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

Academic Program and Course Description Guide

2026 -2025

Introduction:

The educational program is a coordinated and organized package of courses that include procedures and experiences organized in the form of study vocabulary. The primary purpose of these courses is to build and refine the skills of graduates, qualifying them to meet the requirements of the labor market. It is reviewed and evaluated annually through internal or external audit procedures and programs, such as the External Examiner Program.

The academic program description provides a brief summary of the main features of the program and its courses, indicating the skills that students are working to acquire based on the objectives of the academic program. The importance of this description is evident as it represents the cornerstone for obtaining program accreditation, and the teaching staff participates in writing it under the supervision of the academic committees in the academic departments

This guide, in its second edition, includes a description of the academic program after updating the vocabulary and paragraphs of the previous guide in light of the developments and changes in the educational system in Iraq. This included a description of the academic program in its traditional form, the annual-semester system, in addition to adopting the description of the academic program circulated pursuant to the Department of Studies letter TM 2906/3 dated 5/3/2023 regarding programs that adopt the Bologna process as a basis for their work.

In this regard, we cannot but emphasize the importance of writing descriptions of academic programs and courses to ensure the smooth running of the educational process.

Concepts and Terms

Academic Program Description: The academic program description provides a concise 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 concise summary of the most important course characteristics and the learning outcomes expected of the student, demonstrating whether the student has made maximum use of the available learning opportunities. It is derived from the program description.

The program vision is an ambitious picture of the future of the academic program to be an advanced, inspiring, motivating, realistic, and applicable program.

The program mission: It briefly clarifies the goals and the activities necessary to achieve them, and it also identifies the paths and directions of the program's development

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

Curriculum structure: All courses/subjects included in the academic program according to the approved learning system: semester, annual, Bologna track, whether a requirement of the ministry, university, college, or scientific department, along with the number of credit hours.

Learning outcomes: A compatible set of knowledge, skills, and values acquired by the student after successfully completing the academic program. Learning outcomes must be specified for each course in a way that achieves the program objectives.

Academic Program Description Form

University Name: University of Basrah
Faculty/Institute: College of Science
Scientific Department: Department of Mathematics
Academic or Professional Program Name: BSc. of Math.
Final Certificate Name: BSc. of Math.
Academic System: Courses
Description Preparation Date: 10-9-2025
File Completion Date: 10-9-2025

Signature:
Head of Department Name: Mohammed S. Kadhim
Date: 10/9/2025

Signature:
Scientific Associate Name:
الأستاذ الدكتور
عادل علي عبد الحسن
معاون العميد للشؤون العلمية والدراسات العليا
Date:

The file is checked by:
Department of Quality Assurance and University Performance
Director of the Quality Assurance and University Performance Department:
Date: 10/9/2025
Signature: Dunya Ali Hussain

Approval of the Dean
الاستاذ الدكتور
علي عبد الامام عبد الزهرة
عميد كلية العلوم / جامعة البصرة

1. Program vision

The program aims to raise the level of mathematics department graduates to truly participate in keeping pace with scientific, cognitive, and technological developments. This is achieved by working to raise the level of the department among Iraqi university departments to reach an advanced level befitting its status.

2. Program message

The program's mission seeks to advance the educational and pedagogical process in the mathematics department to achieve advanced levels of quality and academic performance. This is achieved by equipping students with logical thinking and research skills, enabling them to integrate into the labor market, and achieve advanced accomplishments.

3. Program objectives

Stimulate the logical faculty of graduates, enabling them to comprehend mathematical concepts.

-Improve the quality of education to keep pace with scientific and technological developments in international universities.

-Raise the level of undergraduate curricula to address scientific progress.

-Graduate cadres with the necessary skills by maintaining the department's academic level by attracting and developing scientific competencies.

-Support and develop the foundations of scientific research in mathematics.

4. Program accreditation

There is currently no program accreditation for the program, and we are actively pursuing accreditation by meeting all required requirements.

5. Other external influences

Currently, the university is sponsoring the program and there are no external sponsors for the program.

6. : Program description

The curriculum includes a set of courses taught at four academic levels, including theoretical and practical courses that address the requirements of the mathematics major, as follows:

Credit hours		Course name	Course code	Level
practical	theoretical			Level 1
	3	Calculus 1	R101	
	3	Mathematics Foundations 1	R103	
	4	Sports methods	R107	
	3	Mathematics Foundations 2	R104	
	3	Calculus 2	102	
				Level 2
	3	Linear Algebra 1	R211	
	3	Linear Algebra 2	R212	
	3	Linear programming	R213	
	3	Solving ordinary differential equations	R214	
	3	probability	R215	
	3	Mathematical statistics	R216	
	3	Dihyat systems	R219	
				Level 3
	3	Mathematical Analysis 1	R331	
	3	Mathematical Analysis 2	R332	
	3	Group theory	R333	
	3	Guessing theory	R334	
	4	Numerical Analysis 1	R335	
	3	Theory of ordinary differential equations	R336	
	3	Applied Mathematics	R337	
	3	Operations Research	R338	
	3	Ring theory	R339	
	3	Hypothesis testing	R341	
	3	Data Theory	R350	
				Level 4
	3	Functional analysis	R411	
	3	Nodal Analysis 1	R431	
	3	Nodal analysis 2	R432	
	3	Topology 1	R433	
	3	Topology 2	R434	
	3	Example 1	R435	
	3	Ideal 2	R436	
	3	Partial differential equations	R437	
	3	Numerical Analysis 2	R441	
	3	approximation theory	R443	
	3	Numerical solutions of ordinary differential equations	R444	

	3	stochastic operations	R445	
	3	Analysis of variance	R448	
	3	Graduation project	R450	

7. the program Expected learning outcomes of	
Knowledge	
It expresses the scientific content the student studies, including basic facts, concepts, and principles. The importance of this knowledge lies in building a solid foundation for the student, enabling them to grasp applied concepts later.	1. Creating a generation that understands mathematics and is capable of investing in it to serve and develop society. 2. Providing the opportunity for creative minds to practice their hobby of thinking. 3. Understanding and absorbing mathematical methods. 4. The ability to use modern mathematics, computer science, and statistics programs to solve many real-life problems. 5. Teaching students that most mathematical concepts and ideas are derived from real life and are not alien to it.
Skills	
Students acquire their skills and experience through participation in carefully designed study or training plans. The teacher determines the desired objectives for each lesson and uses effective teaching methods to develop and refine the student's skills.	1. Using the traditional method of blackboard and chalk for teaching and explaining lectures. 2. Using modern and advanced methods such as interactive whiteboards and smart screens to deliver information. **3.** Using discussion and dialogue with the student to develop their ability to think and discuss.
values	
Learning outcomes play a significant and fundamental role in determining what a student should learn and what they can accomplish after completing the academic program. These values are reflected in the student's responsibility and prepare them to enter the job market or continue their	1) Developing the student's ability to engage in dialogue, debate, and assert themselves. 2) Developing the student's ability to use modern learning tools, such as the internet. 3) Developing the student's ability to interact with multimedia.

higher education.	4) Developing the student's ability to engage with advanced technologies.

8. Teaching and learning strategies

The program's teaching strategies rely on:
- Traditional theoretical lectures explained by the professor.
- The use of modern tools such as projectors, the internet, and e-classrooms.
- Mini-projects within lectures to enhance practical understanding.

