Description Guide of Mathematics Department-3rd Class

Course Description Form

University: Mosul **College:** Computer Science and Mathematics **Department:** Mathematics

1. Course name and academic level	
Computational Mathematics I / 3rd Class	
2. Course Code:	
CM MS 25 F 365	
3. Semester / Year:	
Second Semester 2025-2024	
4. Description Preparation Date:	
18/09/2024	
5. Available Attendance Forms:	
Attendance in the classroom and laboratory according to the announced weekly lesson schedule	
6. Number of Credit Hours (Total) / Number of Units (Total)	
2 Hours of theory per week / 2 units 2 Hours of practical work per week / 1 unit	
7. Course administrator's name (mention all, if more than one name)	
Dr. Waleed Mohammed Al-Hayani Dr. Ahmed Entesar Ghitheeth Dr. Mahasin Thabet Younis Dr. Mohammed Sabah Mahmoud	waleedalhayani@uomosul.edu.iq ahmed_entesar@uomosul.edu.iq mahasin_thabet@uomosul.edu.iq msmt_math@uomosul.edu.iq
8. Course objectives	
Course Objectives	Teaching the student the Maple program, which is an interactive computational system and a programming language at the same time, so that the student can use it as a programming language capable of solving many of his simple and complex scientific problems in his field of research, as Maple can perform numerical and symbolic solutions to mathematical functions and expressions.
9. Teaching and Learning Strategies	
Strategy	The student obtains sufficient basic information and instructions in the Maple program, so that the student learns and has the ability to create a simple program in Maple.
10. Course Structure	

Description Guide of Mathematics Department-3rd Class

Week	Hours	Required learning outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Learn the basics of programming	Introduction to Maple: How to download and run Maple.	Presence in the classroom and through practical work in the laboratory with application	According to the tasks assigned to the student, such as daily preparation, daily, oral, monthly and written exams.
2	4		Basic arithmetic operations, Basic mathematical functions.		
3	4		High School Algebra 1: Floating-point Arithmetic, Evaluate, Factoring a polynomial, Expanding an expression, Collecting like terms, Simplifying an expression.		
4	4		Simplifying radicals, Simplifying rational functions, convert an expression to a different form, Solve equations, Sort, Primes, gcd and lcm.		
5	4		High School Algebra 2: Sequences, Sets, Lists, Summation and producto, The “for” loop with examples.		
6	4		Calculus One Variable: Functions, Limits, Differentiation, Extrema, Taylor, and series expansions.		
7	4		Integration (Integration by Substitution, Integration by parts, Partial fractions).		
8	4		Calculus Multi Variables: Functions, Limits, Partial Derivatives, Implicit derivatives.		
9	4		Multiple integrals (Double integrals, Triple integrals).		
10	4		Graphics 2D: Two-Dimensional Plotting, Parametric Plots, Multiple plots.		
11	4		عطلة العيد		
12	4		Polar plots, Plotting implicit functions, Plotting Points, Title and text in a plot.		
13	4		Mid-Exam		
14	4		Graphics 3D: Three-Dimensional Plotting, Parametric Plots, Multiple plots, Space Curves, Contour Plots.		
15	4		Linear Algebra: Matrices and their types, Vectors and their types.		
11. Course Evaluation and Grade Distribution					

Midterm exam = 30 Degrees. Daily attendance and preparation = 5 Degrees. Practical exam = 15 Degrees. Final exam = 50 Degrees.	
12. Learning and Teaching Resources	
Required textbooks (methodology books if any)	Indeterminate
Main References (Sources)	• Bernard V. Liengme, "Maple", Morgan & Claypool Publishers, (2019). • Frank Garvan, "The Maple Book", Chapman & Hall/CRC, (2002).
Recommended supporting books and references (scientific journals, reports...)	• Martha L. Abell and James P. Braselton, "Maple by Example", 3rd Ed., Elsevier Academic Press, (2005).
Electronic References, Websites	Indeterminate
Curriculum or description update rate	10%

Lecturer Coordinator
Assist. Prof. Dr. Waleed Mohammed Al-Hayani

Head of the Department
Prof. Dr. Abdulghafor Jassim Salim

Description Guide of Mathematics Department-3rd Class

University: Mosul **College:** Computer Science and Mathematics s **Department:** Mathematics

1. Course Name:
Financial Mathematics
2. Course Code:
CMMS24F367
3. Semester / Year:
2nd Semester 2024-2025
4. Description Preparation Date:
18/09/2024
5. Available Attendance Forms:
Classroom attendance according to the announced weekly class schedule
6. Number of Credit Hours (Total) / Number of Units (Total)
4 weekly hours / 3 credit units
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Mohammed Omar Al-Amr Email: alamr@uomosul.edu.iq
8. Course Objectives

Course Objectives	1. Provide students with the fundamental concepts of simple interest, including its definitions, formulas, and methods of calculation, in addition to the amount's formula, equal payments, debt discounting. 2. Master the concept of periodic interest and its related mathematics, including calculating delay periods and interest, and applying the amount's formula. 3. Explain and simplify the concept of compound interest and its calculation methods, including the compound amount and present value of long-term payments. 4. Enable students to apply financial mathematical concepts and techniques in

	solving practical problems related to interest. 5. Provide students with the necessary computational and analytical skills to deal with financial problems in fields such as investment, and finance.

