Ministry of Higher Education and Scientific Research
Scientific Supervision and Scientific Evaluation Apparatus
Directorate of Quality Assurance and Academic Accreditation
Accreditation Department

Department of Mathematics / College of Science/ Mustansiriyah University

2024-2025

Academic Program and Course Description Guide

2025

Description of The Academic Program

University Name: Mustansiriyah University

College/Institute: College of Science

Scientific Department: Department of Mathematics

Name of Academic or Professional Program: University Performance

Name of Final Degree: Bachelor of Mathematics

Study System: Semester

Description Preparation Date: 16/2/2025

File Filling Date: 16/2/2025

Signature:
Name of Head of Department:
Assist. Prof. Dr. Bassam Jabbar Jasim
Date: 20/2/2025

Signature:
Name of Scientific Assistant:
Assist. Prof. Dr. Ahmed Mahdi Rheima
Date: 20/2/2025

File checked by
Quality Assurance and University Performance Division
Name of Director of Quality Assurance and University Performance Division:
Assist. Prof. Dr. Ali Jasim Mohammed
Date: 20/2/2025
Signature:

Signature:
Approval of the Dean: Prof. Dr. Methaq Talib Gaata
Date: 20/2/2025

Introduction

The educational program is a well-planned set of courses that include procedures and experiences arranged in the form of an academic syllabus. Its main goal is to improve and build graduates' skills so they are ready for the job market. The program is reviewed and evaluated every year through internal or external audit procedures and programs like the External Examiner Program.

The academic program description is a short summary of the main features of the program and its courses. It shows what skills students are working to develop based on the program's goals. This description is very important because it is the main part of getting the program accredited, and it is written by the teaching staff together under the supervision of scientific committees in the scientific departments.

This guide, in its second version, includes a description of the academic program after updating the subjects and paragraphs of the previous guide in light of the updates and developments of the educational system in Iraq, which included the description of the academic program in its traditional form (annual, quarterly), as well as the adoption of the academic program description circulated according to the letter of the Department of Studies T 3/2906 on 3/5/2023 regarding the programs that adopt the Bologna Process as the basis for their work.

In this regard, we can only emphasize the importance of writing an academic programs and course description to ensure the proper functioning of the educational process.

Concepts and terminology

Academic Program Description: The academic program description provides a brief summary of its vision, mission and objectives, including an accurate description of the targeted learning outcomes according to specific learning strategies.

Course Description: Provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the students to achieve, proving whether they have made the most of the available learning opportunities. It is derived from the program description.

Program Vision: An ambitious picture for the future of the academic program to be sophisticated, inspiring, stimulating, realistic and applicable.

Program Mission: Briefly outlines the objectives and activities necessary to achieve them and defines the program's development paths and directions.

Program Objectives: They are statements that describe what the academic program intends to achieve within a specific period of time and are measurable and observable.

Curriculum Structure: All courses / subjects included in the academic program according to the approved learning system (quarterly, annual, Bologna Process) whether it is a requirement (ministry, university, college and scientific department) with the number of credit hours.

Learning Outcomes: A compatible set of knowledge, skills and values acquired by students after the successful completion of the academic program and must determine the learning outcomes of each course in a way that achieves the objectives of the program.

Teaching and learning strategies: They are the strategies used by the faculty members to develop students' teaching and learning, and they are plans that are followed to reach the learning goals. They describe all classroom and extra-curricular activities to achieve the learning outcomes of the program.

Academic Program Description Form

1. **Program Vision**
The department of Mathematics at the College of Science - Mustansiriyah University seeks to prepare and develop scientific staff specialized in mathematical sciences, so that the department becomes a pioneering and distinguished academic system for preparing students for the labor market and developing their abilities to interact and communicate with others by highlighting the importance and beauty of mathematics.

2. **Program Mission**
The main objective of the department of Mathematics' mission is to continually work for achieving the department's goals by achieving the following primary tasks: 1. Providing an excellent learning environment for students, educating them with knowledge, preparing them for responsibilities in society, searching for and encouraging the distinguished energies of students. 2. Activating scientific research by involving faculty staff and students in preparing scientific discussions, conferences, mathematics research, and disseminating knowledge. 3. Effective contribution with other sciences in developing the local community by using mathematical applications to address the problems facing this community.

Active participation in international, regional and local conferences and development courses inside and outside Iraq for raise the efficiency of staff and keep pace with development.

3. Program Objectives

1. Develop the student's ability to think abstractly based on scientific foundations (analysis and inference) and expand his horizons and encourage to think objectively to solve any problem facing in scientific and social life, as mathematics is always interested in discussing all possible possibilities to solve various problems.
2. Stimulating the student's interest in the importance of mathematics and its applications in various fields of scientific life by highlighting its creative aspects and its close relationship with other sciences.

Providing the student with a sober scientific base of information that enables to continue his postgraduate studies and keep pace with modern trends in mathematics.

4. Program Accreditation

Does the program have program accreditation? No

5. Other external influences

1- Training courses, workshops, continuing education seminars and women empowerment.
2- Scientific visits.

6. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	39	160		Core course
College Requirements	39	160		
Department Requirements	39	160		
Summer Training	Summer training required			
Other	/			

* This can include notes whether the course is basic or optional.

7. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
			theoretical	practical
Third stage/ Pure mathematics (First semester) 2024-2025	54453114	Mathematical Analysis 1	4	
	54453144	Numerical Analysis 1	3	2
	54453183	Algebra 1	4	
	54453163	Data Theory	4	
	54453123	Operations Research 1	4	
Third stage/ Pure mathematics (Second semester) 2024-2025	54453214	Mathematical Analysis 2	5	
	54453244	Numerical Analysis 2	3	2
	54453283	Algebra 2	4	
	54453263	Numerical Theory	4	
	54453253	Mathematical Statistic	4	
	-	Professional ethics	2	
	-	English	2	
Stage Three/ Applied Mathematics (First Semester) 2024-2025	54453114	Mathematical Analysis 1	4	
	54453144	Numerical Analysis 1	3	2
	54453194	Partial Differential Equations	5	
	54453183	Algebra 1	4	
	54453173	Applied statistics	4	
Stage Three/ Applied Mathematics (Second Semester) 2024-2025	54453214	Mathematical Analysis 2	5	
	54453244	Numerical Analysis 2	3	2
	54453283	Algebra 2	4	
	54453223	Operations Research	4	
	-	Differential Geometry	4	
	-	Professional ethics	2	
	-	English	2	
Stage Three/ Statistics and Operations Research (First Semester) 2024-2025	54453153	Mathematical Statistic	4	
	54453114	Mathematical Analysis 1	5	
	54453144	Numerical Analysis 1	3	2
	54453183	Algebra 1	4	
	54453123	Operations Research 1	4	
Stage Three/ Statistics and Operations Research (Second Semester) 2024-2025	54453214	Mathematical Analysis 2	5	
	54453244	Numerical Analysis 2	3	2
	54453283	Algebra 2	4	
	54454213	Multivariate Analysis	4	
	54453223	Operations Research 2	4	
	-	Professional ethics	2	
	-	English	2	
Stage Four / Pure Mathematics	54454114	Complex Analysis 1	5	
	54454133	Topology 1	4	
	54454153	Module Theory 1	4	
	54453124	Theory of Differential Equation 1	5	

(First Semester) 2024-2025	54454173	Measure Theory	4	
	-	Professional ethics	2	
	-	English	2	
Stage Four / Pure Mathematics (Second Semester) 2024-2025	54454214	Complex Analysis 2	5	
	54454233	Topology 2	4	
	54454253	Module Theory 2	4	
	54453224	Theory of Differential Equation 2	5	
	54454243	Functional Analysis 2	4	
	54454262	Project	2	
Stage Four / Applied Mathematics (First Semester) 2024-2025	54454114	Complex Analysis 1	5	
	54454133	Topology 1	4	
	54454143	Functional Analysis 1	4	
	54453124	Theory of Differential Equation 1	5	
	54454194	Calculus Variations	4	
	-	Professional ethics	2	
	-	English	2	
Stage Four / Applied Mathematics (Second Semester) 2024-2025	54454214	Complex Analysis 2	5	
	54454233	Topology 2	4	
	54453224	Theory of Differential Equation 2	5	
	54454223	Optimal Control Theory	4	
	-	Fractional Geometry	4	
	54454262	Project	2	
Stage Four / Statistics and Operations Research (First Semester) 2024-2025	54453164	Regression Analysis	4	
	-	Combinatorial optimization problems	4	
	54454114	Complex Analysis 1	5	
	54454133	Topology 1	4	
	54453124	Theory of Differential Equation 1	5	
	-	Professional ethics	2	
	-	English	2	
Stage Four / Statistics and Operations Research (Second Semester) 2024-2025	54454273	Stochastic Process	5	
	54453293	Problems in Scheduling 2	4	
	54454214	Complex Analysis 2	5	
	54454233	Topology 2	4	
	54453224	Theory of Differential Equation 2	5	
	54454262	Project	2	

8. Expected learning outcomes of the program

Knowledge

1- Comprehending and understanding the material with regard to the required and programmed vocabulary.
2- Using the board, dry pen and smart board.
3- Preparing appropriate questions as weekly discussions that contribute to clarifying the study material more.

Skills

1- The ability to comprehend mathematics and apply it practically. 2- The student acquires quantitative and scientific thinking skills that can be applied mathematically 3- Using many scientific and applied examples. 4- Solving exercises from the prescribed book and from auxiliary sources.
Ethics
1- Developing students' abilities to share scientific ideas. 2- Developing students' abilities to understand the basic principles of mathematics. 3- Developing students' abilities to participate in dialogue, present ideas, and accept the opinions of others. 4- Developing students' abilities in scientific thinking.

9. **Teaching and Learning Strategies**
1- Explain the scientific material to the students in detail. 2- Involve students in solving mathematical problems. 3- Discuss and dialogue about vocabulary related to the topic. 4- Develop a plan for raising and setting questions and quick exams. 5- Assign the student some group activities and duties.

10. Evaluation methods
1- Adopting classroom discussions and active participation in the classroom is evidence of the student's commitment and responsibility. 2- Raising the problem and assigning students to find solutions. 3- Solving the questions asked. 4- Answering quick exams to evaluate the students' level. 5- Commitment to the specified date for submitting daily exercises, assignments and research. 6- Daily, weekly and monthly exams and the end of the semester exam. 7- Activating the visiting colleague's visit, periodic visits to all academic stages, filling out a form and submitting it to the relevant committee in the department. 8- Discussing students' graduation projects.