9. Evaluation methods

1- Continuous follow-up by the instructor.
2- Daily and monthly discussions.
3- Daily, weekly, and monthly tests.
4- Quarterly reports and seminar presentations.
5- Homework assignments.

teaching staff		Specialization		rank
lecturer	permanent	private	general	
	permanent	Harmonics	mathematics	حسام لوتي سعد حسن الثعالبي
	permanent	algebraic topology	mathematics	هناء مرتضى علي كرم الحمداني
	permanent	partial differential equations	mathematics	عقيل جاسم حرفش سيد الرحماني
	permanent	soccer	sports	لفته حميد سلمان داوود العطبي
	permanent	dynamic systems	mathematics	اياد ريسان خضير عبيد عباس
	permanent	numerical analysis	mathematics	علاء حسن عبدالله غدنان المسلماوي
	permanent	algebra	mathematics	شكر محمود خليل ابراهيم السالم
	permanent	Literature/Literary Criticism	Arabic language	رباب حسين منير كريم الصادج
	permanent	Sound processing	mathematics	ايناس وهاب عبود داود الحلفي
	permanent	dynamic systems	mathematics	سناء لفته خلف عطية الثعلبي
	permanent	Applied Mathematics	mathematics	عبير مجيد جاسم محمد حسيكا
	permanent	algebraic topology	mathematics	قصي سعود عبدالعزيز خالد الزامل
	permanent	numerical analysis	mathematics	بشرى عزيز طه ياسين الدوسري
	permanent	Mathematical statistics	mathematics	زينب عبدالحسين عبدالله محسن الكعباوي
	permanent	Mathematical statistics	mathematics	عبدالله عبد القادر امين عبدالله العبيدي
	permanent	Data Theory	mathematics	علاء عامر نجم عباس الصالحي
	permanent	partial differential equations	mathematics	شذى احمد مهدي احمد حداد
	permanent	approximatio theory n	mathematics	امل خليل حسن ناصر المحمود
	permanent	literature	Arabic language	زينب كامل عبدالحسن جياد الاسدي
	permanent	Operations Research	mathematics	مهند رياض سعد رشم البهادلي
	permanent	differential equations	mathematics	هدى عبد الجبار جلوب حسن المالكي
	permanent	Applied Statistics	mathematics	هدى زكي ناجي صادق احمد
	permanent	networks	computer	حيدر نوري حسين نور الهاشمي

	permanent	Applied Mathematics	mathematics	جيهان محمد خضير جعفر العامري
	permanent	partial differential equations	mathematics	خلدون سعد غالب حمادي الياسري
	permanent	count	mathematics	محمد ساري كاظم سوادي السكيني
	permanent	algebra	mathematics	محمد علي إبراهيم
	permanent	dynamic systems	mathematics	صبيح لفتة جاسم محمود المعدن
	permanent	partial differential equations	mathematics	ماهر جاسم جابر سلطان العبودي
	permanent	Mathematical statistics	mathematics	ولاء خزعل سالم راضي الكريماوي
	permanent	Information technology	compuer	زينب امين عبد الجبار عبد الله السلمي
	permanent	Operations Research	mathematics	فرحان كاظم شعين مجيد المالكي
	permanent	algebra	mathematics	احمد حسين جاسم سلطان الدراجي
	permanent	differential topology	mathematics	محمد يوسف عباس عبد الكريم الشامي
	permanent	Applied mathematics	mathematics	رنا داود عبد الوهاب داود الحلفي
	permanent	numerical analysis	mathematics	افراح عبد الإمام احمد عباس المازني
	permanent	approximation theory	mathematics	حنين جعفر صادق جعفر المنصوري
	permanent	Artificial intelligence	mathematics	بهاء حسين طاهر نعمة الجبيلي
	permanent	control	mathematics	ندى كاظم مهدي عبدالله الكطراني
	permanent	Dali analysis	mathematics	محمد خلف عبد الله محمد المحمد
	permanent	Data Theory	mathematics	سماهر عدنان عبدالغني ابراهيم العيسى
	permanent	Data Theory	mathematics	سعاد عبد الرزاق سوادي رومي المالكي
	permanent	Mathematical analysis	mathematics	زينب سامي ماضي ديوان الضويح
	permanent	algebra	mathematics	جنان عبد الرضا رسن علواش المالكي
	permanent	Mathematical statistics	mathematics	خولة عبد الرزاق سوادي رومي المالكي
	permanent	control	mathematics	وسن إبراهيم خليل ابراهيم الحمادة
	permanent	Operations Research	mathematics	هيفاء عاصي كاوي مبادر المالكي
	permanent	numerical analysis	mathematics	اسماء جبار مذخور حسين آل أزيرج

	permanent	algebraic topology	mathematics	اماني جمال فاضل زرزور العبود
	permanent	Mathematical analysis	mathematics	شيرين جميل عباس علي الحلفي
	permanent	Fractional differential equations	mathematics	كريمة محمد جايد فعيل العيداني
	permanent	numerical analysis	mathematics	سحر داود شاكر محمد البصري
	permanent	Harmonics	mathematics	رشا هادي جابر عبد العالي الحلفي
	permanent	numerical analysis	mathematics	فهد كامل نشمي جراد الزهيري
	permanent	numerical analysis	mathematics	بشائر كاظم جاسم كاظم البحراني
	permanent	algebra	mathematics	مروى محمد جواد كاظم حمد الموسوي
	permanent	Communications and Computer	engineering	وفاء عبدالمحسن خضير
	permanent	Algebraic topology	mathematics	حوراء حيدر عبد الكريم عبد الله المبارك
	permanent	Mathematical analysis	mathematics	عذراء فاضل عبد علي عبيد الحلفي
	permanent	Harmonics	mathematics	صادق ماجد خلف محمد علي الشاوي
	permanent	differential equations	mathematics	ايات عبد الكريم حميد ياسين الاسماعيلي
	permanent	Numerical analysis	mathematics	محمد حمود هاشم باسين الشميمي
	permanent	dynamic systems	mathematics	زينب اسعد لازم علي العطب
	permanent	algebraic topology	mathematics	لبيبة مضير عبد الوهاب عبد الواحد الحلفي
	permanent	algebra	mathematics	فاطمة حميد خضير شمير القطراني
	permanent		sports	لفته حميد سلمان داوود العطبي

10.Acceptance criteria

The college develops plans and procedures to guide new members to help them integrate into the educational process at all levels.

11.The most important sources of information about the program

1. Central admissions and student admission regulations are in accordance with approved ministerial instructions.
2. Personal interviews for students during the application period.
3. The department's capacity in terms of financial and human resources. .

12.Program Development Plan

-The Quality Assurance and Academic Performance Department at the university and college.
- The program description form and its accompanying explanations provided by the university.
- Electronic links to Iraqi and foreign universities.
- The Ministry of Higher Education and its standards through official letters, workshops, and ongoing seminars.

Program Skills Map

Required learning outcomes of the program															
values				Skills				knowledge				Essential or ?optional	Course name	Course code	Year/Level
A4	Part 3	Part 2	Part 1	B4	B3	B2	B1	A4	A3	A2	A1				
√	√	√	√	√	√	√	√	√	√	√	√	essential	Calculus 1	R101	First
												essential	Mathematics Foundations 1	R103	
√	√	√	√	√	√	√	√	√	√	√	√	essential	Sports methods	R107	
√	√	√	√	√	√	√	√	√	√	√	√	essential	Mathematics Foundations 2	R104	
√	√	√	√	√	√	√	√	√	√	√	√	essential	Calculus 2	102	
√	√	√	√	√	√	√	√	√	√	√	√	essential	Linear Algebra 1	R211	Second
√	√	√	√	√	√	√	√	√	√	√	√	essential	Linear Algebra 2	R212	
√	√	√	√	√	√	√	√	√	√	√	√	essential	Linear programming	R213	
√	√	√	√	√	√	√	√	√	√	√	√	essential	Solving ordinary differential equations	R214	
√	√	√	√	√	√	√	√	√	√	√	√	essential	probability	R215	
√	√	√	√	√	√	√	√	√	√	√	√	essential	Mathematical statistics	R216	