9. Teaching and Learning Strategies	
Interactive Lectures	Explanation of core concepts with real-world examples
Problem-Based Learning	Solving applied problems in interest calculations, loans, and investm
Practical Exercises	Application of mathematical formulas to real financial data
Continuous Assessment	Short quizzes, weekly assignments, written exam

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand simple interest fundamentals and apply its formula	Simple Interest: Definition and Formula	Interactive Lecture	Applied Exercises
2	4	Master simple interest calculation methods	Simple Interest Calculation Methods	Interactive Lecture	Assignments
3	4	Apply short-term equal payment concepts	Short-Term Equal Payments	Interactive Lecture	Applied Exercises
4	4	Understand debt repayment mechanisms	Debt Repayment	Interactive Lecture	Assignments
5	4	Master present value and discount calculations	Present Value and Discount	Interactive Lecture	Short Quiz
6	4	Apply present value concepts to multiple amounts	Present Value for Multiple Amounts	Interactive Lecture	Applied Exercises
7	4	Understand periodic interest fundamentals	Periodic Interest: Definition and Formula	Interactive Lecture	Applied Exercises
8	4	Evaluate acquired knowledge	Midterm Exam	Cumulative Assessment	Written Exam

9	4	Calculate late payment interest	Late Payment Interest	Interactive Lecture	Applied Exercises
10	4	Extract final loan installment	Final Loan Installment Calculation	Interactive Lecture	Assignments
11	4	Understand compound interest fundamentals	Compound Interest: Definition and Formula	Interactive Lecture	Applied Exercises
12	4	Apply compound interest formula	Compound Interest Formula	Interactive Lecture	Practical Evaluation
13	4	Calculate long-term payments	Long-Term Equal Payments	Interactive Lecture	Short Quiz
14	4	Master present value calculations	Present Value with Compound Interest	Interactive Lecture	Applied Exercises
15	4	Discuss practical applications	Applications Discussion	Practical Exercises	Participation Assessment

11.Course Evaluation

Midterm exam = 30 Degrees. Attendance and preparation = 5 Degrees.

Short exam = 5 Degrees. Final exam = 60 Degrees.

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	مقدمة في الرياضيات المالية، 2013، مناضل الجواري، دار اليازوري.
Recommended books and references (scientific journals, reports...)	• An Undergraduate Introduction to Financial Mathematics, 3rd Edition, 2012, J. Robert Buchanan. ○ An Elementary Introduction to Mathematical Finance, 3rd Edition, 2011, Sheldon Ross.
Electronic References, Websites	
Curriculum or description update rate	10%

Lecturer Coordinator
Assist. Prof. Dr. Mohammed Omar Al-Amr

Head of the Department
Prof. Dr. Abdulghafor Jassim Salim

Description Guide of Mathematics Department-3rd Class

University: Mosul **College:** Computer Science and Mathematics s **Department:** Mathematics

1.Course Name:	
Mathematical Statistics1	
2.Course Code:	
CM MS 25 F 302 SS	
3.Semester / Year:	
Spring semester/ 2024-2025	
4.Description Preparation Date:	
18/9/2024	
5. Available Attendance Forms:	
Attendance in the classroom according to the announced weekly class schedule	
6.Number of Credit Hours (Total) / Number of Units (Total)	
4 hours of theory per the week/ 3 units	
7.Course administrator's name (mention all, if more than one name)	
Name: Email: @uomosul.edu.iq Lecturer: Hanadi Dawood Saleem hanadidawood@uomosul.edu.iq	
8.Course Objectives	
Course Objectives	Learn the basic concepts of mathematical statistics. - Learn about distributions and their importance. - Learn about random sampling distributions. - Know the applications of distributions in various sciences. - Learn about the principle of ordered statistics and its distributions
9.Teaching and Learning Strategies	
Strategy	The main strategy adopted in delivering this course is to encourage student participation in exercises, while simultaneously improving and expanding their thinking skills. This will be achieved through interactive classroom and tutorials, and by examining challenging issues to motivate

	students.