11. Faculty			
Faculty Members			
Academic Rank	**Specialization**	**Special Requirements/Skills (if applicable)**	**Number of the teaching staff**

	General	Special		Staff	Lecturer
Bassam Jabbar Jasim	Mathematics	Differential and Difference equations	Head of Department	Staff	
Nadia Hashim Al-Noor	Statistics	Mathematical statistics		Staff	
Jamil A.Ali Al-Hawsy	Mathematics	Optimal Control Theory and Numerical		Staff	
Haider Jebur Ali	Mathematics	Topology		Staff	
Saad Abdulkadhim Alsaadi	Mathematics	Algebra - Module Theory		Staff	
Arkan Jasim Mohammed	Mathematics	Fractional Geometry		Staff	
Hanan A. Chachan	Mathematics	Operation Research		Staff	
Haytham Razooki Hassan	Mathematics	Homological Algebra		Staff	
Radhi Ali Zaboon	Mathematics	Dynamic system and optimal control theory		Staff	
Najm abdulzahra Makhrib	Mathematics	Number theory and algebraic geometry		Staff	
Emad Bakr Abdulkareem	Mathematics	Number Theory - Algebraic Geometry		Staff	
Nabaa N. Hasan	Mathematics	Approximation Theory		Staff	
Sabiha I. Mahmood	Mathematics	Topology		Staff	
Faez Hassan Ali	Mathematics	Operation Research and Cryptology		Staff	
Shatha sami sejad	Mathematics	Complex Analysis		Staff	
Sudad Khalil Abraheem	Mathematics	Mathematical statistics		Staff	
Faria Ali Chechan	Mathematics	Fuzzy Functional Theory		Staff	
Huda Abdullah Rasheed	Statistics	Mathematical statistics		Staff	
Rabeaa Gatea Abtan	Mathematics	Algebraic topology - Arrangement theory		Staff	
Arwa Nazar Mustafa	Mathematics	Functional Analysis		Staff	
Abdul khaleq Owaid Mazeel	Mathematics	Numerical Analysis		Staff	
Anmar Hashim Jasim	Mathematics	Deferential Equation		Staff	
Kasim Abbas Hussain	Mathematics	Applied Mathematics		Staff	
Zainab Esa Abdulnaby	Mathematics	Functional and Complex Analysis		Staff	
Zainab Shehab Hamed	Mathematics	Number Theory		Staff	
Zainab Mohammed Alwan	Mathematics	Differential Equations		Staff	
Wafaa Sayyid Hasanain	Statistics	Mathematical Statistics		Staff	
Zainab Shehab Hamed	Mathematics	Number Theory		Staff	
Ahmed Bakheet Saeed	Mathematics	Biomathematics		Staff	
Akbal Jabber Sultan	Mathematics	Mathematical statistics		Staff	
Lamyaa Hussein Ali	Mathematics	Numerical Analysis		Staff	
Jawad Kadhim Khalaf	Mathematics	Functional Analysis		Staff	
Khalid Hammood mohammedali	Mathematics	Applied Mathematics Delay Differential equations with Control Systems		Staff	
Ghazwa faisal abd	Mathematics	Descriptor Systems		Staff	
Shurooq Ahmed Kareem	Mathematics	Mathematical statistics		Staff	
Ali H. Al-Saedi	Mathematics	Number Theory		Staff	

Mohammed Abdulhadi Sarhan	Mathematics	Optimal control for Numerical Solution		Staff	
Ahmed Shawki Jaber	Mathematics	Integral Equations		Staff	
Sahar Ahmed Mohammed	Mathematics	Mathematical statistics		Staff	
Nadia Jaffa Fezaa	Mathematics	Mathematical statistics		Staff	
Zainab john kallaf	Mathematics	Partial Differential Equations		Staff	
Saad Owaid Bedewi	Mathematics	Algebra and Computer Applications		Staff	
Umilkeram Qasim Obaid	Mathematics	Fuzzy Functional Analysis		Staff	
Suhear Saady Alwan	Mathematics	Algebraic Topology		Staff	
Niran Abbas Ali	Mathematics	Graph theory		Staff	
Laheeb Muhsen Noman	Mathematics	Differential Geometry		Staff	
Ahmed Hanun Abud	Mathematics	Applied Mathematics		Staff	
Manal Hashim Ibrahim	Mathematics	Operation Research		Staff	
Amer Ismael Mustafa	Mathematics	Topological Groups		Staff	
Shaymaa Noori Abdulridha	Mathematics	Modules		Staff	
Murtadha Jaber Shanwa	Mathematics	Algebraic Topology		Staff	
Mahdi Jasim Hasan	Mathematics	Applied Algebra		Staff	
Manal Ghassan Ahmed	Mathematics	Operation Research		Staff	
Hiba Ghassan Fareed	Mathematics	Mathematics		Staff	
Akeel Nasir Kadhim	Mathematics	Modules and Rings Theory		Staff	
Ali Abdulrasool Abdulhussein	Mathematics	Differential Equations		Staff	
Hateem Kareem Khdair	Mathematics	Computational and Applied Mathematics		Staff	
Ayad Wali Ali	Mathematics	Differential Equations		Staff	
Amenah Hassan Ibraheem	Mathematics	Optimization Theory		Staff	
Hasan Wasi Maktoof	Mathematics	Pure Mathematics		Staff	
Zainab Sadiq Jafar	Mathematics	Numerical Analysis		Staff	
Ahmed Najm abdulla	Mathematics	Mathematics		Staff	
Rasha Abdulmahdi M.Saleh	Mathematics	Functional Analysis		Staff	
Aliaa Adnan Kadhim	Mathematics	Mathematics		Staff	
Shimaa Mohammed Dawood	Mathematics	Dynamic system and control		Staff	
Alaa Malek Soady	Mathematics	Functional Analysis		Staff	
Israa Mohammed Hassoon	Mathematics	Image Processing & Pattern Recognition		Staff	
Faten Hashim Mohammed	Mathematics	Module Theory		Staff	
Doha Adel Abbas	Mathematics	Operation Research		Staff	

Professional Development
Mentoring new faculty members
1- Continuous and accurate follow-up of the program. 2- Proposing new scientific ideas and participating in developing the academic program.
Professional development of faculty members
1- Participation in scientific courses, seminars and discussion groups. 2- Following up on the latest scientific research within the specialization.

3- Conducting scientific visits to relevant government institutions and the private sector.

12.**Acceptance Criterion**
1. Adopting the conditions for accepting students according to the regulations of the Ministry of Higher Education and Scientific Research (central admission criteria). 2. Successfully pass a special test or personal interview set by the college or university council. 3. Be medically fit for the specialization applied for. The capacity of the scientific department.

13.**The most important sources of information about the program**
1- Curriculum books approved by the scientific committee in the department. 2- Auxiliary books. 3- International books and sources (sources in English). 4- Additional sources from the Internet.

14.Program Development Plan
1- Using new concepts in the field of mathematics and using electronic devices to display information and related issues. 2- Updating curricula by searching the latest approved global sources. 3- Developing laboratories by updating scientific experiments and using the latest laboratory equipment. 4- Diversifying lecture delivery methods by using modern teaching methods.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
3rd year (pure) 1st course 2024-2025	54453114	Mathematical Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54453144	Numerical Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54453183	Algebra 1	Basic	√		√		√	√	√		√	√	√	√
	54453163	Data Theory	Basic	√		√		√	√	√		√	√	√	√
	54453123	Operations Research	Basic	√		√		√	√			√	√	√	√
3rd year (pure) 2nd course 2024-2025	54453214	Mathematical Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54453244	Numerical Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54453283	Algebra 2	Basic	√		√		√	√	√		√	√	√	√
	54453263	Numerical Theory	Basic	√		√		√	√	√		√	√	√	√

	54453253	Mathematical Statistic	Basic	√		√		√	√	√		√	√	√	√
	-	Professional ethics	Basic	√		√									
	-	English	Basic	√		√									
3rd year (applied) 1st course 2024-2025	54453114	Mathematical Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54453144	Numerical Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54453194	Partial Differential Equations	Basic	√		√		√	√	√		√	√	√	√
	54453183	Algebra 1	Basic	√		√		√	√	√		√	√	√	√
	54453173	Applied statistics	Basic	√		√		√	√	√		√	√	√	√
3rd year (applied) 2nd course 2024-2025	54453214	Mathematical Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54453244	Numerical Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54453283	Algebra 2	Basic	√		√		√	√	√		√	√	√	√
	54453223	Operations Research	Basic	√		√		√	√	√		√	√	√	√
	-	Differential Geometry	Basic	√		√		√	√	√		√	√	√	√

	-	Professional ethics	Basic	√		√										
	-	English	Basic	√		√										
3rd year (Operation Research and Statistics) 1st course 2024-2025	54453153	Mathematical Statistic	Basic	√		√		√	√	√		√	√	√	√
	54453114	Mathematical Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54453144	Numerical Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54453183	Algebra 1	Basic	√		√		√	√	√		√	√	√	√
	54453123	Operations Research 1	Basic	√		√		√	√	√		√	√	√	√
3rd year (Operation Research and Statistics) 2nd course 2024-2025	54453214	Mathematical Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54453244	Numerical Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54453283	Algebra 2	Basic	√		√		√	√	√		√	√	√	√
	54454213	Multivariate Analysis	Basic	√		√		√	√	√		√	√	√	√
	54453223	Operations Research 2	Basic	√		√		√	√	√		√	√	√	√
	-	Professional ethics	Basic	√		√										

	-	English	Basic	√		√									
4th year (pure) 1st course 2024-2025	54454114	Complex Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54454133	Topology 1	Basic	√		√		√	√	√		√	√	√	√
	54454153	Module Theory 1	Basic	√		√		√	√	√		√	√	√	√
	54453124	Theory of Differential Equation 1	Basic	√		√		√	√	√		√	√	√	√
	54454173	Measure Theory	Basic	√		√		√	√	√		√	√	√	√
	-	Professional ethics	Basic	√		√									
	-	English	Basic	√		√									
4th year (pure) 2nd course 2024-2025	54454214	Complex Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54454233	Topology 2	Basic	√		√		√	√	√		√	√	√	√
	54454253	Module Theory 2	Basic	√		√		√	√	√		√	√	√	√
	54453224	Theory of Differential Equation 2	Basic	√		√		√	√	√		√	√	√	√
	54454243	Functional Analysis 2	Basic	√		√		√	√	√		√	√	√	√

	54454262	Project	Basic	√		√		√	√	√		√	√	√	√
4th year (applied) 1st course 2024-2025	54454114	Complex Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54454133	Topology 1	Basic	√		√		√	√	√		√	√	√	√
	54454143	Functional Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54453124	Theory of Differential Equation 1	Basic	√		√		√	√	√		√	√	√	√
	54454194	Calculus Variations	Basic	√		√		√	√	√		√	√	√	√
	-	Professional ethics	Basic	√		√									
	-	English	Basic	√		√									
4th year (applied) 2nd Course 2024-2025	54454214	Complex Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54454233	Topology 2	Basic	√		√		√	√	√		√	√	√	√
	54453224	Theory of Differential Equation 2	Basic	√		√		√	√	√		√	√	√	√
	54454223	Applied Control Theory	Basic	√		√		√	√	√		√	√	√	√
	-	Fractional Geometry	Basic	√		√		√	√	√		√	√	√	√
	54454262	Project	Basic	√		√		√	√	√		√	√	√	√

4th year (Operation Research and Statistics) 1st course 2024-2025	54453164	Regression Analysis	Basic	√		√		√	√	√		√	√	√	√
	-	Combinatorial optimization problems	Basic	√		√		√	√	√		√	√	√	√
	54454114	Complex Analysis 1	Basic	√		√		√	√	√		√	√	√	√
	54454133	Topology 1	Basic	√		√		√	√	√		√	√	√	√
	54453124	Theory of Differential Equation 1	Basic	√		√		√	√	√		√	√	√	√
	-	Professional ethics	Basic	√		√									
	-	English	Basic	√		√									
4th year (Operation Research and Statistics) 2nd course 2024-2025	54454273	Stochastic Process	Basic	√		√		√	√	√		√	√	√	√
	54453293	Problems in Scheduling 2	Basic	√		√		√	√	√		√	√	√	√
	54454214	Complex Analysis 2	Basic	√		√		√	√	√		√	√	√	√
	54454233	Topology 2	Basic	√		√		√	√	√		√	√	√	√
	54453224	Theory of Differential Equation 2	Basic	√		√		√	√	√		√	√	√	√
	54454262	Project	Basic	√		√		√	√	√		√	√	√	√

- Please tick the boxes corresponding to the individual program learning outcomes under evaluation.

Course Description Form

1. Course Name:
Theory of Differential Equations I
2. Course Code:
54452114
3. Semester / Year:
First Semester / 2024-2025
4. Description Preparation Date:
17/10/2024
5. Available Attendance Forms:
Attendees Weekly
6. Number of Credit Hours (Total) / Number of Units (Total)
5 hours / 75 hours
7. Course administrator's name (mention all, if more than one name)
Name: Assistant Professor Dr. Kasim Abbas Hussain Email: kasimabbas@uomustansiriyah.edu.iq
8. Course Objectives

Course Objectives	A detailed study in The existence and uniqueness theorems for first, second and higher order differential equations. The existence and uniqueness theorem of second and higher order linear nonhomogeneous differential equations. Linear homogeneous and nonhomogeneous systems: solution and verification of the solution.