√	√	√	√	√	√	√	√	√	√	√	√	**test My**	Dihyat systems	R219	
√ √	√ √	√ √	√ √	√ √	√ √	√ √	√ √	√ √	√ √	√ √	√ √				**Third**
												essential	Mathematical Analysis 1	R331	
												essential	Mathematical Analysis 2	R332	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Group theory	R333	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Guessing theory	R334	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Numerical Analysis 1	R335	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Theory of ordinary differential equations	R336	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Applied Mathematics	R337	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Operations Research	R338	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Ring theory	R339	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Hypothesis testing	R341	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Data Theory	R350	
															Fourth
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Functional analysis	R411	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Nodal Analysis 1	R431	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Nodal analysis 2	R432	

√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Topology 1	R433	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Topology 2	R434	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Example 1	R435	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Ideal 2	R436	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Partial differential equations	R437	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Numerical Analysis 2	R441	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	approximation theory	R443	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Numerical solutions of ordinary differential equations	R444	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	stochastic operations	R445	
√	√	√	√	√	√	√	√	√	√	√	√	**optional**	Analysis of variance	R448	
√	√	√	√	√	√	√	√	√	√	√	√	**essential**	Graduation project	R450	

Course Description Form

1. Course name
Calculus (1)
2. Course code
R101
3. semester/year
First semester / 2025-2026
4. prepared Date this description was

2025\9\1	
5. Available attendance forms	
Face to face mode	
6. (total) Number of units / (total) Number of study hours	
3/60	
7. is than one name More (if applicable) Course instructor name (mentioned	
8. Course objectives	
1. Provide students with a solid understanding of real numbers and their properties. 2. Introduce students to important examples of functions, limits, and their graphs. 3. Prepare students for advanced studies in integrals and their derivatives. 4. Develop the ability to apply basic laws of integration to solve problems in various ways	**Course objectives**
Learning and teaching strategies	
1- Lectures: Classroom lectures to introduce and explain key concepts and features.	**Strategy**

2- Examples and Problem Solving: Work through examples and problem-solving exercises to enhance understanding and develop problem-solving skills. 3- Group Discussions: Encourage student participation in group discussions to promote critical thinking and collaborative learning. 4- Tutoring: Conduct tutoring sessions to provide additional support and clarify any doubts or questions. 5- Self-Study: Encourage students to engage in independent study and explore additional resources to deepen their understanding.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	. Real numbers	and Real numbers , their properties arithmetic .operations	4	1
		functions	Definition of a function, domain, codomain, and function, range of a operations on functions, composition of functions, graphing functions The quick	4	2

			.way		
		and Goals continuity	Purpose (definition of purpose and theories related to Continuity and ,(it .its theories	**4**	**3**
		derivation	Derivative definition and) related theorems), the relationship between derivative .and continuity	**4**	**4**
		. Rolle's theorem	Rolle's Theorem text and proof with) examples) Derivative .applications	**4**	**5**
		Mean value . theorem	value Mean Text,) theorem proof, examples), derivative .applications	**4**	**6**
		definite integration	Definition of definite integration and its geometric , interpretation examples, applications (area .(calculation	**4**	**7**
		Indefinite integration	integral indefinite and its relationship to the derivative of integration) functions whose derivative is .(available	**4**	**8**

		Transcendental functions	Its goals / derivatives / . integrations	**4**	**9**
		Transcendental functions	. Its integrations	**4**	**10**
		Integration and methods their applications	laws of Basic . integration	**4**	**11**
		Integration and methods their applications	Integration methods parts Integration by .	**4**	**12**
		Integration and methods their applications	integration The trigonometric With . substitutions	**4**	**13**
		Integration and methods their applications	Integration by fraction division method, applications of . integration	**4**	**14**
		Improper integrals	Improper integrals of and methods .calculating them	**4**	**15**
Course Evaluation .11					
degree					

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
	1990		Tomas	**Calculus**	**1**
	1984	4th	Thomas. GB	**Calculus and Analytic Geometry**	**2**
	2000		Craw. I.	**Advanced Calculus and analysis MA 1002**	**3**
	1999		Dovermann. KH	**Applied Calculus math215**	**4**
New York	1971		Durfee. WH	**Calculus and Analytic Geometric**	**5**
Ministry of Higher and Education	1981		-Sabry Radif Al Ani and others	**Calculus Advanced**	**6**

Scientific Research					
Ministry of Higher Education and Scientific Research	1986		and Ali Aziz Ali others	**Principles of Calculus**	***7**
University of Iraq -Mosul	1983	Parts One and Two	.A.J Send Translated by Ali Aziz Ali and others	**Calculus and Analytical Geometry**	**8**

Course Description Form

5. Course name
Calculus (2)
6. Course code
R102
7. semester/year
First semester / 2025-2026
8. description was prepared Date this
2025\9\1
9. Available attendance forms
Face to face mode
10. (total) Number of units / (total) Number of study hours
3/60

11. is than one name More (if applicable) Course instructor name (mentioned	
Ms. Rana Daoud	
objectives Course .8	
1. Provide students with a solid understanding of basic concepts and conic sections. 2. Introduce students to important examples of polar coordinates and their applications. 3. Develop the ability to apply theoretical concepts to series testing methods and their applications. 4. Prepare students for advanced studies in advanced calculus and related fields.	Course objectives
Learning and teaching strategies .9	
1- Lectures: Classroom lectures to introduce and explain key concepts and features. 2- Examples and Problem Solving: Work through examples and problem-solving exercises to enhance understanding and develop problem-solving skills. 3- Group Discussions: Encourage student participation in group discussions to promote critical thinking and collaborative learning. 4- Tutoring: Conduct tutoring sessions to provide additional support and clarify any doubts or questions. 5- Self-Study: Encourage students to engage in independent	Strategy

study and explore additional resources to deepen their understanding.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	hours	week
degree	Face to face	conic sections	Conic sections and quadratic equations, .rotations	4	1
		Polar coordinates	Polar coordinates, the relationship between polar and Cartesian .coordinates	4	2
		Polar coordinates	The relationship between polar coordinates and conic .sections	4	3
		Polar coordinates	Graphing in polar coordinates, equation circle, and ,of a line cone in polar .coordinates	4	4
		Polar coordinates	Arc length, area in .polar coordinates	4	5
		cylindrical coordinates	Cylindrical . coordinates	4	6
		D spaces3	D coordinate system, 3 .vectors	4	7
		D spaces3	Dot product, cross .lines ,product	4	8
		D spaces3	Levels in space, their . applications	4	9

		Sequences	Sequences (definition .(and examples	**4**	**10**
		Sequences	Convergence and divergence of .sequences	**4**	**11**
		Sequences	Monotonic .sequences	**4**	**12**
		Infinite series	Methods of testing their series with **.** applications	**4**	**13**
		Infinite series	with Taylor series applications	**4**	**14**
		Infinite series	with Maclaurin series .their applications	**4**	**15**

Course Evaluation .11

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	address the	T
	1990		Tomas	**Calculus**	**1**
	1984	4th	Thomas. GB	**Calculus and Analytic Geometry**	**2**

	2000		Craw. I.	**Advanced Calculus and analysis MA 1002**	**3**
	1999		Dovermann. KH	**Applied Calculus math215**	**4**
New York	1971		Durfee. WH	**Calculus and Analytic Geometric**	**5**
Ministry of Higher and Education Scientific Research	1981		-Sabry Radif Al Ani and others	**Calculus Advanced**	***6**
Ministry of Higher Education and Scientific Research	1986		and Ali Aziz Ali others	**Principles of Calculus**	**7**