10.Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	The student learns the Distribution function	Distributions of functions of random variables: Distribution function technique	Attendance in the classroom and through the educational tools available inside the classroom	According to the tasks assigned to the student, such as daily preparation, daily, oral, monthly and written exams, and reports.
2	4	The student learns the Single variable transformation	Distributions of functions of random variables: Single variable transformation technique		
3	4	The student learns the Multivariable transformation	Distributions of functions of random variables: Multivariable transformation technique		
4	4	The student learns about Moment generation function	Distributions of functions of random variables: Moment generation function technique		
5	4	The student learns the mean	Sampling distributions of the mean		
6	4	The student learns populations	Sampling distributions of the mean: Finite populations		
7	4	The student learns Chi-square distribution	Sampling distributions: Chi-square distribution		
8	4	The student learns t-distribution	Sampling distributions: t-distribution		
9	4	The student learns F-distribution	Sampling distributions: F-distribution		
10	4	The student learns Ordered statistics	Sampling distributions: Ordered statistics		
11	4	The student learns about the Central purpose theorem	The purpose of distributions: Central purpose theorem		

12	4	The student learns the concept of Beta distribution	Beta distribution		
13	4	The student learns the concept of simulation	Introduction to simulation		
14	4	The student learns about the Distribution function relationship with simulation	Distribution function relationship with simulation		
15	4	The student learns about the **Jointly** Ordered statistics	**Jointly** Ordered statistics		

11.Course Evaluation	
Assignment and Daily Exams 10% Mid Exam 30% Final Exam 60% Total 100%	
12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	John E. Freund's Mathematical Statistics with Applicatio Irwin Miller Marylees Miller,2014 1) Introduction to Mathematical Statistics, Robert V Hogg,2019 2) Mathematical Statistics with Applications, D. Wackerly,2008
Main references (sources)	Probability and statistical inference, Robert V. Hogg,202
Recommended books and references (scientific journals, reports…)	Not specified, Only within the specialization of different equations theory and according to the approved course titles
Electronic References, Websites	Not specified, Only within the specialization of differen equations theory and according to the approved cou titles

Description Guide of Mathematics Department-3rd Class

University: Mosul **College:** Computer Science and Mathematics s **Department:** Mathematics

Course Name:	
Mathematical Statistics 2	
Course Code:	
CM MS 25 F 302 SS	
Semester / Year:	
Spring semester/ 2024-2025	
Description Preparation Date:	
18/9/2024	
Available Attendance Forms:	
Attendance in the classroom according to the announced weekly class schedule	
Number of Credit Hours (Total) / Number of Units (Total)	
4 hours of theory per the week/ 3 units	
Course administrator's name (mention all, if more than one name)	
Name: Email: @uomosul.edu.iq Lecturer: Hanadi Dawood Saleem hanadidawood@uomosul.edu.iq	
Course Objectives	
Course Objectives	• - Learn the basic concepts of mathematical statistics. • - Learn about estimation methods • - Study point estimation and its types • - Learn about the principle of linear regression and analysis variance
Teaching and Learning Strategies	
Strategy	The main strategy adopted in delivering this course is to encourage student participation in exercises, while simultaneously improving and expanding their thinking skills. This will be achieved through interactive classroom and

	tutorials, and by examining challenging issues to motivate students.

Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	The student learns methods of estimation	Point estimation: Unbiasedness	Attendance in the classroom and through the educational tools available inside the classroom	According to the tasks assigned to the student, such as daily preparation, daily, oral, monthly and written exams, and reports.
2	4	The student learns the smallest variance	Point estimation: Efficiency		
3	4	The student learns the convergence of probability	Point estimation: Consistency		
4	4	The student learns about sufficidncy	Point estimation: Adequacy		
5	4	The student learns the types of estimation	Methods of finding an estimator: Method of moments		
6	4	The student learns estimation mathematically	Methods of finding an estimator: Maximum likelihood method		
7	4	The student learns Bayes estimation for samples	Methods of finding an estimator: Bayes estimation		
8	4	The student learns estimates parameter in the interval	Interval estimation: Confidence intervals for means		
9	4	The student learns F-distribution	Interval estimation: Difference between two means		
10	4	The student learns estimates parameter in the interval	Interval estimation: Confidence intervals for variances		
11	4	The student learns estimates parameter in the interval	Interval estimation: Ratio between two variances		

12	4	The student learns the concept of Regression	Regression		
13	4	The student learns the concept of Least squares method	Least squares method		
14	4	The student learns the concept of Correlation	Correlation		
15	4	The student learns about the Regression Applications	Regression Applications		

Course Evaluation	
Assignment and Daily Exams 10% Mid Exam 30% Final Exam 60% Total 100%	
Learning and Teaching Resources	
Required textbooks (curricular books, if any)	John E. Freund's Mathematical Statistics with Applications Irwin Miller Marylees Miller,2014 1) Introduction to Mathematical Statistics, Robe V. Hogg,2019 2) Mathematical Statistics with Applications, D. Wackerly,2008
Main references (sources)	Probability and statistical inference, Robert Hogg,2020
Recommended books and references (scientific journals, reports…)	Not specified, Only within the specialization of differential equations theory and according to the approved course titles
Electronic References, Websites	Not specified, Only within the specialization differential equations theory and according to t approved course titles

Description Guide of Mathematics Department-3rd Class

University: Mosul **College:** Computer Science and Mathematics s **Department:** Mathematics