9. Teaching and Learning Strategies

Strategy	• **Lectures** • **Discussions** • **Tests**

10. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	5	First-Order Differential Equations	existence and uniqueness theorem	theoretical Lectures	Exam, tests, assignments
2	5	Linear Differential Equations of second Order ODEs	linear homogeneous equations	theoretical Lectures	Exam, tests, assignments
3	5	Linear Differential Equations of second Order ODEs	Theorems for the general solution of second and higher ODEs	theoretical Lectures	Exam, tests, assignments
4	5	Linear Differential Equations of second Order ODEs	Linear independence theorems for the solution of second and higher order	theoretical Lectures	Exam, tests, assignments
5	5	Linear Differential Equations of second order ODEs	Second and Higher order linear nonhomogeneous equations	theoretical Lectures	Exam, tests, assignments

6	5	Linear Differential Equations of second order ODEs	Wronskian determinant	theoretical Lectures	Exam, tests, assignments
7	5	Exam	Monthly Exam		Exam
8	5	Linear Differential Equations of second Order ODEs	Solution of second and higher order linear differential equations with constant coefficients	theoretical Lectures	Exam, tests, assignments
9	5	Linear Differential Equations of second Order ODEs	Reduction the order of linear differential equations of second and of higher order.	theoretical Lectures	Exam, tests, assignments
10	5	Linear Systems of Ordinary Differential Equations	Linear homogeneous and nonhomogeneous systems: solution and verification of the solution	theoretical Lectures	Exam, tests, assignments
11	5	Linear Systems of Ordinary Differential Equations	Reducing an initial value problem to a system of 1st order differential equations	theoretical Lectures	Exam, tests, assignments
12	5	Linear Systems of Ordinary Differential Equations	Linear homogeneous system: Solution matrix and fundamental matrix,theorems	theoretical Lectures	Exam, tests, assignments
13	5	Linear Systems of Ordinary Differential Equations	Fundamental matrix calculation: exponential method and the eigenvalue and eigenvector method	theoretical Lectures	Exam, tests, assignments
14	5	Linear Systems of Ordinary Differential Equations	Linear nonhomogeneous system of differential equations: particular solution	theoretical Lectures	Exam, tests, assignments
15	5	Exam	Monthly Exam		Exam

11. Course Evaluation
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, ... etc

12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Ordinary Differential Equations by Fred Brauer
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

13. Course Name:
Theory of Ordinary Differential Equations II
14. Course Code:
54452224

15. Semester / Year:
Second Semester / 2024-2025
16. Description Preparation Date:
4-2-2025
17. Available Attendance Forms:
Attendees Weekly
18. Number of Credit Hours (Total) / Number of Units (Total)
5 hours / 75 hours
19. Course administrator's name (mention all, if more than one name)
Name: Assistant Professor Dr. Kasim Abbas Hussain Email: kasimabbas@uomustansiriyah.edu.iq
20. Course Objectives

Course Objectives	A detailed study in the existence and uniqueness theory of first order differential equation, boundary value problems, fixed (critical) points, orbits, phase portrait, stability and the Laplace transforms for solving linear system of differential equations.

21. Teaching and Learning Strategies

Strategy	• Lectures • Discussions • Tests

22. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	5	Existence and Uniqueness theory of first order differential equation	Existence of solution: successive approximation " Picard approximations", Lipschitz condition, continuity	theoretical Lectures	Exam, tests, assignments
2	5	Existence and Uniqueness theory of first order differential equation	Gronwall inequality, Uniqueness of solutions, Continuation of solutions	theoretical Lectures	Exam, tests, assignments
3	5	Boundary Value Problems	Homogeneous and non Homogeneous boundary value problems; Green function	theoretical Lectures	Exam, tests, assignments
4	5	Boundary Value Problems	Self-Adjoint ; Sturm Liouville problems	theoretical Lectures	Exam, tests, assignments
5	5	Boundary Value Problems	Second and Higher order linear nonhomogeneous equations	theoretical Lectures	Exam, tests, assignments
6	5	Fixed (critical) points , Orbits, Phase portrait, Stability	Two dimensional linear systems of differential equation: fixed points	theoretical Lectures	Exam, tests, assignments
7	5	Exam	Monthly Exam		Exam
8	5	Fixed (critical) points , Orbits, Phase portrait, Stability	General solution and Jordan canonical form for two dimensional	theoretical Lectures	Exam, tests, assignments

			homogeneous linear systems of differential equations		
9	5	Fixed (critical) points , Orbits, Phase portrait, Stability	Classification for critical points and their stability for two dimensional homogeneous linear systems of differential equations: Types of Phase diagram	theoretical Lectures	Exam, tests, assignments
10	5	Fixed (critical) points , Orbits, Phase portrait, Stability	Classification for critical points and their stability for two dimensional nonhomogeneous linear systems of differential equations: Types of Phase diagram	theoretical Lectures	Exam, tests, assignments
11	5	Fixed (critical) points , Orbits, Phase portrait, Stability	Classification of critical points and their Stability for the nonlinear systems of 1st order by Jacobian method (linearization method): Phase diagram	theoretical Lectures	Exam, tests, assignments
12	5	Fixed (critical) points , Orbits, Phase portrait, Stability	Classification of critical points and their Stability for the Nonlinear systems of 1st order by Lypanovs Method: Phase diagram	theoretical Lectures	Exam, tests, assignments
13	5	The Laplace Transforms for solving linear system of differential equations	Laplace transforms, Inverse of Laplace transforms	theoretical Lectures	Exam, tests, assignments
14	5	The Laplace Transforms for solving linear system of differential equations	Solving linear and linear systems differential equations with constant coefficients	theoretical Lectures	Exam, tests, assignments
15	5	Exam	Monthly Exam		Exam

23. Course Evaluation
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams. etc

24. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Ordinary Differential Equations by Fred Brauer
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Theory of Differential Equations I
2. Course Code:
54454124
3. Semester / Year:
1st Semester / 2024-2025
4. Description Preparation Date:
15-10-2024
5. Available Attendance Forms:
Weekly Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
5 Hours per week(Total Number of Hours 75)/ 4 Units
7. Course administrator's name (mention all, if more than one name)
Name: Professor Dr. Jamil Amir Ali Name: Asst. Prof. Lmyaa Hussian Ali Email: jhawassy17@uomustansiriyah.edu.iq Email: lamya_h2@uomustansiriyah.edu.iq

8. Course Objectives	
Course Objective	Student will learn about the existence theorems of a unique solution for the ODEs of order 1,2 till to order n. also will learn about the existence of a unique solution for the 2nd order (and then nth order) linear nonhomogeneous ODEs. Wronskian Determinants and its relation with independence for the solutions of the 2nd order linear homogeneous ODEs. Method of Variations of constants for solving 2nd order (and then nth order) linear nonhomogeneous ODEs. Study of the existence theorem of a unique solution for nonhomogeneous linear system of 1st order ODEs solution. Fundamental matrix, the particular solution for nonhomogeneous linear system of 1st order ODEs. Exponential matrix method and the eigenvalue method for solving homogeneous linear system of 1st order ODEs. Lipschitz conditions, Picard successive approximation method for solving 1st order ODEs, proof of the existence theorem for a solution of the 1st order ODE in rectangular region and then extension this solution into any region in the plane general.

9. Teaching and Learning Strategies	
Strategy	Lectures Quizzes Examinations Reports

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	5	Test the existence for a unique solution of the for the ODEs of order 1,2 till to order n.	the existence theorems of a unique solution for the ODEs of order 1,2 till to order n.	Theoretical Lectures and Exercises for Solutions	Examinations, discussion, reports, homework
2	5	Find the solutions of the homogeneous ODEs with constant coefficients of 1st,2nd, and nth order	Solutions of the homogeneous ODEs with constant coefficients of 1st ,2nd , and nth order .	=	

3	5	Test the interval of existence solution for linear ODEs of order 2 with variable coefficients	The existence theorem of a unique solution for linear ODEs of order 2 with variable coefficients	=	
4	5	Test the interval of existence solution For linear ODEs of order n with variable coefficients	Generalization for the existence theorem of a unique solution for linear ODEs of order n with variable coefficients	=	
5	5	Calculate the Wronskian determinants, and the Independence of the solutions of the 2^{nd} order linear homogeneous ODEs	Wronskian determinants and theorems about the relation between the independence for the solutions of the 2^{nd} order linear homogeneous ODEs		
6	5	Calculate the Wronskian determinants, and the Independence of the solutions of the n-th order linear homogeneous ODEs	Generalization for the Wronskian determinants and theorems about the relation between the independence for the solutions of the n-th order linear homogeneous ODEs		
7	5	Learn how they find the 2^{nd} independent solution from a given solution for linear homogeneous ODEs of 2^{nd} order	Find the second independent solution from a given solution for linear homogeneous ODEs of 2^{nd} order		
8	5		Monthly examination		
9	5	Learn how they find the solution of 2^{nd}, up to nth order linear nonhomogeneous ODEs.	Method of Variations of constants for solving 2^{nd} order (and then nth order) linear nonhomogeneous ODEs. The equivalent between the n th order ODEs and the linear system of 1^{st} order ODEs		
10	5	Find particular Solution for ofr nonhomogeneous linear system of 1^{st} order ODEs, the exponetional matrix	The particular solution for nonhomogeneous linear system of 1^{st} order ODEs, the exponetional matrix, and the solution of homogenous linear system of 1^{st} order ODEs.		
11	5	Find Eigenvalue and eigenvector method	Eigenvalue and eigenvector method		

		for solving linear homogeneous system of 1st order ODEs	for solving linear homogeneous system of 1st order ODEs		
12	5	Learn how they Transform the n-th Order ODEs to a system of 1storder ODEs.	The equivalent between the n-th order and 1st degree of ODEs and the integral equation		
13	5	Use the Picard method to solve the 1st order ODEs	Picard successive approximation method for solving 1st order and 1st degree of ODEs		
14	5	Test the existence of a unique solution. Learn the technique of proof .	Proof of the 1st order ODEs of 1st degree in a rectangular region then generalization the existence solution to a general regions, the uniqueness of the solution.		
15	5		Monthly examination		

11. Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as 20% monthly examinations 5% reports 5% home works 70% final examinations	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	A First course of Ordinary Differential Equations by F. Brauer and J. A. Nohel, 2nd edition 1973
Main references (sources)	A textbook of ordinary differential equations, by Shair A. and Antonio A., 2nd edition, 2015 Springer.
Recommended books and references (scientific journals, reports...)	Ordinary differential equations by George F. Simmons
Electronic References, Websites	Students can have followed their academic profile

Course Description Form

1. Course Name:
Theory of Differential Equations II
2. Course Code:
54454124
3. Semester / Year:
2nd Semester / 2024-2025
4. Description Preparation Date:
4-2-2025
5. Available Attendance Forms:
Weekly Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)

5 Hours per week(Total Number of Hours 75)/ 4 Units
7. Course administrator's name (mention all, if more than one name)
Name: Professor Dr. Jamil Amir Ali Name: Asst. Prof. Lmyaa Hussian Ali Email: jhawassy17@uomustansiriyah.edu.iq Email: lamya_h2@uomustansiriyah.edu.iq
8. Course Objectives