University of Iraq -Mosul	1983	Parts One and Two	.A.J Send Translated by Ali Aziz Ali and others	**Calculus and Analytical Geometry**	**8**

Course Description Form

12.	**Course name**
Foundations of Mathematics (1)	
13.	**Course code**
R103	
14.	**semester/year**

First semester / 2025-2026	
15. Date this description was prepared	
2025\9\1	
16. Available attendance form	
Face to face mode	
17. (total) Number of units / (total) Number of study hours	
3/60	
18. is than one name More (if applicable) Course instructor name (mentioned	
A.M.D. Alaa Amer	
Course objectives .8	
1. Provide students with a solid understanding of mathematical logic and sets. 2. Introduce students to important examples of set algebra and its applications. 3. Prepare students for advanced studies in basic numbers and their calculations. 4. Develop the ability to understand types of relationships and calculate equivalence classes.	**Course objectives**

Learning and teaching strategies .9

1- Lectures: Classroom lectures to introduce and explain key concepts and features. 2- Examples and Problem Solving: Work through examples and problem-solving exercises to enhance understanding and develop problem-solving skills. 3- Group Discussions: Encourage student participation in group discussions to promote critical thinking and collaborative learning. 4- Tutoring: Conduct tutoring sessions to provide additional support and clarify any doubts or questions. 5- Self-Study: Encourage students to engage in independent study and explore additional resources to deepen their understanding.	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	hours	week
degree	**Face to face**	**Principles of Mathematical Logic**	and Compound conditional phrases ,Condition Duality , summation and contradictions . arguments	**4**	**1**
		Principles of Mathematical	sentences , Open , boxed phrases	**4**	**2**

		Logic	, forms argumentative Methods of . proof mathematical		
		of Algebra groups	,of set Concept ,of sets equality complement , subsets . of set	**4**	**3**
		of Algebra groups	sets Operations on intersection and) union of sets, (.distributive law, etc	**4**	**4**
		of Algebra groups	De Morquin's laws, Cartesian product of .sets	**4**	**5**
		Relationships and their types	Relationships and their types:Reflexive, symmetrical, transitive, and .equivalence relations	**4**	**6**
		Relationships and their types	Equivalence classes, division set, and set .partitioning	**4**	**7**
		Relationships and their types	Partially ordered and .ordered sets fully	**4**	**8**
		Applications and their types	, Applications Definitions and) .(examples	**4**	**9**
		Applications and their types	Application statement, comprehensive, contrasting and contrasting .applications	**4**	**10**
		Applications and their types	Types of applications application limitation,) application	**4**	**11**

			composition and properties, peer .(application		
		Applications and their types	Images and mirror images (reverse images) are created .by applications	**4**	**12**
		Prime numbers	, numbers Cardinal . sets infinite	**4**	**13**
		Prime numbers	.Multiple groups	**4**	**14**
		Prime numbers	Calculating basic .numbers	**4**	**15**

Course Evaluation .11

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
			Seymour Lipschutz	**Theory and Problems of set theory and related topics**	**1**
New York.	1965	2nd	Wildel R.	**Introduction to the**	**2**

				foundation of mathematics	
University of Iraq , Basra	1983	Parts one and two	Hadi Jaber Mustafa and others	**Foundations of * mathematics**	**3**
University of Iraq -Baghdad	2000	1	Adel Ghassan Naoum and -Atta Al Basil Hashemi	**Introduction to the Foundations of Mathematics**	**4**

Course Description Form

19. Course name
Foundations of Mathematics (2)
20. Course code
R104
21. semester/year
semester / 2025 First-2026
22. Date this description was prepared
2025\9\1
23. Available attendance forms
Face to face mode
24. Number of units / (total) Number of study hours
3/60

25. is than one name More (if applicable) Course instructor name (mentioned	
Shukr Mahmoud .Prof. Dr	
Course objectives .8	
1- Understand the concepts and properties of the natural abacus, the integer abacus, the fundamental abacus, and the real abacus. 2- Introduce number theory and its importance in various fields of mathematics. 3- Basic exploration of calculations and their applications in number predictions.	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: Classroom lectures to introduce and explain key concepts and features. 2- Examples and Problem Solving: Work through examples and problem-solving exercises to enhance understanding and develop problem-solving skills. 3- Group Discussions: Encourage student participation in group discussions to promote critical thinking and collaborative learning. 4- Tutoring: Conduct tutoring sessions to provide additional support and clarify any doubts or questions. 5- Self-Study: Encourage students to engage in independent study and explore additional resources to deepen their	**Strategy**

understanding.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	hours	week
degree	Fce to face mode	Introduction to Natural Numbers	Natural numbers as a .ordered set-well	4	1
		natural numbers	Piano system for ,natural numbers creating natural .numbers	4	2
		inductive reasoning	Mathematical .induction	4	3
		absolute value	Absolute value and its . applications	4	4
		integers	integers Definition of And the and examples for algorithm division .integers	4	5
		rational numbers	numbers Rational definitions,) properties, and .(operations	4	6
		Equivalent Fractions and Simplification	And ,Definition mathematical . operations	4	7
		numbers real	) numbers Real definition, properties, and arithmetic	4	8

			and the (operations between relationship and numbers rational numbers real		
		Introduction to Number Theory	Constructing complex numbers and their geometric . representation	**4**	**9**
		Prime numbers, composite numbers, and divisibility	number Complex The , angle fundamental theorem . in algebra	**4**	**10**
		Prime factorization and its applications	. of integers Divisibility	**4**	**11**
		Euclid's algorithm and greatest common divisor	Greatest common and Euclid's divisor . primer	**4**	**12**
		Fundamental Theorem of Arithmetic	Relatively prime statement , numbers . and proof	**4**	**13**
		Unique factorization theory	Prime numbers and . their distributions	**4**	**14**
		The fundamental theorem of	Applications of the theorem fundamental and in arithmetic perfect numbers.	**4**	**15**

		arithmetic			

Course Evaluation .11

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
			Seymour Lipschutz	**Theory and Problems of set theory and related topics**	**1**
New York.	1965	2nd	Wildel R.	**Introduction to the foundation of mathematics**	**2**
University of Iraq , Basra	1983	Parts one and two	Hadi Jaber Mustafa and others	**Foundations of mathematics**	**3**

University of Iraq - Baghdad	2000	1	Adel Ghassan Naoum and -Atta Al Basil Hashemi	**Introduction to the Foundations of * Mathematics**	**4**

Course Description Form

26.	**Course name**
Topics in General Mathematics	
27.	**Course code**
R107	
28.	**semester/year**
First semester / 2025-2026	
29.	**Date this description was prepared**
2025\9\1	
30.	**Available attendance forms**
Face to face mode	
31.	**(total) Number of units / (total) Number of study hours**

4/60	
32. is than one name More (if applicable) Course instructor name (mentioned	
M.M. Asmaa Jabbar	
Course objectives .8	
1. Introduce students to complex numbers and their geometric representation. 2. Provide students with a comprehensive understanding of matrices, their types and properties, and how to find their determinant and inverse. 3. Develop students' skills in using various methods to solve linear systems and polynomials.	**rse objectivesCou**
Learning and teaching strategies .9	
1- Lectures: Classroom lectures to introduce and explain key concepts and features. 2- Examples and Problem Solving: Work through examples and problem-solving exercises to enhance understanding and develop problem-solving skills. 3- Group Discussions: Encourage student participation in group discussions to promote critical thinking and collaborative learning. 4- Tutoring: Conduct tutoring sessions to provide additional support and clarify any doubts or questions.	**Strategy**