Course Name:	
Theory of Differential Equations	
Course Code:	
CM MS 25 F 336	
Semester / Year:	
Spring semester/ 2024-2025	
Description Preparation Date:	
18/9/2024	
Available Attendance Forms:	
Attendance in the classroom according to the announced weekly class schedule	
Number of Credit Hours (Total) / Number of Units (Total)	
4 hours of theory per the week/ 3 units	
Course administrator's name (mention all, if more than one name)	
Name: D. Thair Younis Tahnoon Email: Thairyounis59@uomosul.edu.iq Lecturer: Merna Adel Aziz merna_samarchi@uomosul.edu.iq	
Course Objectives	
Course Objectives	• Learning the theoretical concepts of differential equations • Studying the existence and uniqueness theorems for solving differential equations • Understanding the linear independence theorems for solving differential equations • Learning how to solve linear homogeneous differential systems using eigenvalues and eigenvectors • Learning the concept of stability of solutions to differential systems, types of critical points of systems, and the phase plane and the trajectories of these points.
Teaching and Learning Strategies	
Strategy	The main strategy adopted in delivering this course is to

	encourage student participation in exercises, while simultaneously improving and expanding their thinking skills. This will be achieved through interactive classroom and tutorials, and by examining challenging issues to motivate students.

Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	The student learns the theories of the existence and uniqueness of solutions to differential equations	first order D.Es., the existence of solution theorem (Cauchy – peano th.1)	Attendance in the classroom and through the educational tools available inside the classroom	According to the tasks assigned to the student, such as daily preparation, daily, oral, monthly and written exams, and reports.
2	4	The student learns the theories of the existence and uniqueness of solutions to differential equations	Lipschitz condition, the existence and uniqness solutions theorem (Cauchy – peano th.2)		
3	4	The student learns the approximate methods for finding the solutions for differential equations	fixed point theorem, successive approximations method (Picard method) with examples.		
4	4	The student learns about nth order differential systems and the independence of their solutions.	Systems of n differential equations of first order, linearly independent functions		
5	4	The student learns the theorems of independence and linear dependence of solutions.	Linear independence theorems		

Description Guide of Mathematics Department-3rd Class

6	4	The student learns how to solve equations of order n with constant coefficients using the method of variation of parameters	Linear differential equation of n th order with constant Coefficient, Variation of parameters to find the solution of higher order D.Es., theorems		
7	4	The student learns how to solve linear homogeneous differential systems.	Linear differential systems, linear homogenous differential systems, Eigen values, Eigen vectors		
8	4		Mid term exam		
9	4	The student learns how to solve linear homogeneous differential systems.	solution for homogenous D.S. distinct Eigen values,		
10	4	The student learns how to solve linear homogeneous differential systems.	solution for homogenous D.S. distinct Eigen values, repeated Eigen values		
11	4	The student learns about the Legander equation and the Bessel equation and how to solve them.	Legendre equation, Bessel equation, method of solution		
12	4	The student learns the concept of oscillation theory and its theorems.	Oscillation theory with theorems		
13	4	The student learns the concept of stability and critical points of differential systems.	The concept of stability, stable solution, asymptotically stable solution, critical points for systems		
14	4	The student learns about the stability of linear differential systems.	Stability of the critical points for linear systems, roots of characteristic eq. are real and distinct, complex numbers		

15	4	The student learns about the stability of nonlinear systems.	Stability of the critical points for nonlinear systems, linearization method		

Course Evaluation	
Assignment and Daily Exams 10% Mid Exam 30% Final Exam 60% Total 100%	
Learning and Teaching Resources	
Required textbooks (curricular books, if any)	نظرية المعادلات التفاضلية، د. احمد زين العابدين محمد، جامعة الموصل، 1992
Main references (sources)	1. Elementary differential equations – Earl D. Rainville and Bedient E , 1990 2. Ordinary Differential Equations, Gabriel Nagy, 2021
Recommended books and references (scientific journals, reports…)	Not specified, Only within the specialization of differential equations theory and according to the approved course titles
Electronic References, Websites	Not specified, Only within the specialization differential equations theory and according to t approved course titles

Description Guide of Mathematics Department-3rd Class

University: Mosul College: Computer Science and Mathematics

Department or Branch: Mathematics

1. Course Name:
Numerical Analysis (2) / 3rd Class
2. Course Code:
MS 306
3. Semester / Year:
1st Semester / 2024 - 2025
4. Description Preparation Date:
18/9/2024
5. Available Attendance Forms:
Classroom according to the announced weekly lesson schedule
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours of theory and 2 hours of practical per week / 3 units
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Ekhlass Saadallah Ahmed/ Professor Email:drekhlass-alrawi@uomosul.edu.iq Name: Dr. Abdulghafor M. Al-Rozbayani/ Professor Email: abdulghafor_rozbayani@uomosul.edu.iq Name: Dr. Mohammed Omar Al-Amr/ Asst. Prof. Email: alamr@uomosul.edu.iq Name: Dr. Raghad Abdul azeez Mustafa Email: raghad.math@uomosul.edu.iq
8. Course Objectives

Course Objectives	• The student's teaching of Numerical Analysis 2 aims at his knowledge of the numerical methods for solving a problem that may be difficult to find an analytical solution. • Study numerical methods to find the numerical integral with their application in solving examples.