Course Objective	Student will learn about the Eigenvalue problems for homogeneous boundary value problems, Eigenvalue problems for nonhomogeneous boundary value problems and the Green's functions, generalization of Green's functions. Sturm-Liouville problems and self adjiont operators. Phase portrait, stability for 1st order linear differential homogeneous 2x2 systems type 1,2,3,4 (Jordan Form) and their classifications. Stability for 1st order linear differential homogeneous 2x2 systems (non canonical matrix) and their classifications. stability for 1st order linear differential nonhomogeneous 2x2 systems and their classifications. stability for 1st order nonlinear differential 2x2 systems and their classifications (Jacobi method). stability for 1st order nonlinear differential 2x2 systems and their classifications (Lyapunov's method). Laplace transform for solving system of differential equations with constants coefficients.
9. Teaching and Learning Strategies	
Strategy	Lectures Quizzes Examinations Reports

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	5	Solution for the Eigenvalue problems for homogeneous BVPs	Eigenvalue problems for homogeneous boundary value problems (BVPs)	Theoretical Lectures and Exercises for Solutions	Examinations, discussion, reports homework
2	5	Solution for the Eigenvalue problems for homogeneous BVPs	Eigenvalue problems for homogeneous BVPs	=	
3	5	Eigenvalue problems for nonhomogeneous BVPs and the Green's functions	Eigenvalue problems for Nonhomogeneous BVPs and the Green's functions.	=	
4	5	Generalization for the Green functions	Generalization for the Green functions	=	
5	5	Sturm-Liouville problems and self adjoint operators	Sturm-Liouville problems and self adjiont operators		
6	5		Monthly examination		
7	5	Find the type ans stability for 1st order linear differential homogeneous 2x2 systems	Phase portrait, stability for 1st order Linear differential homogeneous 2x2 systems type 1,2 (Jordan Form)		

			and their classifications.		
8	5	Find the type ans stability for 1st Order linear Differential homogeneous 2x2 2x2 systems	Phase portrait, stability for 1st order linear differential homogeneous 2x2 systems type 3,4 (Jordan Form) and their classifications.		
9	5	Find the type and stability for the 1st order linear differential homogeneous 2x2 systems (noncanonical matrix)	stability for 1st order linear differential homogeneous 2x2 systems (non canonical matrix) and their classifications.		
10	5	Find the type and stability for 1st order linear differential nonhomogeneous 2x2 systems ..	stability for 1st order linear differential nonhomogeneous 2x2 systems and their classifications.		
11	5	Use the Jacobi method to find the stability for 1st order Nonlinear differential 2x2 systems	stability for 1st order nonlinear differential 2x2 systems and their classifications. (Jacobi method)		
12	5	Use the Lyapunov's method to find the stability for 1st order nonlinear differential 2x2 systems	stability for 1st order nonlinear differential 2x2 systems and their classifications (Lyapunov's method)		
13	5	Solving system of diff. eqs. with constants coefficients by Laplace transform	Laplace transform for solving system of diff. eqs. with constants coefficients		
14	5	Solving system of diff. eqs. with constants coefficients by Laplace transform	Laplace transform for solving a system of diff. eqs. with constants coefficients		
15	5		Monthly examination		
11. Course Evaluation					
Distributing the score out of 100 according to the tasks assigned to the student such as 20% monthly examinations 5% reports					

5% home works 70% final examination	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	A First course of Ordinary Differential Equations by F. Brauer and J. A. Nohel, 2nd edition 1973
Main references (sources)	A textbook of ordinary differential equations, by Shair A. and Antonio A., 2nd edition, 2015 Springer.
Recommended books and references (scientific journals, reports...)	Ordinary differential equations by George F. Simmons
Electronic References, Websites	Students can have followed their academic profile

Course Description Form

1-Course Name
Partial Differential Equations
2- Course Code
54453294
3- Semester/Year
Third class / First course / Applied Mathematics, 2024-2025
4-Desacription Preparation Date
15/10/2024
5-Available Attendance
Weekly attendance
6- Number of Credit Hours (Total) / Number of Units (Total)
4 hours per week / 60 hours per semester
7-Course Administrators Name
Asst. prof. Dr. Ghazwa Faisal Abd , Email: k.abd@uomustansiriyah.edu.iq Shamia mohammed Dawod Email: shamaa_84@uomustansiriyah.edu.iq
8- Course Objective
1. **Understand the Fundamentals of PDEs**: Students will learn the basic types of partial differential equations (such as elliptic, parabolic, and hyperbolic), their physical interpretations, and the underlying principles governing them. 2. **Mathematical Formulation**: Develop the ability to model real-world problems from physics, engineering, and other fields using partial differential equations. 3. **Solution Methods**: Master classical methods for solving PDEs, such as separation of variables, Fourier series, transform methods, and Green's functions. 4. **Boundary and Initial Conditions**: Understand how to apply appropriate boundary and initial conditions to make problems well-posed and solvable. 5. **Application of PDEs in Various Fields**: Apply PDEs to solve problems in fluid dynamics, heat transfer, wave propagation, quantum mechanics, and other areas
9-Teaching and Learning Strategies
• Lectures • Oral discussions • Tests • Reports
10- Course Structure

Week	Hours	Required learning outcomes	Unit or subject name	Learning method	Evaluation method

1	4	Students will learn the basic types of partial differential equations (such as elliptic, parabolic, and hyperbolic	Basic concept in partial differential equation and Classification of partial differential equation.	Theoretical lectures	Test
2	4	Develop the ability to model real-world problems from physics, engineering, and other fields using partial differential equations	Standard form of partial differential equation and solution of partial differential equation.	Theoretical lectures	Homework
3	4	Enhance critical thinking skills by analyzing complex PDE problems and applying appropriate solution strategies	solve linear homogeneous partial differential equation of first order.	Theoretical lectures	Oral Exam
4	4	Develop a deeper theoretical understanding of the existence, uniqueness, and stability of solutions to PDEs.	higher order partial differential equation.	Theoretical lectures	Homework
5	4	Learning about : Cauchy's method, Charpit's method, Jacobi's method.	Nonlinear partial differential equation	Theoretical lectures	Report
6	4	Understanding the Theory of Nonhomogeneous PDEs: Classification: Students should be able to classify PDEs as elliptic, parabolic, or hyperbolic and understand how these classifications apply to nonhomogeneous equations.	Nonhomogeneous partial differential equation.	Theoretical lectures	Test
7	4	Boundary and Initial Conditions: Handling Different Boundary Conditions: Understand how different types of boundary conditions (Dirichlet, Neumann, or mixed) affect the solution of nonhomogeneous PDEs. Solving with Given Initial Conditions: Solve time-dependent nonhomogeneous PDEs using appropriate initial conditions.	Initial-boundary value problem. Even and odd functions and The Hessian matrix.	Theoretical lectures	Homework
8	4	Learning Solution Techniques: Method of Separation of Variables: Apply separation of variables to solve nonhomogeneous problems, when possible.	Fourier series, Half-range sine and cosine Fourier series.	Theoretical lectures	Oral Exam

		Fourier Series and Transforms: Use Fourier series and Fourier transforms to solve nonhomogeneous boundary and initial value problems.			
9	4	Use Fourier series Change interval to solve nonhomogeneous boundary and initial value problems	Fourier series: Change interval.	Theoretical lectures	Homework
10	4	Fourier Series and Transforms: Use Fourier series and Fourier transforms to solve nonhomogeneous boundary and initial value problems.	Fourier transformation.	Theoretical lectures	Report
11	4	Interpreting Physical Meaning: Understand the physical implications of the terms in nonhomogeneous PDEs, particularly in models of heat, wave propagation, diffusion, or fluid dynamics.	Separation of variables: Heat-flow problem.	Theoretical lectures	Oral Exam
12	4	Particular Solution Techniques: Method of Undetermined Coefficients: Learn how to find particular solutions to nonhomogeneous PDEs using undetermined coefficients.	Non-homogenous Heat-flow problem.	Theoretical lectures	Homework
13	4	Solve real-world problems involving nonhomogeneous PDEs, such as heat conduction with a source term, wave equations with external forcing, or fluid flow.	Wave problem.	Theoretical lectures	Oral Exam
14	4	Variation of Parameters: Use variation of parameters for solving nonhomogeneous PDEs.	Non-homogenous Wave problem.	Theoretical lectures	Homework
15	4	Interpreting Physical Meaning: Understand the physical implications of the terms in nonhomogeneous PDEs, particularly in models of heat, wave propagation, diffusion, or fluid dynamics.	Laplace equation in two dimensional space. Laplace equation in three dimensional space.	Theoretical lectures	Homework

11- Course Evaluation

The final grade is 100% and is divided as follows:
- Monthly exam 20 points
- Reports 5 points
- Tests and assignments 5 points
- Final exam 70 points

12-Learning and Teaching Resources

[1] Partial Differential Equations for Scientists and Engineers, By Stanley J. Farlow, (1993).

[2] Partial Differntial Equations with Fourier series and Boundary Value Problems, Second Edition, By Nakhle H. Asmar, (2005).
[3]Introduction to Partial Differential Equations, By Peter J. Olver (2014).

Corse Description Form

1-Course Name

Calculus of variation

2- Course Code

54454194

3- Semester/Year

Fourth class / First course / Applied Mathematics, 2024-2025

4-Desacription Preparation Date

15/10/2024

5-Available Attendance

Weekly attendance

6- Number of Credit Hours (Total) / Number of Units (Total)

4 hours per week / 60 hours per semester

7-Course Administrators Name

Prof. Dr. Radhi Ali Zaboon Email: Radhizaboon@gmail.com
Asst. prof. Dr. Ghazwa Faisal Abd , Email: k.abd@uomustansiriyah.edu.iq

8- Course Objective

course aims to provide students with a deep understanding of the principles and methods used to find functions that optimize functionals, which typically depend on curves or surfaces. Students will:

- Learn to formulate variational problems in mathematical and physical contexts.
- Master the Euler-Lagrange equation and its applications to minimize or maximize functionals.
- Explore both classical and modern methods of solving boundary value problems in variational calculus.
- Apply these techniques to various fields such as physics, engineering, and economics, emphasizing practical problem-solving and theoretical insight.

9-Teaching and Learning Strategies

• Lectures
• Oral discussions
• Tests
• Reports

10- Course Structure

Week	Hours	Required learning outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Students will understand the definition of functional and norms and be able to solve basic variational problems involving functional.	Functionals and some basic concept on norms, some simple variational problems	Theoretical lectures	Test

2	4	Students will learn to identify and apply the necessary conditions for finding extrema of functional in variational problems.	The necessary condition for extremum	Theoretical lectures	Homework
3	4	Students will derive Euler's equation as a solution to the simplest variation problem and understand its significance in variational calculus	The simplest variation problem, Euler's equation	Theoretical lectures	Oral Exam
4	4	Students will analyze various examples that illustrate the application of Euler's equation in solving practical variational problems.	Examples and application of Euler's equation	Theoretical lectures	Homework
5	4	Students will explore Ostrogradsky's equation in the context of variational calculus with two independent variables and understand its formulation.	The case of two independent variables ostrogradsky's equation	Theoretical lectures	Report
6	4	Students will solve specific examples of Ostrogradsky's equation, applying the theoretical concepts learned in class.	Examples on ostrogradsky's equation	Theoretical lectures	Test
7	4	Students will extend the principles of calculus of variations to functionals involving several independent variables and understand their complexities.	The case of several (n) independent variables	Theoretical lectures	Homework
8	4	Students will work through various examples to solidify their understanding of variational problems with multiple independent variables.	Examples on several case	Theoretical lectures	Oral Exam
9	4	Students will learn to formulate and approach fixed point problems in the context of unknown functions within variational frameworks.	Fixed point problem for unknown function	Theoretical lectures	Homework
10	4	Students will examine examples involving n dependent variables and	Examples of (n) dependent variables	Theoretical lectures	Report

		apply variational principles to solve them.			
11	4	Students will understand the concept of geodesies in the context of calculus of variations and their importance in differential geometry.	Geodesies	Theoretical lectures	Oral Exam
12	4	Students will analyze functionals that involve higher-order derivatives and understand the implications for the calculus of variations.	Functional depending on higher order derivatives	Theoretical lectures	Homework
13	4	Students will apply the concepts of higher-order derivatives in variational calculus to solve practical problems in physics and engineering.	Application of this case	Theoretical lectures	Oral Exam
14	4	Students will learn to handle functionals defined with free boundaries and understand the implications for variational problems.	Functional with free boundary { free end points}	Theoretical lectures	Homework
15	4	Students will explore illustrations of functionals with free end points, enhancing their understanding of the complexities involved in these scenarios.	Some illustration on the Functional free end points	Theoretical lectures	Homework