5- Self-Study: Encourage students to engage in independent study and explore additional resources to deepen their understanding.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	**Introduction to Complex Numbers**	Introduction to complex and numbers ,their properties geometric of representation complex roots of ,numbers complex . numbers	4	1
		Polynomials	and Polynomials ,their properties the relationship between the coefficients of and polynomials . their roots	4	2
		Solve a polynomial	Methods for	4	3

		equation	- first solving fourth degree polynomial . equations		
		consistent systems linear	of Definitions consistent ,linear inconsistent and and their systems .solutions	**4**	**4**
		homogeneous systems	of Definition homogeneous linear systems and their .solutions	**4**	**5**
		Matrices	Some types of arrays (their definitions and .(properties	**4**	**6**
		Algebraic operations	Algebraic operations on matrices, transpose of a (transpose) .matrix	**4**	**7**
		symmetric	Symmetric and	**4**	**8**

		matrices	symmetric -non matrices and their some of . properties		
		algebraic properties	Algebraic properties of operations on , matrices reduced row . system	**4**	**9**
		Class equivalence	Class equivalence in . matrices	**4**	**10**
		System of linear equations	Solve a system of linear equations using . matrices	**4**	**11**
		Jordan -Kaos	-the Gauss Use , Jordan method anomalous and anomalous -non matrices , and the analogue of a -non	**4**	**12**

			dysfunctional to find the matrix solution of the .system		
		The determinants	Determinants and their And properties use the publishing method Cofactors for finding the value ,determinants of . cofactor matrix	**4**	**13**
		Linear system	Solve the linear using system R's Karami . method	**4**	**14**
		inverse matrix	the inverse Use matrix method to solve a linear . system	**4**	**15**
Course Evaluation .11					

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
University of Basra Iraq -	1985	First Edition	Riyad Shaker Naoum and others	***Sports methods**	**1**
University of Baghdad, Iraq	1989	Parts One and Two	-Khaled Ahmed Al Samarrai and Saad Ibrahim Mahdi	**Introduction to Linear Algebra**	**2**
University of Mosul, Iraq	1988	First Edition	Yahya Abdul Saeed and Nizar Hamdoun Shukr	**Linear algebra**	**3**
Mustansiriya -Al Iraq -University	1978	First Edition	Bayati-Adel Zainal Al	**Matrices**	**4**
University of Iraq -Technology	1991	First Edition	Mustafa Ahmed and others	**Introduction to Finite Mathematics**	**5**
University of	1990	First	Bernard Coleman, translated by Adel	**Introduction to Linear**	**6**

Baghdad, Iraq		Edition	Ghassan Naoum and -Basil Atta Al Hashemi	**Algebra with Applications**	

Description Form R201 Course

33. Course Name : Advanced Calculus
34. Course code :R201
35. First Semester 2025 : Semester/Year-2026
36. 2025/9/12 : Date this description was prepared
37. Available attendance forms : Face to face mode
38. total): 60 / 4) Number of units / (total) Number of study hours

39. is than one name More (if applicable) Course instructor name Prof. Dr. Aqil Jassim Harfash (mentioned	
Course objectives .8	
To develop advanced calculus problem-solving skills. 2. To understand the derivation of multivariable cases. 3. This course covers the basic concepts of multiple integrals. 4. It includes a comprehensive understanding of vectors and their applications. 5. It includes studies of surface and line integrals. 6. It also includes a study of the basic theorems of integration.	**Course objectives**
Learning and teaching strategies .9	
1-Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems.	**gyStrate**

7- Self-study: Read recommended textbooks and research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face mode**	Definition of multivariable functions	Understanding Mathematical Rigor: Develop a strong foundation in mathematical proof techniques, including logical reasoning, theorem formulation, and proof writing skills .	**4**	**1**
degree	**Face to face mode**	Definition of multivariable functions	Understanding Mathematical Rigor: Develop a strong foundation in mathematical proof techniques, including logical reasoning, theorem formulation, and proof writing skills .	**4**	**2**

degree	**Face to face mode**	Goals and continuity	Limits and Continuity: Gain a deeper understanding of the concepts of limits and continuity, including the ability to evaluate limits using different techniques, such as L'Hôpital's rule .	**4**	**3**
degree	**Face to face mode**	derivatives partial	:Differentiation Expand your knowledge of differentiation to include more advanced topics, such as partial derivatives, implicit differentiation, and order -higher derivatives. Apply differentiation techniques to solve problems involving optimization, related rates of e, and curve chang graphing.	**4**	**4**

degree	**Face to face mode**	Tangent and normal planes to the surface	Differentiation: Expand your knowledge of differentiation to include more advanced topics, such as partial derivatives, implicit differentiation, and order -higher derivatives. Apply differentiation techniques to solve problems involving optimization, ed rates of relat change, and curve graphing.	**4**	**5**
degree	**Face to face mode**	Double integrals and their applications	Integration: Explore advanced integration techniques, such as integration by parts, trigonometric substitutions, factoring partial fractions, and indefinite integrals. Apply methods of integration to calculate areas, volumes, and arc lengths.	**4**	**6**

degree	**Face to face mode**	Equation of a straight line in a ,plane Differentials and approximation, maximum and minimum values.	Sequences and Series: Study of convergence and divergence of sequences and series, including the use of tests such as the comparison test, the ratio test, and the integration test. Understand power series and Taylor series expansions.	**4**	**7**
degree	**Face to face mode**	Double integrals in polar coordinates	Vector Calculus: Introduces the concepts of vector functions, including differentiation and integration of vectors. Study vector fields, line integrals, surface integrals, and the theorems of Green, Gauss, and Stokes.	**4**	**8**

degree	**Face to face mode**	integrals Triple and their applications	Multivariable Calculus: Extending the ideas of calculus to include functions of several variables. Explore topics such as partial derivatives, directional derivatives, multiple integrals, and applications to s, areas, volume and centers of gravity.	**4**	**9**
degree	**Face to face mode**	integrals Triple and their applications	Multivariable Calculus: Extending the ideas of calculus to include functions of several variables. Explore topics such as partial derivatives, directional derivatives, multiple integrals, and applications to areas, volumes, and centers of gravity.	**4**	**10**

degree	**Face to face mode**	in Integrals cylindrical coordinates	Differential Equations: Introducing ordinary differential equations(ODEs) and their solutions. Covering topics order -such as first ordinary differential equations, order -second linear ordinary differential equations with constant coefficients, and basic techniques for solving ordinary differential equations.	**4**	**11**
degree	**Face to face mode**	in Integrals spherical coordinates	Applications: Apply calculus -concepts to real world problems in physics, engineering, economics, and other fields. Develop the ability to model and solve practical problems using	**4**	**12**

			calculus techniques.		
degree	**Face to face mode**	Linear integration	Mathematical Communication: Enhance mathematical communication skills, including the ability to explain concepts, write clear mathematical proofs, and present solutions to complex problems.	**4**	**13**
degree	**Face to face mode**	Linear integration	Mathematical Communication: Enhance mathematical communication skills, including the ability to explain concepts, write clear mathematical proofs, and present solutions to complex	**4**	**14**

			problems.		
degree	**Face to face mode**	Linear integration applications	Mathematical Communication: Enhance mathematical communication skills, including the ability to explain concepts, write clear mathematical proofs, and present solutions to complex problems.	**4**	**15**
Course Evaluation .11					
degree					
Learning and teaching resources .12					
Calculus			Tomas		
Calculus and Analytic Geomatry			Thomas. GB		

Advanced Calculus and analysis MA 1002	Craw. I.
Applied Calculus math215	Dovermann. KH
Calculus and Analytic Geometric	Durfee. WH
Calculus Advanced	Ani and others-Sabri Radif Al
Principles of Calculus	others Ali Aziz Ali and
Calculus and Analytical Geometry	.A.G I send Translated by Ali Aziz Ali and others