	• Study the error analysis of the approximate solutions of these numerical methods to make it easier for us to know which numerical methods are better in finding the value of numerical integration. • To understand the methods of solving ordinary differential equations numerically with different examples. • To understand the least square approximation ,linear, nonlinear approximation for x and for constants. • Writing algorithms for those numerical methods and programming them using MatLab language practically.

9. Teaching and Learning Strategies

Strategy	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

10. Course Structure

Wee	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2+2	Learn how to derive formulas for numerical integration methods, solve differential equations, and integrate, while studying errors and writing algorithms for each and program it in MATLAB.	Interpolation polynomial approximation (Lagrange polynomial)	My presence in the classroom and through the educational tools available inside the classroom	According to the tasks assigned to the student, such as daily preparation, daily, oral, monthly and written exams, and reports.
2	2+2		Newton formulas of finite differences and solving examples		
3	2+2		Numerical integration –derivative of Trapezoidal rule with solving an example and write algorithm		
4	2+2		Derivative of one third Simpson's rule with a study of error analysis and solving an example and write algorithm		
5	2+2		Derivative of 3/8 Simpson's rule and solving an example and write algorithm		
6	2+2		Midpoint Method with solving an example with write a duty-solving example		
7	2+2		Romberg method and solving an example and write algorithm		
8	2+2		Gauss-Legendre with solving different examples		
9	2+2		Closed Newton-Cotes methods with a daily exam		

10	2+2		Mid - course exam		
11	2+2		Derivative of explicit Euler's and implicit Euler's method with solving an example and write algorithm		
12	2+2		Derivative of implicit Euler's method with solving an example and write algorithm		
13	2+2		Taylor series method and solving examples and write algorithm		
14	2+2		Fourth order Runge-Kutta method and solving examples and write algorithm		
15	2+2		Preparatory week before the final Exam		

11. Course Evaluation

Daily attendance and preparation: 10 points

Practical: 15 points , Monthly exams: 25 points , Final exam: 50 points

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Ali Muhammad Sadiq Saifi and Ibtisam Kamal Al-Din, Principles of Numerical Analysis, University of Baghdad, 1986.
Main references (sources)	Numerical Methods Using MatLab, fourth edition, John H.M. and Kurtis D.F. :2004
Recommended books and references (scientific journals, reports, ...)	Not specified only includes numerical analysis2 and identifying specific addresses
Electronic References, Websites	Not specified only includes numerical analysis2 and identifying specific addresses
Curriculum or description update rate	10 %

Name and Signature of the Course Instructor

Prof. Dr. Ekhlass Saadallah Ahmed
Prof. Dr. Abdulghafor M. Al-Rozbayani

Name and Signature of the Head of Department or Branch

Prof. Dr. Abdulghafoor Jasim Salim

Description Guide of Mathematics Department-3rd Class

1. Course Name:
Operations Research (Third Year)
2. Course Code:
CM MS 24 F 338
3. Semester / Year:
Autumn / 2024-2025
4. Description Preparation Date:
18/9/2024
5. Available Attendance Forms:
Attendance in the classroom according to the announced weekly schedule
6. Number of Credit Hours (Total) / Number of Units (Total)
Four theoretical hours per week / 3 credit hours
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Ghada Moayid Al-Naemi Email: drghadaalnaemi@uomosul.edu.iq
8. Course Objectives

Course Objectives	• Determining the minimum or maximum value of a specific function is called the objective function. • The objective of Operations Research is to provide a scientific basis to the decision maker for solving the problems involving the interaction of various components of an organization by employing a team of scientists from various disciplines, all working together for finding a solution which is in the best interest of the organisaton as a whole. The best solution thus obtained is known as optimal decision. • The Operations Research analyst or team of experts first have to examine the situation and clearly define what exactly happening there and identify the variables and constraints. Similarly identify what is the objective and put them all in the form of statement. The statement must include a) a precise description goals or objectives of the study, b) identification of controllable and uncontrollable variables and c) restrictions of the problem. The team should consult the personals at the spot and collect information, if something is beyond their reach, they have to consult duty engineers available and understand the facts and formulate the problem. • The objective of studying Operations Research is to apply scientific and analytical methods to support better and more

	efficient decision-making, especially in complex environments involving limited resources, multiple variables, and various constraints.