11- Course Evaluation

The final grade is 100% and is divided as follows:
- Monthly exam 20 points
- Reports 5 points
- Tests and assignments 5 points
- Final exam 70 points

12-Learning and Teaching Resources

Textbooks:

[1] Calculus of variation by I.Gelfand

[2] Differential equations and the calculus of variations by L.Elsgolts

Suggested references:

[1] Calculus Of Variations, With Applications to Physics And Engineering by Robert Wienstock

Corse Description Form

1-Course Name

Optimal Control Theory

2- Course Code

54454223

3- Semester/Year

Fourth class / Second course / Applied Mathematics, 2024-2025

4-Desacription Preparation Date

4-2-2025

5-Available Attendance

Weekly attendance

6- Number of Credit Hours (Total) / Number of Units (Total)

4 hours per week / 60 hours per semester

7-Course Administrators Name

Prof. Dr. Radhi Ali Zaboon Email: Radhizaboon@gmail.com
Asst. prof. Dr. Ghazwa Faisal Abd , Email: k.abd@uomustansiriyah.edu.iq

8- Course Objective

1. **Understand Basic Concepts**: Gain an understanding of the fundamental principles of optimal control theory, including the formulation of control systems and the optimization of dynamic systems.
2. **Mathematical Foundations**: Develop the mathematical tools necessary to analyze and solve optimal control problems, such as calculus of variations, dynamic programming, and Pontryagin's Maximum Principle.
3. **Modeling and Analysis**: Learn how to model real-world systems using control theory and analyze the stability, controllability, and observability of these systems.
4. **Design of Optimal Controllers**: Apply theoretical concepts to design optimal control strategies for both linear and nonlinear systems.
5. **Explore Applications**: Study the application of optimal control in various fields such as engineering, economics, robotics, and aerospace.

9-Teaching and Learning Strategies

- Lectures
- Oral discussions
- Tests
- Reports

10- Course Structure

Week	Hours	Required learning outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the concept of control systems and optimal control, and apply these concepts to real-world examples such as trajectory optimization or resource management.	Control and optimal control with example.	Theoretical lectures	Test
2	4	Develop a solid foundation in formulating and solving optimization problems by applying concepts like objective functions and constraints.	Some basic concepts of optimization problems	Theoretical lectures	Homework
3	4	Learn to use Lagrange multipliers and the calculus of variations to solve constrained optimization problems, with practical examples to illustrate these techniques.	Lagrange multipliers and calculus of variations with classifications and examples.	Theoretical lectures	Oral Exam

4	4	Apply the Hamiltonian framework to optimize systems with continuous, unbounded control variables.	Optimal control with unbounded control (continuous):the Hamiltonian.	Theoretical lectures	Homework
5	4	Understand and apply both necessary and sufficient conditions for optimality in control problems, such as Pontryagin's Maximum Principle.	Necessary condition of optimality and Sufficient condition of optimality.	Theoretical lectures	Report
6	4	Learn to implement transversality conditions in optimal control problems, particularly in cases involving terminal constraints or free final time.	Transversality conditions with applications.	Theoretical lectures	Test
7	4	Analyze and solve optimal control problems that involve specific constraints at the terminal time, such as fixed endpoints.	Optimal control problem with terminal constraints	Theoretical lectures	Homework
8	4	Explore methods for solving control problems where the final time is not fixed, allowing for optimization of both control variables and time.	Optimal control problem with free time, terminal time.	Theoretical lectures	Oral Exam
9	4	Understand the mathematical conditions that must be satisfied for a system to be controllable, and apply these principles to real-world problems.	Optimal control problem with constraints on the state variables.	Theoretical lectures	Homework
10	4	Extend the principles of optimal control to situations where both time and state at the endpoint can be optimized, using necessary conditions for optimality.	Optimal control problem with unspecified boundary conditions, terminal time with examples.	Theoretical lectures	Report
11	4	Apply linear quadratic control theory to design both open-loop and closed-loop control strategies for minimizing a quadratic cost function.	Linear quadratic optimal control with open loop control and closed loop control.	Theoretical lectures	Oral Exam
12	4	Solve target problems where the objective is to drive a system to a specific state, using real-world applications like missile guidance or robotic control.	Target problem with application.	Theoretical lectures	Homework

13	4	Develop practical solutions for target problems, focusing on applications that require precise end-point control.	State controllable and complete state controllable.	Theoretical lectures	Oral Exam
14	4	Understand the concept of output controllability and apply it to design systems that can achieve desired output behavior.	Output controllable.	Theoretical lectures	Homework
15	4	Learn the fundamental conditions required for the controllability of a dynamic system and apply these conditions to practical control problems.	Necessary condition for controllability.	Theoretical lectures	Homework

11- Course Evaluation

The final grade is 100% and is divided as follows:
- Monthly exam 20 points
- Reports 5 points
- Tests and assignments 5 points
- Final exam 70 points

12-Learning and Teaching Resources

[1] Optimal Control Theory: An Introduction by Donald E. kirk, 1998
[2] Introduction to Optimal Control theory by Jack Macki, Aarson Strauss, 1982
[3] Calculus of Variations and Optimal Control Theory, by Daniel Liberzon , 2012

Corse Description Form

1-Course Name
Differential Geometry
2- Course Code
54453294
3- Semester/Year
Third class / Second course / Applied Mathematics, 2024-2025
4-Desacription Preparation Date
4-2-2025
5-Available Attendance
Weekly attendance
6- Number of Credit Hours (Total) / Number of Units (Total)
4 hours per week / 60 hours per semester
7-Course Administrators Name
Asst. prof. Dr. Ghazwa Faisal Abd , Email: k.abd@uomustansiriyah.edu.iq Shamia mohammed Dawod Email: shamaa_84@uomustansiriyah.edu.iq
8- Course Objective
The course objectives of a Differential Geometry course typically focus on equipping students with an understanding of the geometric properties of curves, surfaces, and higher-dimensional manifolds using calculus and linear algebra and Understanding of Curves and Surfaces in Euclidean Space Develop a deep understanding of the geometry of curves and surfaces in three-dimensional Euclidean space, including concepts such as curvature and torsion of curves, and Gaussian curvature of surfaces.
9-Teaching and Learning Strategies

• Lectures
• Oral discussions
• Tests
• Reports

10- Course Structure

Week	Hours	Required learning outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Students will be able to analyze and interpret the properties of Euclidean space, utilize natural coordinate functions, and apply pointwise principles to understand geometric structures and solve related mathematical problems.	Euclidean space E^n,E^3, natural coordinate functions, pointwise principles , Exercises.	Theoretical lectures	Test
2	4	Students will be able to define and compute tangent vectors and vector fields, and apply these concepts to describe and analyze directional properties of curves and surfaces in differential geometry.	Tangent vectors, vector field, Exercises.	Theoretical lectures	Homework
3	4	Students will be able to compute directional derivatives in the context of tangent vectors and evaluate the derivatives of vector fields, understanding how these derivatives describe changes in direction and magnitude across surfaces.	Directional derivatives in tangent vector, derivative of vector fields, Exercises.	Theoretical lectures	Oral Exam
4	4		Curves in E^3, Velocity in E^3.	Theoretical lectures	Homework
5	4	Students will be able to apply the concept of reparametrization to curves, understanding how different parametrizations describe the same geometric curve and how to use them effectively in differential geometry.	Reparametrization of the curve, Exercises	Theoretical lectures	Report
6	4	Students will understand the role of 1-forms in differential geometry, including how to evaluate them on tangent vectors and vector fields, and how to convert a smooth function into a corresponding 1-form.	1-Forms: with tangent vector, with vector field, convert function into 1-forms Exercises.	Theoretical lectures	Test
7	4	Students will be able to work with differential forms and perform wedge products, gaining insight into antisymmetric bilinear operations that are foundational in exterior algebra.	Differential forms, wedge product	Theoretical lectures	Homework

8	4	Students will learn to compute the exterior derivative of differential forms, developing the ability to extend the concept of differentiation to higher-dimensional objects in differential geometry.	exterior derivative, Exercises.	Theoretical lectures	Oral Exam
9	4	Students will analyze the mapping of Euclidean spaces and understand how a curve is transformed under such mappings, with a focus on the image of the curve.	Mappings of Euclidean spaces, mage of curve under map.	Theoretical lectures	Homework
10	4	Students will be able to compute the tangent map, regular maps, and Jacobian matrices of mappings, while understanding the role of frame fields in these computations.	Tangent map, regular map, Jacobian Matrix of mapping, Frame fields, Exercises	Theoretical lectures	Report
11	4	Students will understand how to compute dot products and Euclidean distances, and learn to construct the attitude matrix of a frame for orientation and position analysis.	Dot product, Euclidian distance, attitude matrix of the frame.	Theoretical lectures	Oral Exam
12	4	Students will be proficient in calculating norms in frame fields and performing cross products in vector spaces, applying these concepts to geometric problems.	Norms in frame field, Cross product	Theoretical lectures	Homework
13	4	Students will master the computation of covariant derivatives, understanding how to extend the concept of a derivative to curved spaces, preserving the geometric properties of a manifold.	Covariant Derivatives, Exercises	Theoretical lectures	Oral Exam
14	4	Students will gain a deep understanding of frame fields and their role in describing local bases for tangent spaces on a manifold.	Frame field, Exercises	Theoretical lectures	Homework
15	4	Students will understand the concept of connection forms and their application in defining how vector fields change along curves, with an emphasis on parallel transport and curvature	Connection Forms, Exercises	Theoretical lectures	Homework

11- Course Evaluation

The final grade is 100% and is divided as follows:
- Monthly exam 20 points
- Reports 5 points

• Tests and assignments 5 points • Final exam 70 points
12-Learning and Teaching Resources
[1] Elementary Differential Geometry, Revised Second Edition, By Barrett O'neill, (2006). [2] Schaum's Outline of Theory and Problems of Differential Geometry, By Martin M. Lipschutz, (1969). [3] Differential Geometry, Dover Edition, By Erwin Kreyszig.(1991) [4] Elementary Differential Geometry, Second Edition, By Andrew Pressley, (2010).