Course Description Form R211

40. Course Name : Linear Algebra 1
41. Course code : R211
42. First Semester 2025 : Semester/Year-2026
43. 2025/9/1 : Date this description was prepared
44. Available attendance forms : Face to face mode

45. total): 60 / 3) Number of units / (total) Number of study hours
46. is than one name More (applicable if) Course instructor name Dr. Mohammed Khalaf : (mentioned

Course objectives .8	
• ..... • ..... •	
Learning and teaching strategies .9	
1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems. 7- Self-study: Read recommended textbooks and	**Strategy**

research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face mode**	vector space, subspace		**4**	**1**
degree	**Face to face mode**	Subspace Algebra ,Intersection) Union, Addition and Direct Addition of (Subspaces		**4**	**2**

degree	**Face to face mode**	Linear Independence with Related Theorems		**4**	**3**
degree	**Face to face mode**	basis of vector space		**4**	**4**
degree	**Face to face mode**	Vector space dimension and its properties		**4**	**5**

degree	**Face to face mode**	Coordinates and changing rules		**4**	**6**
degree	**Face to face mode**	Row order and column order of a matrix and the relationship between them		**4**	**7**
degree	**Face to face mode**	Foundations bases) in)R^n		**4**	**8**

degree	**Face to face mode**	Scalar and directional product of vectors		**4**	**9**
degree	**Face to face mode**	Linear transformations with examples		**4**	**10**
degree	**Face to face mode**	conversion kernel		**4**	**11**

degree	**Face to face mode**	Conversion range		**4**	**12**
degree	**Face to face mode**	Linear transformation matrix and its properties		**4**	**13**
degree	**Face to face mode**	Linearly symmetric spaces		**4**	**14**

degree	**Face to face mode**	Linear functions		**4**	**15**
Course Evaluation .11					
degree					
and teaching resources Learning .12					
Linear algebra			**Linear Algebra**		
Introduction to Linear Algebra			**Linear Algebra and Its Applications**		
Linear algebra			**Linear Algebra**		
Introduction to Linear Algebra with Applications			**Introductory Linear Algebra with Applications**		

Course Description Form R212

47.	Course Name: Linear Algebra 2
48.	Course code : R212
49.	Semester/Year: First Semester 2025-2026
50.	2025/9/1 : Date this description was prepared
51.	Available attendance forms : Face to face mode
52.	total) / Number of units (total): 60 / 3) Number of study hours

53. Name of the course supervisor (if more than one name is mentioned): Assistant Professor Dr. Khaldoun Saad Ghaleb	
Course objectives .8	
1. To provide an understanding of the basic concepts and techniques in linear algebra. 2. To develop the ability to solve problems related to eigenvalues, eigenvectors, and matrix decomposition. 3. To explore the applications of linear algebra in various fields such as linear programming, quadratic forms, and graph theory. 4. To enhance critical thinking and analytical skills through the study of abstract mathematical concepts.	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems. 7- Self-study: Read recommended textbooks and research	**Strategy**

articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	

10.Course structure

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face mode**	Characteristic polynomial of a square matrix	Demonstrate a strong understanding of characteristic limits and the characteristic equation of a matrix.	**4**	**1**
degree	**Face to face mode**	characteristic equation	Demonstrate a strong understanding of characteristic limits and the characteristic equation of a matrix.	**4**	**2**

degree	**Face to face mode**	Eigenvalues and eigenvector of a matrix	Calculate the eigenvalues and eigenvectors of matrices and apply them to .roblemssolve p	**4**	**3**
degree	**Face to face mode**	-Caley Hamilton's Theorem and Its Applications	Calculate the eigenvalues and eigenvectors of matrices and apply them to .solve problems	**4**	**4**
degree	**Face to face mode**	Similar matrices	Apply the -Cayley Hamilton theorem to evaluate powers of matrices and express polynomials in terms of matrices.	**4**	**5**

degree	**Face to face mode**	Distillable matrices and their properties	Apply the -Cayley Hamilton theorem to evaluate powers of matrices and express polynomials in terms of matrices.	**4**	**6**
degree	**Face to face mode**	Euclidean spaces	Determine whether two matrices are similar and understand the implications of similarity.	**4**	**7**
degree	**Face to face mode**	-Cauchy Schwartz inequality	Determine whether two matrices are similar and understand the implications of similarity.	**4**	**8**

degree	**Face to face mode**	Triangle inequality	Learn about and work with slicable matrices and their properties.	**4**	**9**
degree	**Face to face mode**	Perpendicular foundations	Learn about and work with slicable matrices and their properties.	**4**	**10**
degree	**Face to face mode**	-Kram Schmidt method with examples	Apply linear algebra techniques to solve problems in linear programming, quadratic forms, and graph .theory	**4**	**11**

degree	**Face to face mode**	Some applications of linear algebra	Apply linear algebra techniques to solve problems in linear programming, c forms, quadrati and graph .theory	**4**	**12**
degree	**Face to face mode**	Linear programming	Apply the concepts of Euclidean space, orthogonal basis, and Schmidt -Gram process to solve problems.	**4**	**13**
degree	**Face to face mode**	Quadratic formulas	Apply the concepts of Euclidean space, orthogonal basis, and Schmidt -Gram process to solve problems.	**4**	**14**

degree	**Face to face mode**	.Data theory	Apply the concepts of Euclidean space, orthogonal basis, and Schmidt -Gram process to solve problems.	**4**	**15**

Course Evaluation .11	
degree	
Learning and teaching resources .12	
Linear algebra	**Linear Algebra**
Introduction to Linear Algebra	**Linear Algebra and Its Applications**
Linear algebra	**Linear Algebra**
Introduction to Linear Algebra with Applications	**Introductory Linear Algebra with Applications**

Course Description Form R2

54. Course Name: Linear Programming
55. Course code: R213
56. Semester/Year: First Semester 2025-2026
57. 2025/9/1 : Date this description was prepared
58. Available attendance forms : Face to face mode

59. Number of study hours (total) / Number of units (total): 60 / 3	
60. Name of the course supervisor (if more than one name is mentioned): Asst. Dr. Farhan Kazim Sha'een	
Course objectives .8	
1- Understand the nature of linear programming (LPP) problems and their applications. 2. Learn to formulate and construct linear programming models. 3. Identify different methods for solving linear programming models, including the simplex method, the M-procedure method, the two-step method, the dual simplex method, and the modified simplex method. 4. Explore the graphical representation of linear programming models. 5. Gain knowledge of sensitivity analysis and its importance in improving solutions to linear programming models. 6. Study special types of linear programming solutions in real-world applications. 7. Develop skills in constructing dual models and understanding their relationship to the original models. 8. Learn different methods for solving numerical programming models, such as the approximation method, the plane partition method, and the branch-and-expansion method. 9. Gain an understanding of dual programming and its	**Course objectives**

importance in linear programming.	