9. Teaching and Learning Strategies

Strategy	This course introduces students to the fundamentals of Operations Research (OR), emphasizing its theoretical foundations and practical applications in decision-making and optimization. The course covers the formulation of mathematical models for real-world problems, particularly linear programming, and explores solution techniques including the Simplex method, Duality Theory, and Sensitivity Analysis. Practical applications such as the transportation problem are also discussed. Students engage in exploratory tasks to foster critical thinking and deepen their understanding of OR principles.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	**Understanding the fundamental concepts** and principles of Operations Research and its role in decision-making. Formulating real-world problems into mathematical models. **Applying optimization techniques** such as linear programming. The basic and important methods that help in making correct decisions, which are linear programming problems, and some methods for solving linear programming problems and applying them to the	Introduction, Theoretical models for linear programming problems. Numerical procedures for soling linear programming problems, Graphical method. Basic and Basic feasible solution. Prime numbers and theorems. Simplex method (slack variables) Simplex method (artificial variables) Simplex multipliers method. Introduction, Dual method and Dual theorem.	My participation in the classroom and the utilization of electronic platforms	In accordance with the responsibilities assigned to the student, including daily preparation, oral, monthly, and written exams, as well as reports.
2	4				
3	4				
4	4				
5	4				
6	4				
7	4				

8	4	transportation problem.	Mid Examination.		
9	4		The relationship between the two models solution and what results from them, The inverse basis method.		
10	4		Sensitivity analysis method, Changes in the right side of the constraints, Changes in objective function coefficients.		
11	4		Introduction, Find a primary solution , West corner method, least cost method.		
12	4		Vogle's method, Unbalanced transport problems, Find the optimal solution to the transport problem.		
13	4		Fractional Linear Programming.		
14	4		Methods for solving linear fractional programming Problems.		
15	4		Some methods to solve Methods for solving linear fractional programming problems		

11. Course Evaluation

Daily attendance and preparation are worth five points. Daily homework and exam = 5 marks. Monthly exams = 30 marks. Final exam = 60 marks.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports…)	Linear and Nonlinear Programming, 2008 Engineering Optimization Theory and Practice • Introduction to operation research • Operation research.
Electronic References, Websites	There are many sources available on

1. Course Name:
Number theory (Third Year)
2. Course Code:
CMMS 25 F3 49
3. Semester / Year:
Spring/ 2024-2025
4. Description Preparation Date:
18/9/2024
5. Available Attendance Forms:
Attendance in the classroom according to the announced weekly schedule
6. Number of Credit Hours (Total) / Number of Units (Total)
Four theoretical hours per week / 3 credit hours
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Ghada Moayid Al-Naemi Assist. Prof. Susan H. Mohammad Email: drghadaalnaemi@uomosul.edu.iq
8. Course Objectives

Course Objectives	• The *Number Theory* course aims to introduce students to the concepts of: divisibility, linear congruence, and the law of quadratic reciprocity. • It seeks to familiarize students with the theorems related to this subject, including: Fermat's theorem, the theorem of power residues, exponential functions, and Diophantine equations. • Given the importance of divisibility and the greatest common divisor (GCD) and how to find them, as well as prime numbers, their properties, the fundamental theorem of arithmetic, and its applications, the course also covers what divisibility means and how it is calculated. • Congruence offer an alternative perspective on divisibility by providing an effective tool for facilitating proofs and another means of studying number theory, including properties of congruence, their applications, and methods of solving them. • Complete and reduced residues, linear congruence, and the Chinese Remainder Theorem, along with Euler's and Fermat's theorems and the converse of Fermat's theorem are also discussed.

	• Algebraic congruence: what it means and how it is calculated, numerical functions: their meaning and how to compute them. • Familiarization with residue systems.

9. Teaching and Learning Strategies

Strategy	The course aims to equip students with a thorough understanding of the properties and philosophy of Number Theory. Students will recognize that arithmetic and number theory represent the science that studies the properties of numbers and their various relationships. The teaching approach focuses on core concepts such as divisibility, prime numbers, and congruences, rather than merely memorizing formulas. Each concept will be connected to practical or historical examples to enhance comprehension Simple, progressively challenging examples will be provided to guide students in writing mathematical proofs, especially using mathematical induction and congruence techniques Students will be assigned open-ended problems that require critical thinking and the integration of multiple ideas. Additionally, students will be given hypotheses and exploratory problems to investigate independently, such as observing patterns in modular residues without being provided with the underlying rules directly.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Providing the student with the ability to prove the theorems associated with the prescribed topics, solve mathematical problems related to each topic, provide mathematical examples of all the theorems in the course, and review the history of this course and its affiliation with other mathematics topics.	An introduction and historical overview of number theory, natural and integer numbers, integer characteristics, and basic integer theorems.	My participation in the classroom and the utilization of electronic platforms	In accordance with the responsibilities assigned to the student, including daily preparation, oral, monthly, and written exams, as well as reports.
2	4		The mathematical induction principle, divisibility, basic divisibility properties, the divisibility algorithm theorem, and numerical examples.		
3	4		Greatest common divisor, basic theorems for greatest common divisor, Euclid's algorithm theorem.		
4	4		Prime numbers and theorems.		