Course Description Form

25. Course Name:					
Mathematical statistics					
26. Course Code:					
54453153					
27. Semester / Year:					
First Semester / (2024-2025)					
28. Description Preparation Date:					
15-10-2024					
29. Available Attendance Forms:					
Weekly Attendance					
30. Number of Credit Hours (Total) / Number of Units (Total)					
4 Hours per Week / 60 Hours during the Semester					
31. Course administrator's name (mention all, if more than one name)					
Name: Assistant Professor Huda Abdullah Rashid Email: hudamath@uomustansiriyah.edu.iq					
32. Course Objectives					
Course Objectives	• Finding the probability distribution of one or more variables • Studying the probability distribution of ordered statistics. • The central purpose theory. • Relationship between some common probability distributions.				
33. Teaching and Learning Strategies					
Strategy	Course Objectives This course covers methods for finding the probability distribution of one or more variables, which is a function of one or more of the identical and independent random variables, in addition to. The course also includes studying the central purpose theory and the relationship between some common probability distributions.				
34. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	4	Sampling concept	Sampling concept	Theoretical lectures	Participation, assignments

2	4	The case of one variable	Distribution of function of random variable using Transformation of variables technique	Theoretical lectures	Participation, assignments
3	4	The case of two variables (with discrete type)	Distribution of function of random variable using Transformation of variables technique	Theoretical lectures	Participation, assignments
4	4	The case of two variables (with continuous type)	Distribution of function of random variable using transformation of variables technique: i. The case of two variables	Theoretical lectures	Participation, assignments
5	4	Moment generating function technique	Moment generating function technique	Theoretical lectures	Participation, assignments
6	4	The cumulative distribution function technique	The cumulative distribution function technique	Theoretical lectures	Participation, assignments
7	4	Exam	Monthly exam	Exam	Monthly exam
8	4	Distribution of $\bar{x}$ for Normal distribution and Distribution of $n\,S^2/\,\sigma^2$ for Normal distribution	Distribution of some statistics of Normal distribution	Theoretical lectures	Participation, assignments
9	4	Order statistics	Order statistics	Theoretical lectures	Participation, assignments
10	4	Central limit theory	Central limit theory	Theoretical lectures	Participation, assignments
11	4	Student's t distribution	Student's t distribution	Theoretical lectures	Participation, assignments
12	4	F - distribution	F - distribution	Theoretical lectures	Participation, assignments
13	4	1. Normal with some distributions	The relation between some distributions	Theoretical lectures	Participation, assignments
14	4	2. Gamma with some distributions	The relation between some distributions	Theoretical lectures	Participation, assignments
15	4	Exam	Monthly exam	Exam	Monthly exam

35. Course Evaluation

- Monthly exam 20 marks
- Participation during the lecture and attendance
- Tests and assignments 5 marks
- Final exam 70 marks

36. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introduction to Mathematical Statistics. Robert V. Hogg, Joseph W. McKean and Allen T. Craig (2013).

Main references (sources)	
Recommended books and references (scientific journals, reports...)	Introduction to mathematical statistics. Prof. Dr. Dhafir H. Rasheed and Ali A. Al-Wakil.
Electronic References, Websites	

Course Description Form

37. Course Name:
Numerical Analysis I
38. Course Code:
54453144
39. Semester / Year:
1st Course / 2024-2025
40. Description Preparation Date:
17-10-2024
41. Available Attendance Forms:
Weekly attendance
42. Number of Credit Hours (Total) / Number of Units (Total)
4 hours per week / 60 hours per semester
43. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Nabaa Najdi Hasan, Email: alzaer1972@uomustansiriyah.edu.iq Name: Prof. Dr. Faez Hassan Ali, Email: faezhassan@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Sudad Khalil Ibraheem, Email: sudad1968@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Abdul khaleq Owaid Mazeel, Email: khaleqmazeel@uomustansiriyah.edu.iq
44. Course Objectives

Course Objective	Study of numerical errors and their types, then discussing the numerical methods that contribute to solving nonlinear equations and systems of linear equations and numerical methods for solving them, and studying how to find the inclusion and numerical completion, as well as studying the methods of calculating the numerical derivative of differential equations. In each topic, more than one method is usually discussed and the most accurate methods are determined.
45. Teaching and Learning Strategies	
Strategy	• Lectures. • Oral discussions. • Tests. • Reports.

46. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Source of error, Classification of error, Number Representation, Absolute & Relative error	Numerical Error	Theoretical Lectures	Test, assignments, oral exam, report
2	4	Non-linear Equation, Locating ,Root, Bisection Method	Non-Linear Equations	Theoretical Lectures	Test, assignments,

					oral exam, report
3	4	Fixed-point Iteration Method, Fixed-point Theorem	Non-Linear Equations	Theoretical Lectures	Test, assignments, oral exam, report
4	4	Newton-Raphson Iteration Method, Secant Method, False-Position Method	Non-Linear Equations	Theoretical Lectures	Test, assignments, oral exam, report
5	4	Monthly Test	Error & Nonlinear system	Theoretical Test	Only Test
6	4	Linear System, Direct Method,	Linear system	Theoretical Lectures	Test, assignments, oral exam, report
7	4	Gauss elimination method, Indirect Method	Linear system	Theoretical Lectures	Test, assignments, oral exam, report
8	4	Gauss Jacobi Iterative Method	Linear System	Theoretical Lectures	Test, assignments, oral exam, report
9	4	Gauss-Seidel Method,	Linear System	Theoretical Lectures	Test, assignments, oral exam, report
10	4	Interpolation and Polynomials Approximate, Lagrange Interpolation Polynomials	Interpolation	Theoretical Lectures	Test, assignments, oral exam, report
11	4	Divided Difference, Newton interpolation formulae	Interpolation	Theoretical Lectures	Test, assignments, oral exam, report
12	4	Newton's Forward Difference Interpolation polynomials	Interpolation	Theoretical Lectures	Test, assignments, oral exam, report
13	4	Newton's Backward Difference Interpolation polynomials	Interpolation	Theoretical Lectures	Test, assignments, oral exam, report
14	4	Numerical Differentiation.	Differentiation	Theoretical Lectures	Test, assignments, oral exam, report

15	4	Monthly Test	Linear system, Interpolation & Differentiation	Theoretical Test	Only Test

47. Course Evaluation
• Two months theoretical exam with a rate of 20 degrees. • Reports for one course 5 degrees. • Tests and assignments for one course 5 degrees. • Practical tests 10 degrees, so the total is 40 degrees. • Final exam (theoretical 48 points + practical 12) 60 degrees.

48. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Numerical Analysis 9th Ed. By R. L. Burden and J. D. Faires, 2001.
Main references (sources)	Introduction to Numerical analysis, by T. Maraim, 2005.
Recommended books and references (scientific journals, reports...)	An Introduction to Numerical Methods and Analysis by J. F. Epperson, 2013.
Electronic References, Websites	

Course Description Form

49. Course Name:	
Numerical Analysis II	
50. Course Code:	
54453244	
51. Semester / Year:	
2nd Course / 2024-2025	
52. Description Preparation Date:	
4-2-2025	
53. Available Attendance Forms:	
Weekly attendance	
54. Number of Credit Hours (Total) / Number of Units (Total)	
4 hours per week / 60 hours per semester	
55. Course administrator's name (mention all, if more than one name)	
Name: Prof. Dr. Nabaa Najdi Hasan, Email: alzaer1972@uomustansiriyah.edu.iq Name: Prof. Dr. Faez Hassan Ali, Email: faezhassan@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Sudad Khalil Ibraheem, Email: sudad1968@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Abdul khaleq owaid mazeel, Email: khaleqmazeel@uomustansiriyah.edu.iq	
56. Course Objectives	
Course Objectiv	Study of numerical errors and their types, then discussing the numerical methods that contribute to solving nonlinear equations and systems of linear equations and numerical methods for solving them, and studying how to find the inclusion and numerical completion, as well as studying the methods of calculating the numerical derivative of differential equations. In each topic, more than one method is usually discussed and the most accurate methods are determined.
57. Teaching and Learning Strategies	

Strategy	• Lectures. • Oral discussions. • Tests. • Reports.

58. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
16	4	Numerical Integrations: Trapezoidal Rule of Integration: Derivation of the Trapezoidal Rule, Error in Trapezoidal Rule.	Numerical Integrations	Theoretical Lectures	Test, assignments, oral exam, report
17	4	Simpson's 1/3 Rule, Simpson 3/8 Rule for Integration, Mid-Point Rule.	Numerical Integrations	Theoretical Lectures	Test, assignments, oral exam, report
18	4	Romberg Integration.	Numerical Integrations	Theoretical Lectures	Test, assignments, oral exam, report
19	4	Opened and closed Newton-Cotes methods.	Numerical Integrations	Theoretical Lectures	Test, assignments, oral exam, report
20	4	Composite Numerical Integration (Multiple Integrals).	Numerical Integrations	Theoretical Lectures	Test, assignments, oral exam, report
21	4	Monthly Test	Numerical Integrations	Theoretical Test	Only Test
22	4	Euler's Method for Ordinary Differential Equations and Taylor's Series Method.	Ordinary Differential Equations	Theoretical Lectures	Test, assignments, oral exam, report
23	4	Modified Euler Method.	Ordinary Differential Equations	Theoretical Lectures	Test, assignments, oral exam, report
24	4	Runge-Kutta 4th Order Method.	Ordinary Differential Equations	Theoretical Lectures	Test, assignments, oral exam, report
25	4	Systems of Differential Equations: Runge-Kutta 4th Order Method.	System of ODE's	Theoretical Lectures	Test, assignments, oral exam, report

26	4	Adam-Bashforth multi-step method Least Squares Approximation Methods.	System of ODE's	Theoretical Lectures	Test, assignments, oral exam, report
27	4	Higher Order Ordinary Differential Equations: Shooting method.	Higher Order of ODE	Theoretical Lectures	Test, assignments, oral exam, report
28	4	Numerical Solutions of BVPs for ODEs: Finite Difference Methods.	BVP's of ODE's	Theoretical Lectures	Test, assignments, oral exam, report
29	4	Numerical Solutions of PDEs: Finite Difference Methods for Parabolic Problems.	Partial Differential Equations	Theoretical Lectures	Test, assignments, oral exam, report
30	4	Monthly Test	ODE & PDE	Theoretical Test	Only Test

59. Course Evaluation

- Two months' theoretical exam with a rate of 20 degrees.
- Reports for one course 5 degrees.
- Tests and assignments for one course 5 degrees.
- Practical tests 10 degrees, so the total is 40 degrees.
- Final exam (theoretical 48 points + practical 12) 60 degrees.

60. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Numerical Analysis 9th Ed. By R. L. Bur and J. D. Faires, 2001.
Main references (sources)	Introduction to Numerical analysis, by T. Maraim, 2005.
Recommended books and references (scientific journals, reports...)	An Introduction to Numerical Methods Analysis by J. F. Epperson, 2013.
Electronic References, Websites	

Course Description Form

61. Course Name:
Practical Part, Numerical Analysis I
62. Course Code:
54453144
63. Semester / Year:
1st Course / 2024-2025
64. Description Preparation Date:
17-10-2024
65. Available Attendance Forms:
Weekly attendance
66. Number of Credit Hours (Total) / Number of Units (Total)
4 hours per week / 60 hours per semester
67. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Nabaa Najdi Hasan, Email: alzaer1972@uomustansiriyah.edu.iq

Name: Prof. Dr. Faez Hassan Ali, Email: faezhassan@uomustansiriyah.edu.iq
Name: Asst. Prof. Dr. Sudad Khalil Ibraheem, Email: sudad1968@uomustansiriyah.edu.iq
Name: Asst. Prof. Dr. Abdul khaleq owaid mazeel , Email: khaleqmazeel@uomustansiriyah.edu.iq
Name: Asst. Prof. Dr. Sahar Ahmed Mohammed, Email: shuophd@uomustansiriyah.edu.iq
Name: Asst. Prof. Dr. Zainab John Kallaf. Email: zainabjohn22@uomustansirihay.edu.iq
Name: Asst. Lecturer Safanah Faisal Yousif, Email: safanafaysal77@uomustansiriyah.edu.iq
Name: Dr. Ali Abdu Rasool Abdul Husein, Email: aaabdulhussein@uomustansiriyah.edu.iq
Name: Dr. Manal Ghassan Ahmed, Email: safanafaysal77@uomustansiriyah.edu.iq

68. Course Objectives

Course Objectives	The primary objective of the course is to develop the basic understanding of numerical algorithms and skill to implement algorithms to solve mathematical problem on computer. Introduction to numerical methods with emphasis on algorithm construction, analysis and implementation. Solutions of equations in one variable, polynomial approximation, direct solves for linear systems, indirect solves for linear systems.

69. Teaching and Learning Strategies

Strategy	• Practical Lectures. • Oral discussions. • Tests. • Reports.

70. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
31	4	Absolute & Relative error	Numerical Integrations	Practical Lectures	Test, assignments, oral exam, report
32	4	Non-linear Equation, Locating Root, Bisection Method	Numerical Integrations	Practical Lectures	Test, assignments, oral exam, report
33	4	Fixed-point Iteration Method, Fixed-point Theorem	Numerical Integrations	Practical Lectures	Test, assignments, oral exam, report
34	4	Newton-Raphson Iteration Method, Secant Method	Numerical Integrations	Practical Lectures	Test, assignments, oral exam, report
35	4	False-Position Method	Numerical Integrations	Practical Lectures	Test, assignments, oral exam, report
36	4	Linear system, Direct Method, Matrices, Exam	Numerical Integrations	Practical Lectures	Only Test

37	4	Gauss elimination method, Indirect Method	Ordinary Differential Equations	Practical Lectures	Test, assignments, oral exam, report
38	4	Gauss Jacobi Iterative Method	Ordinary Differential Equations	Practical Lectures	Test, assignments, oral exam, report
39	4	Gauss-Seidel Method, Exam	Ordinary Differential Equations	Practical Lectures	Test, assignments, oral exam, report
40	4	Lagrange Interpolation Polynomials	System of ODE's	Practical Lectures	Test, assignments, oral exam, report
41	4	Divided Difference	System of ODE's	Practical Lectures	Test, assignments, oral exam, report
42	4	Newton interpolation formulae, Exam	Higher Order of ODE	Practical Lectures	Test, assignments, oral exam, report
43	4	Newton's Forward Difference Interpolation polynomials	BVP's of ODE's	Practical Lectures	Test, assignments, oral exam, report
44	4	Newton's Backward Difference Interpolation polynomials	Partial Differential Equations	Practical Lectures	Test, assignments, oral exam, report
45	4	Monthly Test	ODE & PDE	Practical Test	Only Test

71. Course Evaluation

• Two months theoretical exam with a rate of 20 degrees.
• Reports for one course 5 degrees.
• Tests and assignments for one course 5 degrees.
• Practical tests 10 degrees, so the total is 40 degrees.
• Final exam (theoretical 48 points + practical 12) 60 degrees.

72. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Numerical Analysis 9th Ed. By R. L. Burden an D. Faires, 2001.
Main references (sources)	Introduction to Numerical analysis, by T. Maraim, 2005.
Recommended books and references (scientific journals, reports...)	An Introduction to Numerical Methods Analysis by J. F. Epperson, 2013.
Electronic References, Websites	

Course Description Form

73. Course Name:
Numerical Analysis II (Practical) All Branches
74. Course Code:
54453144
75. Semester / Year:
2nd Course / 2024-2025
76. Description Preparation Date:
4-2-2025
77. Available Attendance Forms:
Weekly attendance
78. Number of Credit Hours (Total) / Number of Units (Total)
2 hours per week / 30 hours per semester
79. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Nabaa Najdi Hasan, Email: alzaer1972@uomustansiriyah.edu.iq Name: Prof. Dr. Faez Hassan Ali, Email: faezhassan@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Sudad Khalil Ibraheem, Email: sudad1968@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Abdul khaleq owaid mazeel , Email: khaleqmazeel@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Sahar Ahmed Mohammed, Email: shuophd@uomustansiriyah.edu.iq Name: Asst. Prof. Dr. Zainab John Kallaf. Email: zainabjohn22@uomustansirihay.edu.iq Name: Asst. Lecturer Safanah Faisal Yousif, Email: safanafaysal77@uomustansiriyah.edu.iq Name: Dr. Ali Abdul Rasool Abdul Husein, Email: aaabdulhussein@uomustansiriyah.edu.iq Name: Dr. Manal Ghassan Ahmed, Email: safanafaysal77@uomustansiriyah.edu.iq
80. Course Objectives

Course Objectives	Study of numerical errors and their types, then discussing the numerical methods that contribute to solving nonlinear equations and systems of linear equations and numerical methods for solving them, and studying how to find the inclusion and numerical completion, as well as studying the methods of calculating the numerical derivative of differential equations. In each topic, more than one method is usually discussed and the most accurate methods are determined.

81. Teaching and Learning Strategies

Strategy	• Lectures. • Oral discussions. • Tests.

82. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
46	4	Trapezoidal Rule.	Numerical Integrations	Practical Lectures	Test, assignments

47	4	Simpson 1_3 Rule.	Numerical Integrations	Practical Lectures	Test, assignments
48	4	Simpson 3_8 Rule.	Numerical Integrations	Practical Lectures	Test, assignments
49	4	Romberg Rule.	Numerical Integrations	Practical Lectures	Test, assignments
50	4	Closed and Open Newton-Cotes Formula	Numerical Integrations	Practical Lectures	Test, assignments
51	4	Monthly Test	Numerical Integrations	Practical Test	Only Test
52	4	Euler Method.	Ordinary Differential Equations	Practical Lectures	Test, assignments
53	4	Plot_Euler's Method.	Ordinary Differential Equations	Practical Lectures	Test, assignments
54	4	Runge-Kutta (Order 4).	Ordinary Differential Equations	Practical Lectures	Test, assignments
55	4	Runge-Kutta system.	System of ODE's	Practical Lectures	Test, assignments
56	4	Taylor Method	System of ODE's	Practical Lectures	Test, assignments
57	4	Shooting method.	Higher Order of ODE	Practical Lectures	Test, assignments
58	4	Modified Euler method	BVP's of ODE's	Practical Lectures	Test, assignments
59	4	New Modified Euler method	Partial Differential Equations	Practical Lectures	Test, assignments
60	4	Monthly Test	ODE & PDE	Practical Test	Only Test

83. Course Evaluation

- Two months' theoretical exam with a rate of 20 degrees.
- Reports for one course 5 degrees.
- Tests and assignments for one course 5 degrees.
- Practical tests 10 degrees, so the total is 40 degrees.
- Final exam (theoretical 48 points + practical 12) 60 degrees.

84. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Numerical Analysis 9th Ed. By R. L. Burden and J. D. Faires, 2001.
Main references (sources)	Introduction to Numerical analysis, by T. Maraim, 2005.
Recommended books and references (scientific journals, reports...)	An Introduction to Numerical Methods and Analysis by J. F. Epperson, 2013.
Electronic References, Websites	

Course Description Form

85. Course Name:
Module theory 1
86. Course Code:
54454153
87. Semester / Year:
First, 2024 / 2025
88. Description Preparation Date:
15/ 10 / 2024
89. Available Attendance Forms:
Weakly Attendance
90. Number of Credit Hours (Total) / Number of Units (Total)
60 hours during the semester / 60 units during the semester
91. Course administrator's name (mention all, if more than one name)
Name: Dr.Saad Abdualkadhim Al-Saadi Email: saalsaadi@uomustansiriyah.edu.iq
92. Course Objectives

Course Objectives:	This subject presents the foundational material for the basic algebraic structures pervading contemporary pure mathematics, namely modules. The basic definitions and elementary results are given. Also, the concepts of submodule, quotient modules, internal direct sum, and basis are obtained.

93. Teaching and Learning Strategies

Strategy	• Lectures • Oral discussions • Examinations • scientific reports

94. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Definition and Examples Of modules	Basic definitions	Theoretical lectures	Test, assignments, oral exam, report
2	4	Some kind of modules.	Simple, cyclic, f.g. modules	Theoretical lectures	Test, assignments, oral exam, report
3	4	Submodules. Examples and properties of submodules.	submodules	Theoretical lectures	Test, assignments, oral exam, report
4	4	Generating set, basis, free set.	details of generati sets	Theoretical lectures	Test, assignments, oral exam, report
5	4	finitely generated module, Examples and results.	finitely generated	Theoretical lectures	Test, assignments, oral exam, report
6	4	Minimal and maximal submodules.	Max, and min, submodules	Theoretical lectures	Test, assignments, oral exam, report

7	4	Internal DirectSums of submodules.	Direct sum	Theoretical lectures	Test, assignments, oral exam, report
8	4	exam	Monthly exam		exam
9	4	Factor (quotient) Modules.	quotient Modules	Theoretical lectures	Test, assignments, oral exam, report
10	4	Homomorphisms of Modules.Definitions, properties and Examples.	Homomorphisms	Theoretical lectures	Test, assignments, oral exam, report
11	4	Factorization of Homomorphisms.	Factorizations	Theoretical lectures	Test, assignments, oral exam, report
12	4	Fundamental Isomorphism Theorems.	Isomorphism Theorems.	Theoretical lectures	Test, assignments, oral exam, report
13	4	Split epimorphisms , split monomorphisms.	Splits homo,	Theoretical lectures	Test, assignments, oral exam, report
14	4	The Theorem of JORDAN-HÖLDER-SCHREIER.	JORDAN-HÖLDE SCHREIER homo	Theoretical lectures	Test, assignments, oral exam, report
15	4	exam	Monthly exam	Theoretical lectures	exam

95. Course Evaluation

The final mark of 100% is divided as follows:
- A monthly exam of 20 marks
- Reports 5 maks
- Tests and assignments, 5 marks
- Final exam: 70 marks

96. Learning and Teaching Resources

Required textbooks (curricular books, if any)	unavailable
Main references (sources)	Kasch, F. “Modules and rings” Academic Press., London, 1982
Recommended books and references (scientific journals, reports...)	J. S. Golan andTom Head, Modules and the Structure of Rings: A Primer (Hardback, 1991).
Electronic References, Websites	https://libgen.is/

Course Description Form

97. Course Name:
Module theory 2
98. Course Code:
54454253
99. Semester / Year:
Second, 2024 / 2024

100. Description Preparation Date:
15/ 10 / 2024
101. Available Attendance Forms:
Weakly Attendance
102. Number of Credit Hours (Total) / Number of Units (Total)
60 hours during the semester / 60 units during the semester
103. Course administrator's name (mention all, if more than one name)
Name: Dr.Saad Abdualkadhim Al-Saadi Email: saalsaadi@uomustansiriyah.edu.iq
104. Course Objectives

Course Objectives:	This subject presents the foundational material for direct product and external direct sum of modules and the relation between internal direct sum and external direct sum is discussed. Also, in this course the concept of free modules is studied. Moreover, the concepts of Noetherain and Artinain modules are obtained. Characterizations, results and properties of Noetherain and Artinain modules are given.