Learning and teaching strategies .9

1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems. 7- Self-study: Read recommended textbooks and research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week

degree	**Face to face**	The nature of linear programming, formulation and construction of linear programming models with applications	Formulating and constructing linear programming -models for real world applications.	**4**	**1**
degree	**Face to face**	General form of the linear programming model, forms and formulas for linear programming models	Introduction to Linear Programming Problems(LPP)	**4**	**2**
degree	**Face to face**	Graphical representation method, simplex method	Solving linear programming problems using the simplex method.	**4**	**3**

degree	**Face to face**	M style - -method , two .stage method	Solve linear programming problems using the double simplex method, the largeM method and the , modified simplex method .	**4**	**4**
degree	**Face to face**	Special cases of linear programming solutions when applied	Solving linear programming problems using the graphical method and applying special cases to the real world	**4**	**5**
degree	**Face to face**	Special cases of linear programming s when solution applied	Solving linear programming problems using the graphical method and applying special cases to the real world	**4**	**6**

degree	**Face to face**	The importance of the corresponding model, the general steps for forming the second model	General steps for building the second model: Formulating the dual model from the initial model.	**4**	**7**
degree	**Face to face**	The relationship between the first and second models .	The relationship between the solutions to the first and second models: duality theory, complementary slack.	**4**	**8**
degree	**Face to face**	Opposite simplex method	Solving linear programming problems using the double simplex method	**4**	**9**

degree	**Face to face**	Modified Simplex Method	Solving linear programming problems using the double simplex method	**4**	**10**
degree	**Face to face**	Sensitive -analysis (post optimization (analysis	Conduct sensitivity analysis to evaluate the impact of changes inLPP parameters.	**4**	**11**
degree	**Face to face**	Changes in the hand -right side, changes in the objective function coefficients, changes in the coefficients within the constraints	Conduct sensitivity analysis to evaluate the impact of changes inLPP parameters.	**4**	**12**

degree	**Face to face**	Solution methods for numerical programming models approximation) method, plane section method, branching and extension .(method	Apply different methods to solve numerical programming models.	**4**	**13**
degree	**Face to face**	Solution methods for numerical ogramming pr models approximation) method, plane section method, branching and extension .(method	Apply different methods to solve numerical programming models.	**4**	**14**
degree	**Face to face**	binary programming	Understanding the concept of binary programming its and applications	**4**	**15**

Course Evaluation .11	
degree	
Learning and teaching resources .12	
Linear Programming	Gass S.
Basic Linear Programming	Bunday B.
Introduction to Linear Programming	Adel Ghassan Naoum
Introduction to Linear Algebra with its Applications	translated by Dr. , Coleman, Bernard Adel Ghassan and Dr. Basil Atta
Schaum's Outlines of Methods in Operations Research Series	Richard Bruton, translated by Dr. Ghabbari-Hassan Hosni Al
Operations Research	Abdul Diab Jazza

Description Form R214 Course

61. Course Name: Ordinary Differential Equations (1)

62. Course code: R214
63. Semester/Year: First Semester 2025-2026
64. 2025/9/1 : Date this description was prepared
65. Available attendance forms : Face to face mode
66. hours (total) / Number of units (total): 60 / 3 Number of study
67. Course supervisor name (if more than one name is mentioned): Ms. Sanaa Lafta Khalaf

Course objectives .8	
1- To introduce students to the basics of ordinary differential equations (ODEs). 2. To familiarize students with the different types of ODEs, their classifications, and standard forms. 3. To provide students with various methods for solving ODEs, including first-order differential equations and higher-order differential equations with constant and variable coefficients. 4. To enable students to apply ODEs to real-world problems and interpret solutions in the context of problems. 5. To develop students' analytical and problem-solving skills through the study of ODEs. 6. To enhance students' understanding of mathematical modeling and its applications in various fields.	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems.	**Strategy**

7- Self-study: Read recommended textbooks and research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face**	Definition of ordinary differential equations, order and degree of ordinary differential equations, linear and nonlinear differential equations their) (classifications	Define and explain the concepts of ordinary differential equations, order, degree, linearity, nonlinearity, and classifications of ordinary differential equations.	**4**	**1**

degree	**Face to face**	Solving the ordinary differential equation, dividing the solution into the special and general solution of the equation	Define and explain the concepts of ordinary differential equations, order, degree, linearity, nonlinearity, and classifications of ordinary differential equations.	**4**	**2**
degree	**Face to face**	Boundary and initial value .problems	Define and explain the concepts of ordinary differential equations, order, degree, linearity, nonlinearity, and classifications of ordinary differential equations.	**4**	**3**

degree	**Face to face**	order -First differential equations and their solutions, form standard order -of first differential equations	Define and explain the concepts of ordinary differential equations, order, degree, linearity, nonlinearity, and classifications of ordinary differential equations.	**4**	**4**
degree	**Face to face**	Classification differential of equations, linear differential equations	Define and explain the concepts of ordinary differential equations, order, degree, linearity, nonlinearity, and classifications of ordinary differential equations.	**4**	**5**

degree	**Face to face**	order-First separable differential equations and homogeneous equations, complete differential equations	order -Solve first differential equations using various methods, such as separation of variables, complete equations, homogeneous equations, and integration factors.	**4**	**6**
degree	**Face to face**	Linear differential equations of ordern solution) methods) Linear differential equations of ordern with constant coefficients	Solve higher order differential equations with constant coefficients using characteristic roots and the method of indeterminate coefficients.	**4**	**7**
degree	**Face to face**	Method of solving using characteristic roots, solving -non homogeneous linear equations,	Solve higher order differential equations with constant coefficients using teristic charac	**4**	**8**

		method of finding a particular solution using the method of indeterminate coefficients	roots and the method of indeterminate coefficients.		
degree	**Face to face**	How to find a specific solution using the method and the method of changing parameters	Solve higher order differential equations with constant coefficients using characteristic roots and the method of indeterminate coefficients.	**4**	**9**
degree	**Face to face**	Study of differential equations with variable coefficients and some methods for . them solving	-Solving non homogeneous differential equations using the method of indeterminate coefficients and the method of changing parameters.	**4**	**10**

degree	**Face to face**	Euler's equation and how to solve it, using the power series about the normal point	Euler's Equations: Definitions, Solution Methods	**4**	**11**
degree	**Face to face**	Frobenus diffusion method around regular anomalous points, Bessel equation	Power series solutions for regular single points	**4**	**12**
degree	**Face to face**	Legendre's equation, Laplace using transforms to solve differential equations, studying the Laplace concept with its properties	Laplace transforms and their properties	**4**	**13**

degree	**Face to face**	Study the concept of Laplace's inverse and methods for finding it, using Laplace's d to metho solve ordinary differential equations with constant coefficients	Inverse Laplace Transforms. Laplace's method for solving ordinary differential equations with constant .coefficients	**4**	**14**
degree	**Face to face**	Study of systems of ordinary differential equations, transforming the differential equation from ordern to a system of first order andn of independent **.** variables	-Transform higher order differential equations into -systems of first order differential equations. Analyze and interpret solutions of ordinary differential equations in the -context of real world problems.	**4**	**15**
Course Evaluation .11					
degree					

and teaching resources Learning .12	
Ordinary Differential Equations	Arrowsmith. DK & Place. CM
Introduction to Ordinary Differential Equations	Rabenstein. AL
Ordinary Differential Equations: A First course , 2nd	Brauer F. & Nohel JA
Introduction To Ordinary Differential Equations "2 nd	Stein. R.
Methods for solving differential equations	Samarrai and Yahya -Khaled Ahmed Al Abdul Saeed
Methods for solving ordinary differential equations and their applications	Ibrahim Riyad Shaker Naoum and Riyad Gharbal

Course Description Form R215

68. Course Name :Statistics and Probability (1)
69. Course code : R215
70. Semester/Year: First Semester 2025-2026
71. 2025/9/1 : Date this description was prepared
72. Available attendance forms : face to face
73. total): 60 / 3) Number of units / (total) Number of study hours
74. is than one name More (if applicable) Course instructor name A.M. Rana Daoud Abdel Wahab : (mentioned
Course objectives .8