5	4		congruencies and their basic theorems.		
6	4		Divisibility of prime numbers and its fundamental theorems.		
7	4		Linear identities, linear identity systems with a variable.		
8	4		Mid Exam		
9	4		Chinese Remainder Theorem.		
10	4		Algebraic matching.		
11	4		Eid al-Fitr holiday.		
12	4		Euler and Fermat's theorems and the inverse of Fermat's theorem.		
13	4		Sediment systems.		
14	4		Reduced sediment system.		
15	4		Numerical functions.		

11. Course Evaluation

Daily attendance and preparation are worth five points. Daily homework and exam = 5 marks.Monthly exams = 30 marks. Final exam = 60 marks.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	We do not have a prescribed literature.
Recommended books and references (scientific journals, reports…)	نظرية الاعداد، (د.نادر ضبيط)، نظرية الاعداد، (معروف عبد الرحمن)، 2013.
Electronic References, Websites	

اسم وتوقيع صاحب المقرر
أ.د. غادة مؤيد النعيمي

اسم وتوقيع رئيس القسم او الفرع
أ.د. عبد الغفور جاسم سالم

University: Mosul **College:** Computer Science and Mathematics

Department or Branch: Mathematics

1. Course Name / Class
Mathematical Analysis (1) / 3rd Class
2. Course Code:
CM MS 25 F 331
3. Semester / Year:
1st Semester / 2024 – 2025
4. Description Preparation Date:
18 / 9 / 2024
5. Available Attendance Forms:
Classroom according to the announced weekly lesson schedule
6. Number of Credit Hours (Total) / Number of Units (Total)
4 hours per week / 3 units
7. Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Dr. Barah Mahmood Sulaiman Email: barah_mahmood82@uomosul.edu.iq Name: Dr. Salma Muslih Faris Email: salma_muslih67@uomosul.edu.iq

8. Course Objectives

Objectives	– This module aims mathematical analysis aims to introduce the student to the basic concepts and techniques of real analysis. – Exploration of the properties of mathematical numbers: mathematical analysis investigates the properties of real numbers, such as their order, completeness, and algebraic and topological properties. It delves into the structure of the real number system and its various subsets. – Rigorous understanding of calculus: mathematical analysis provides a rigorous foundation for calculus. It aims to give a precise definition of limits, continuity, which are fundamental concepts in calculus. – Study of mathematical functions: mathematical analysis focuses on the behavior and properties of functions defined on the real numbers. – Development of mathematical reasoning and proof-writing skills: mathematical analysis is a discipline that emphasizes rigorous proofs and logical reasoning. It aims to develop students' ability to construct and present mathematical arguments in a precise and coherent manner.

9. Teaching and Learning Strategies

Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or Subject Name	Learning Method	Evaluation Method
1	4	Ability to construct and present rigorous mathematical proofs; Understanding of the properties of real numbers: Students will learn about the order and completeness properties of real numbers, the algebraic structure of real numbers, and the topological properties of	Definition of mathematical analysis with its most important applications	The course will be delivered through in-person lectures held in the Mathematics Department classroom, supplemented by online activities, resources, and assignments provided via the Google	Students will be evaluated based on their performance in assigned tasks, including daily preparation, participation in daily and oral assessments, monthly and written examinations,
2	4		The real numbers, the relationship between the field of rational numbers and the field of real numbers		
3	4		Archimedes property, the set of real numbers, the concept of order, upper and lower bounds		
4	4		The concept of completeness, the complete ordered field, the density of relative numbers, the density of irrational numbers		
5	4	Understanding of fundamental concepts, such as sequences, series, limits, convergence, and continuity;	Real number sequences, convergent sequences, bounded sequences, monotonic sequences, alternating sequences		
6	4		Real number series, types of sequences, convergence of		

			sequences		
7	4		Mid-term Exam + Tests for convergence of infinite series		
8	4	Understand key concepts in metric spaces and topology; analyze convergence and series multiplication; apply compactness and limits properties; study continuity, continuous maps, and uniform continuity; and apply the Mean	Metric spaces, topological concepts, convergence in metric spaces		
9	4		Absolute and conditional convergence, multiplication of series		
10	4		Compactness, limits of functions and some important theorems in limits		
11	4		Continuity, Continuous maps, Real Continuous maps Space		
12	4		Real maps defined on compact spaces, uniform continuity		
13	4		Mean value property (examples with top applications)		
14	4	Understand and analyze sequences and series of functions with pointwise and uniform convergence	Sequences and series of functions, pointwise convergence and absolute convergence		
15	4		Infinite series of functions, power series		

11. Course Evaluation

Daily attendance and preparation: 2.5 points , Homework: 2.5 points
Daily exams: 5 points , Monthly exams: 30 points , Final exam: 60 points

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Adel Ghassan Naoum, Introduction to Mathematical Analysis, Mosul University Press, 1986
Main references (sources)	Rudin, W., Principles of Mathematical Analysis, 3rd ed., 1976, McGraw-Hill, Inc., New York, USA.
Recommended books and references (scientific journals, reports, ...)	Fusco, N., Marcellini, P., & Sbordone, C., "Mathematical Analysis: Functions of Several Real Variables and Applications", Switzerland: Springer International Publishing, 2023.
Electronic References, Websites	https://en.wikipedia.org/wiki/Mathematical_analysis
Curriculum or description update rate	10 %