105. Teaching and Learning Strategies	
Strategy	• Lectures • Oral discussions • Examinations • scientific reports

106. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Construction of Products and coproducts modules	Basic definitions	Theoretical lectures	Test, assignments, oral exam, report
2	4	Connection between the internal and external direct sums of modules.	internal and external direct sums of modules	Theoretical lectures	Test, assignments, oral exam, report
3	4	Free Modules.	Examples, Remarks and result	Theoretical lectures	Test, assignments, oral exam, report
4	4	Characterizations of free free modules.	Characterizations	Theoretical lectures	Test, assignments, oral exam, report
5	4	Artinain and Noetherian modules	Definintions, results and and Examples.	Theoretical lectures	Test, assignments, oral exam, report
6	4	Artinain and Noetherian	Properties, results and relations	Theoretical lectures	Test, assignments, oral exam, report
7	4	Noetherian modules	Characterizations	Theoretical lectures	Test, assignments, oral exam, report

8	4	exam	Monthly exam		exam
9	4	Artinain modules	Characterizations	Theoretical lectures	Test, assignments, oral exam, report
10	4	Artinain and Noetherian rings..	Properties, results and relations	Theoretical lectures	Test, assignments, oral exam, report
11	4	Finite length of Modules	Examples, Remarks and result	Theoretical lectures	Test, assignments, oral exam, report
12	4	Finite length of Modules.	Characterizations.	Theoretical lectures	Test, assignments, oral exam, report
13	4	composition series	Properties, results and relations	Theoretical lectures	Test, assignments, oral exam, report
14	4	Endomorphismsrings of Artinian and Noetherian Modules	Examples, Remarks and result	Theoretical lectures	Test, assignments, oral exam, report
15	4	The Hilbert Basis Theorem	Properties, results and relations	Theoretical lectures	exam

Course Evaluation

The final mark of 100% is divided as follows:
• A monthly exam of 20 marks
• Reports 5 maks
• Tests and assignments, 5 marks
• Final exam: 70 marks

107. Learning and Teaching Resources

Required textbooks (curricular books, if any)	unavailable
Main references (sources)	Kasch, F. "Modules and rings" Academic Press., London, 1982
Recommended books and references (scientific journals, reports...)	J. S. Golan and Tom Head, Modules and the Structure of Rings: A Primer (Hardback, 1991).
Electronic References, Websites	https://libgen.is/

Course Description Form

108. Course Name:
Operation Research
109. Course Code:
54453123
110. Semester / Year:
First Semester/2024-2025
111. Description Preparation Date:
15-10-2024

112.	Available Attendance Forms:
Weekly attendance	
113.	Number of Credit Hours (Total) / Number of Units (Total)
4 hours per week/ 60 hours per semester	
114.	Course administrator's name (mention all, if more than one name)
Name: Dr. Manal Hashim Ibrahim Email: manalhashimibrahim@gmial.com	
115.	Course Objectives
Course Objectives	After studying Linear Programming course, the student is able to study the Applications of Linear programming.
116.	Teaching and Learning Strategies
Strategy	• Lectures • Oral Discussions • Tests • Reports

117. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	4	Linear Programming Problem (LPP) Formulation	Linear Programming Problem	Theortical lectures	Test,exam Oral, repor
2	4	Method Of LPP/P Geometric(Graphical) Solution	Method Of LPP	-	-
3	4	Feasible and Optimal Solutions in LPP	Linear Programming Problem	-	-
4	4	Line Segment, Convex Set Extreme Point in LPP	Linear Programming Problem		
5	4	Bounded and Unbounded Feasible Recion	Feasible Recion	-	-
6	4	Standard Form of a Maximum Problem in LPP	Simplex Method	-	-
7	4	Exam	Monthly Exam		Exam
8	4	Standard Form of a Minmum Problem in LPP	Simplex Method	Theortical lectures	Test,exam Oral, repor
9	4	Slack Variables and the Simplex Tabieau	Simplex Method	-	-
10	4	The Pivot Operation	Simplex Method	-	-
11	4	Examples of Simplex Method	Simplex Method	-	-
12	4	The Unbound Case of LPP	Simplex Method	-	-
13	4	Duality in LPP	Duality Problem	-	-
14	4	Some Examples and Theorem Duality	Duality Problem	-	-

15	4	Exam	Monthly Exam		Exam

118. Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc	
119. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Introduction of Operation Research. Hmdy taha
Main references (sources)	Introduction of Operation Research . Abd Diab Jazae
Recommended books and references (scientific journals, reports...)	Linear programming problems MR. RAVINDER PANT 2020
Electronic References, Websites	

Course Description Form

120. Course Name:
Mathematical statistics
121. Course Code:
54453153
122. Semester / Year:
First Semester/2024-2025
123. Description Preparation Date:
17-10-2024
124. Available Attendance Forms:
Weekly attendance
125. Number of Credit Hours (Total) / Number of Units (Total)
4 hours per week / 60 hours per semester
126. Course administrator's name (mention all, if more than one name)
Name: Shurooq Ahmed Kareem Email: shuroq80@uomustansiriyah.edu.iq
127. Course Objectives

Course Objectives	• Studying some basic principles in statistics and • finding the distribution of variables using techniques of transforming variables into one variable and two variables, the moment generating function technique, the distribution function technique, • and then identifying the ordered statistic, the central limit theorem, the t distribution, the F distribution, and the relationship between some distributions.
128. Teaching and Learning Strategies	
Strategy	• Lectures • Oral discussions • Tests • Reports

129. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**

1	4	Some basic principles (definitions)	Basic Definitions	Theoretical lectures	Test,assignments, oral exam, report
2	4	Finding the distribution of a random variable using the technique of transforming variables into one discrete and continuous variable	Distributin of a Random Variable	Theoretical lectures	
3	4	Finding the distribution of two random variables using the transformation technique for two discrete variables	Distribution of Two Random Variables	Theoretical lectures	
4	4	Finding the distribution of two random variables using the transformation technique for two continuous variables	Distribution of Two Random Variables	Theoretical lectures	
5	4	Finding the distribution of two variables using the moment generating function technique	Moment Generating Function Technique	Theoretical lectures	
6	4	Finding the distribution of two variables using the cumulative distribution function technique	Cumulatie Distribution Function Technique	Theoretical lectures	
7	4	Exam	Monthly Exam	Theoretical lectures	
8	4	The distribution of $\bar{x}$for the normal distribution and the distribution of for the normal distribution	Distribution of $\bar{x}$ and (nS^2)/σ^2 of the Normal Distribution	Theoretical lectures	Test, assignmens, oral exam, report
9	4	Recognizing the ordered statistic	Order Statistics	Theoretical lectures	
10	4	Recognizing the central limit theorem	Central Limit Theorem	Theoretical lectures	
11	4	Finding the T distribution and the F distribution	Distribution of T and Distribution of F	Theoretical lectures	
12	4	The relationship between some distributions: the normal distribution and its relationship with some distributions	Relationship between Some Distributions	Theoretical lectures	
13	4	and Gamma and their relationship with some distributions	Relationship between Some Distributions	Theoretical lectures	

14	4	and the T distribution and their relationship with some distributions	Relationship between Some Distributions	Theoretical lectures	
15	4	Exam	Monthly Exam	Theoretical lectures	

130. Course Evaluation

The final grade is 100% and is divided as follows:
• Monthly exam 20 points
• Reports 5 points
• Tests and assignments 5 points
• Final exam 70 points

131. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	Introduction to mathematical statistics by Robert V. and et. al
Recommended books and references (scientific journals, reports...)	Introduction to mathematical statistics by Prof.Dr.Dhafir H.Rashed and et.al
Electronic References, Websites	

Course Description Form

132. Course Name:

Mathematical Analysis 1

133. Course Code:

54453114

134. Semester / Year:

First, 2024 / 2025

135. Description Preparation Date:

15\10\2024

136. Available Attendance Forms:

Weekly attendance

137. Number of Credit Hours (Total) / Number of Units (Total)

4 hours per week / 60 hours per semester

138. Course administrator's name (mention all, if more than one name)

Name: Dr. Umilkeram Qasim Obaid haider@uomustansiriyah.edu.iq , umilkeram32@gmail.com	Name: Asst. Prof. Dr. Anmar Hashim Jasim dr.anmar@uomustansiriyah.edu.iq
Name: Asst .Prof .Dr. Zainab Mohammed Alwan lionwight_2009@uomustansiriyah.edu.iq	Name: Dr. Amenah Hassan Ibrahim amena_1335723@uomustansiriyah.edu.iq

139. Course Objectives

Course Objectives	A comprehensive study of • The relationship between the field of rational numbers and the field o real numbers

	• Sequences in the real field such as convergent sequences, Cauchy sequences • Infinite series with their convergence test • Metric spaces along with basic concepts such as convergence, completeness, and compactness in a more general framework includir Euclidean spaces.
140. Teaching and Learning Strategies	
Strategy	• Lectures • Oral discussions • Tests • Reports

141. Course Structure

Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	4	Relation between the Real field and Rational field	The Real field	Theoretical lectures	Test, assignments, oral exam, report
2	4	Irrational numbers and Real numbers – Absolute value	The Real field	Theoretical lectures	
3	4	Sequences of Real numbers - convergent sequences	Sequences	Theoretical lectures	
4	4	Bounded sequences and Monotonic sequences	Sequences	Theoretical lectures	
5	4	Cauchy sequences	Sequences	Theoretical lectures	
6	4	Infinite Series – a converging Test	Series	Theoretical lectures	
7	4	Exam	Monthly exam		Exam
8	4	Absolute convergence and conditional convergence – Other Test for convergence	Series	Theoretical lectures	
9	4	Basic Principles of Topology in metric spaces	Metric Spaces	Theoretical lectures	
10	4	Theorems in Metric Spaces	Metric Spaces	Theoretical lectures	
11	4	Convergence sequences in metric spaces	Metric Spaces	Theoretical lectures	
12	4	Cauchy sequences or Fundamental sequences in metric spaces	Metric Spaces	Theoretical lectures	
13	4	Complete metric spaces	Metric Spaces	Theoretical lectures	
14	4	Compact spaces	Metric Spaces	Theoretical lectures	
15	4	Exam	Monthly exam		Exam

142. Course Evaluation	
The final grade is 100% and is divided as follows: • Monthly exam 20 points • Reports 5 points • Tests and assignments 5 points • Final exam 70 points	
143. Learning and Teaching Resources	
Required textbooks (curricular books, if a	1- Introduction to Mathematical Analysis by Adil G. Naoum
Main references (sources)	2- Principle of Mathematical Analysis by W. Rudin
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

144. Course Name:					
Abstract algebra 2					
145. Course Code:					
54453283					
146. Semester / Year:					
2024-2025					
147. Description Preparation Date:					
15/10/2024					
148. Available Attendance Forms:					
Attendance weekly					
149. Number of Credit Hours (Total) / Number of Units (Total)					
4 hours weekly/ 60 hours through the course					
150. Course administrator's name (mention all, if more than one name)					
Name: Prof. Dr. Najm Abdulzahra Makhrib Email: dr.najm@uomustansiriyah.edu.iq					
151. Course Objectives					
Course Objectives	• Study the rings • Study the subrings • Study the homomorphism • Study fundamental theorems • Study the field and domains				
152. Teaching and Learning Strategies					
Strategy	• Lectures • Discussions • Tests • Reports				
153. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**

1	4	Definition and Examples of rings	rings	Theoretical lecture	Test, homework, Oral exam, report
2	4	Some properties of rings	rings	Theoretical lecture	Test, homework, Oral exam, report
3	4	Theorems on rings	rings	Theoretical lecture	Test, homework, Oral exam, report
4	4	Characteristic of the ring	rings	Theoretical lecture	Test, homework, Oral exam, report
5	4	Subrings and Their Properties	subrings	Theoretical lecture	Test, homework, Oral exam, report
6	4	More Results of Subrings	subrings	Theoretical lecture	Test, homework, Oral exam, report
7	4	exam	Monthly exam		exam
8	4	Ideals	subrings	Theoretical lecture	Test, homework, Oral exam, report
9	4	Zero divisors elements and integral domains	rings	Theoretical lecture	Test, homework, Oral exam, report
10	4	Quotient rings	rings	Theoretical lecture	Test, homework, Oral exam, report
11	4	Homomorphism, Examples and Basic Concepts	Homom orphism	Theoretical lecture	Test, homework, Oral exam, report
12	4	Maximal ideal	ideals	Theoretical lecture	Test, homework, Oral exam, report
13	4	Prime ideal	ideals	Theoretical lecture	Test, homework, Oral exam, report
14	4	Fields	Fields	Theoretical lecture	Test, homework, Oral exam, report
15	4	exam	Monthly exam		exam

154. Course Evaluation

Final degree 100 divided by

- 20 degrees for monthly exam.
- 5 degrees for report.
- 5 degrees for tests and homework.
- 70 degree for the final exam.

155. Learning and Teaching Resources

Required textbooks (curricular books, if a	Introduction to Modern Abstract Algebra, by David M. Burton
Main references (sources)	Groups and Numbers, by R. M. Luther
Recommended books and references (scientific journals, reports...)	A First Course in Abstract Algebra, by J. B. Fraleigh
Electronic References, Websites	Group Theory, by M. Suzuki