste reduction, waste tracking systems
Week 4	Introduction to physico-chemical treatment processes
Week 5	Physico-chemical treatment processes
Week 6	Introduction to biological treatment processes
Week 7	Biological treatment processes
Week 8	Midterm Exam
Week 9	Introduction to thermal processes: chemistry and thermodynamics of incineration
Week 10	Thermal Processes: Incineration standards and incineration systems
Week 11	Thermal Processes: Incinerator design
Week 12	Land disposal: disposal site, landfill operations, leachate collection, facilities design and development, Introduction to risk assessment
Week 13	Hazardous waste landfill design-1
Week 14	Hazardous waste landfill design-2
Week 15	Radioactive Waste Management: Sources, measures and health effects; nuclear power plants and fuel production, waste generation from nuclear power plants; disposal options
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Michael D. LaGrega, "Hazardous Waste Management", McGraw-Hill Series in water resources and environmental engineering, 2001.	Yes
Recommended Texts	<u>William C. Blackman, Jr.</u> , "Basic Hazardous Waste Management", Publisher of Humanities, Social Science & STEM Books, 2001	NO
Websites	https://uomosul.edu.iq/en/engineering/environmental-engineering-dept/	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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>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.</p>				

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 <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ENV326		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	3	Semester of Delivery	
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	12/06/2023	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

<p>Module Objectives أهداف المادة الدراسية</p>	<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>
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<p style="text-align: center;">Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <p>CLO-1: Explain the basic material properties of concrete and reinforcement and their role in the behavior of reinforced concrete structures. (i).</p> <p>CLO-2: Apply fundamental mechanics and codified approaches (ACI 318) to the design of reinforced concrete beams at the serviceability limit state (ii).</p> <p>CLO-3: Check the safety of the beams to support the applied loads at the serviceability limit state according to ACI 318 specification (i)</p> <p>CLO-4: Apply fundamental mechanics and codified approaches (ACI 318) to the design of reinforced concrete beams at the ultimate limit state (ii).</p> <p>CLO-5: Check the safety of the beams to support the applied loads according to ACI 318 specification at the ultimate limit state (i)</p> <p>CLO-6: Apply fundamental mechanics and codified approaches (ACI 318) to the design of shear reinforcement of rectangular beam (ii).</p> <p>CLO-7: Check the safety of the short columns to support the applied loads and moment according to ACI 318 specification (i)</p> <p>CLO-8: Apply fundamental mechanics and codified approaches (ACI 318) to evaluate the suitable dimensions of short columns (ii).</p>
<p>Indicative Contents المحتويات الإرشادية</p>	<p style="text-align: center;">Indicative content includes the following.</p> <p><u>Part A – Flexural Analysis of Beams (working stress method)</u> 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> 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> Shear stresses in concrete beams; design for shear (3 hrs)</p> <p><u>Part D - Columns</u></p>

	design of short columns subject to axial load and bending , Design and analysis of eccentrically loaded columns using interaction diagrams (15 hrs)
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	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) الحمل الدراسي للطالب محسوب ل ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) 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	25 % (25)	4, 8, 10,11 and 14	CLO-2,3, CLO-4,5, CLO-6, CLO-7,8
	Assignments	5	15 % (15)	3, 7, 9, 10, and 14	CLO-2,3, CLO-4,5, CLO-6, CLO-7,8
	Projects / Lab.	0	0% (0)		
	Report	0	0 % (0)		
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
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
Week 8	Analysis and Design of T Beams L Beams+ quiz
Week 9	Analysis and Design of T Beams L Beams + H.W
Week 10	Shear Stresses in Concrete Beams; Design for Shear. +quiz +HW
Week 11	Columns+ quiz
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+ quiz + H.W
Week 15	Design and Analysis of Eccentrically Loaded Columns Using Interaction Diagrams
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

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

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (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 (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

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.