Name and Signature of the Course Instructor

Assist. Prof. Dr. Barah M. Sulaiman
Dr. Salma M. Faris

Name and Signature of the Head of Department or Branch

Prof. Dr. Abdulghafoor Jasim Salim

University: Mosul **College:** Computer Science and Mathematics

Department or Branch: Mathematics

1. Course Name / Class	
Mathematical Analysis (2) / 3rd Class	
2. Course Code:	
CM MS 25 F 332	
3. Semester / Year:	
2nd Semester / 2024 - 2025	
4. Description Preparation Date:	
26 / 04 / 2025	
5. Available Attendance Forms:	
Classroom according to the announced weekly lesson schedule	
6. Number of Credit Hours (Total) / Number of Units (Total)	
4 hours per week / 3 units	
7. Course administrator's name (mention all, if more than one name)	
Name: Dr. Salma Muslih Faris Email: salma_muslih67@uomosul.edu.iq Name: Assist. Prof. Dr. Barah Mahmood Sulaiman Email: barah_mahmood82@uomosul.edu.iq	
8. Course Objectives	
Course Objectives	– Mathematical analysis aims to introduce the student to the basic concepts and techniques of real analysis. – Understanding Differentiation helps students develop an understanding of how a function's output changes in response to small changes in its input. – Analyzing Extrema: Differentiation enables the identification and analysis of critical points, which include local maxima and minima of a function. – Analyzing Graphs and Behavior: Differentiation provides valuable insights into the behavior of a function's graph. – Approximating Areas: Riemann integration allows us to approximate the area under a curve by dividing the region into smaller rectangles and summing their individual areas. The aim is to obtain a close approximation to the exact area. – Understanding Measurable Sets: Measure theory aims to study measurable sets and their properties. Measurable sets are subsets of a measure space. The aim is to define and characterize measurable sets and explore their properties.

	– Generalizing Integration: The Lebesgue integral aims to provide a more general and flexible framework for integration compared to the Riemann integral. – Overcoming Riemann's Limitations: The Lebesgue integral aims to overcome the limitations of the Riemann integral, such as the inability to integrate functions with unbounded or discontinuous points.

9. Teaching and Learning Strategies

Strategy	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or Subject Name	Learning Method	Evaluation Method
1	4	Understand differentiation, derivatives, and properties of differentiable functions, Apply Fermat's principle, Rolle's theorem, and the mean value theorem, Use	The differentiation, the derivative, the space of differentiable functions	The course will be delivered through in-person lectures held in the Mathematics Department classroom, supplemented by online activities, resources, and assignments provided via the Google Classroom platform.	Students will be evaluated based on their performance in assigned tasks, including daily preparation, participation in daily and oral assessments, monthly and written examinations, and the submission of reports.
2	4		Fermat's principle, Rolle's theorem, mean value theorem		
3	4		L'Hôpital's law, Taylor series, Taylor's theorem		
4	4	Understand and apply Riemann integration. Analyze continuous and monotonic functions in relation to Riemann integration. Recognize properties of the Riemann integral. Identify Riemann integrable functions.	Riemann integration, definition, examples		
5	4		Relation between continuous, monotonic functions and Riemann integration		
6	4		Riemann integral as a positive non-variance monotonic linear transformation		
7	4		Space of Riemann integrable functions		
8	4	Understand measure theory and measurable functions. Calculate measures of bounded and unbounded sets. Recognize non-measurable and	Mid-term Exam + Measure Theory, lengths of bounded open intervals,		
9	4		lengths of bounded open sets, Measure of unbounded sets, measurable functions		
10	4		Examples of an unmeasurable set		

11	4		Inner and outer measure of bounded sets, measurable bounded sets.		
12	4		Negligible sets, some important characteristics and theories about negligible sets		
13	4	Define Lebesgue integration with examples. Understand Lebesgue's theorem on Riemann integration and its limitations. Explore key properties of Lebesgue integration. Understand the space of Lebesgue integrable functions.	Define Lebesgue integration with some examples,		
14	4		Lebesgue's theorem of Riemann integration, some weaknesses points of Riemann integration.		
15	4		Some properties of Lebesgue integration, the space of Lebesgue integrable functions		

11. Course Evaluation

Daily attendance and preparation: 2.5 points , Homework: 2.5 points
Daily exams: 5 points , Monthly exams: 30 points , Final exam: 60 points

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Adel Ghassan Naoum, Introduction to Mathematical Analysis, Mosul University Press, 1986
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Electronic References, Websites	https://en.wikipedia.org/wiki/Mathematical_analysis
Curriculum or description update rate	10 %

Name and Signature of the Course Instructor

Assist. Prof. Dr. Barah M. Sulaiman
Dr. Salma M. Faris

Name and Signature of the Head of Department or Branch

Prof. Dr. Abdulghafoor Jasim Salim