• ..... • ..... •	**Course objectives**

Learning and teaching strategies .9

1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems. 7- Self-study: Read recommended textbooks and research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	**egyStrat**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face**	Population, sample, statistical data collection, frequency distribution table, data .presentation		**4**	**1**
degree	**Face to face**	, mean Arithmetic median, mode, harmonic mean, geometric mean, squared mean, relationship between measures of .central tendency		**4**	**2**

degree	**Face to face**	Measures of absolute dispersion range, mean) deviation, standard deviation and ,(variance		**4**	**3**
degree	**Face to face**	Measures of relative dispersion coefficient of) variation), standard .deviation		**4**	**4**
degree	**Face to face**	Moments, Moments Calculation from Ungrouped and Grouped Data		**4**	**5**
degree	**Face to face**	Skewness, measures of skewness, flattening, measure of .flattening		**4**	**6**
degree	**Face to face**	The concept of correlation, simple correlation coefficient, the concept of regression, the scatter plot		**4**	**7**

degree	**Face to face**	Least squares method, simple linear regression .equation		**4**	**8**
degree	**Face to face**	The concept of analysis of variance, way analysis of -one .variance		**4**	**9**
degree	**Face to face**	Meaning of probability, events, mutually , exclusive events independent and dependent events, laws of .probability		**4**	**10**
degree	**Face to face**	The concept of conditional probability, Bayes' law, .Bayes' theorem		**4**	**11**
degree	**Face to face**	The concept of a discrete random variable, the distribution function of a random discrete variable		**4**	**12**

degree	**Face to face**	Probability density function of a discrete .random variable		**4**	**13**
degree	**Face to face**	The concept of a continuous random variable, the distribution function of a continuous random variable		**4**	**14**
degree	**Face to face**	Probability density function of a continuous .variable random		**4**	**15**
Course Evaluation .11					
degree					

12. Learning and teaching resources

Probability and Statistics	Degroot. MH
Introduction to Mathematical Statistics	R. Hogg & A. Grage
Introduction To The Theory of Statistic	Mood. AM et.al
Probability Theory And Mathematical Statistic	Klimov. G.
Probability	Knill. O.

Course Description Form R216

75. Course Name : Statistics and Probability (2)
76. Course code: R216
77. Semester/Year: First Semester 2025-2026
78. 2025/9/1 : Date this description was prepared
79. Available attendance forms : face to face
80. Number of study hours (total) / Number of units (total): 60 / 3
81. Name of the course supervisor (if more than one name is Khazal mentioned): Asst. Dr. Walaa Salem

Course objectives .8

To provide an understanding of mathematical expectation and its properties. 2. To introduce the concepts of mean, variance, moment, and moment-generating function. 3. To explain joint distributions for two random samples and the concept of independence. 4. To discuss marginal probability and mass functions for discrete and continuous random variables. 5. To explore conditional distribution functions for discrete and continuous random variables. 6. To analyze expectation, variance, covariance, correlation, and moment-generating function for joint random variables. 7. To introduce Chebyshev's inequality and its applications. 8. To familiarize students with various probability distributions, such as the isotropic, Bernoulli, binomial, Poisson, geometric, negative binomial, hypergeometric, normal, gamma, exponential, chi-square, and beta.	

Learning and teaching strategies .9

1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Applying concepts through solved examples. 3- Discussions: Engaging students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyzing real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems. 7- Self-study: Reading recommended textbooks and research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	**Strategy**

Course structure .10

Evaluation	Learning method	Name of unit or topic	Required educational outcomes	Hours	week

degree	**Face to face mode**	Mathematical expectation, properties of expectation, mean .and variance	1- Understand the concept of mathematical expectation and apply it to problem solving . 2- Calculate the mean, standard deviation, and moment of random variables. Use moment generating functions to determine distribution .properties	**4**	**1**
degree	**Face to face mode**	Moments and moment generating .function	Use moment generating functions to determine the properties of the .distribution	**4**	**2**
degree	**Face to face mode**	The characteristic .function	Use moment generating functions to determine the properties of the .distribution	**4**	**3**
degree	**Face to face mode**	Joint distribution of two random variables, independent random variables	Analyze joint distributions and identify independent random .variables	**4**	**4**

degree	**Face to face mode**	Functions of discrete and continuous random variables	Calculate marginal probabilities and mass functions for discrete and continuous random variables.	**4**	**5**
degree	**Face to face mode**	Conditional distribution functions for discrete and continuous random .variables	late Calcu marginal probabilities and mass functions for discrete and continuous random variables.	**4**	**6**
degree	**Face to face mode**	Expectation of two random variables, variance, covariance, .correlation	Define conditional distribution functions for discrete and continuous random variables.	**4**	**7**
degree	**Face to face mode**	Moments and moment generating function for two .random variables	Calculate covariance, correlation, and moments for covariate random variables.	**4**	**8**
degree	**Face to face mode**	Chebyshev's .inequality	Chebyshev's inequality application for probability limit analysis	**4**	**9**

degree	**Face to face mode**	Stationary ,distribution Bernoulli distribution, binomial distribution	Identify and apply different probability distributions in realistic scenarios.	**4**	**10**
degree	**Face to face mode**	Poisson distribution, geometric distribution	Identify and apply different probability in distributions realistic scenarios.	**4**	**11**
degree	**Face to face mode**	Negative binomial distribution, hypergeometric distribution	Identify and apply different probability distributions in realistic scenarios.	**4**	**12**
degree	**Face to face mode**	stationary ,distribution normal distribution	Identify and apply different probability distributions in realistic scenarios.	**4**	**13**
degree	**Face to face mode**	Gamma distribution, exponential distribution	Identify and apply different probability distributions in realistic scenarios.	**4**	**14**

degree	**Face to face mode**	square -Chi distribution, beta .distribution	Identify and apply different probability distributions in realistic scenarios.	**4**	**15**

Course Evaluation .11

degree

Learning and teaching resources .12

Probability and Statistics	Degroot. MH
Introduction to Mathematical Statistics	R. Hogg & A. Grage
Introduction To The Theory of Statistic	Mood. AM et.al
Probability Theory And Mathematical Statistic	Klimov. G.
Probability	Knill. O.

Course Description Form R219

82. Course Name: Systems of Axioms

83. Course code: R219

84. Semester/Year: First Semester 2025-2026

85. 2025/9/1 : Date this description was prepared

86. Available attendance forms : face to face

87. Number of study hours (total) / Number of units (total): 60 / 3

88. Name of the course supervisor (if more than one name is mentioned): Prof. Dr. Shukr Mahmoud Khalil

Course objectives .8

1- To introduce students to the fundamentals of pre-Euclidian geometry and the development of Euclidean geometry. 2. To introduce students to the axiomatic approach to geometry and various systems of axioms.	**Course objectives**

3. To explore different types of planes, such as projective planes and harmonic planes, and their properties. 4. To examine the concepts of convex sets, triangles, angles, and quadrilaterals and their relationships. 5. To study the congruity axioms for arcs and angles and their applications in proving theorems. 6. To introduce students to geometric constructions and transformations, including symmetry, reflection, translation, and congruence.	

Learning and teaching strategies .9

1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems. 7- Self-study: Read recommended textbooks and research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face**	A Historical Overview of Geometry, Geometry Before Euclid, Euclid's Geometry	Understanding the historical development of geometry before Euclid and Euclidean geometry	**4**	**1**

degree	**Face to face**	Euclid's Fifth Axiom and Equivalent Statements, Some Weaknesses of Euclid's System	Understanding the historical development of geometry before Euclid and Euclidean geometry	**4**	**2**
degree	**Face to face**	Axioms, projective level, finite projective levels	Understanding the historical development of geometry before Euclid and Euclidean geometry	**4**	**3**
degree	**Face to face**	Altavi level, finite damage levels, Yunk and Van .systems	Explain the axiomatic to approach geometry and .its importance	**4**	**4**
degree	**Face to face**	Consistency, independence, .completeness	Explain the axiomatic approach to geometry and .its importance	**4**	**5**
degree	**Face to face**	.Hilbert system	Explain the axiomatic approach to geometry and .importance its	**4**	**6**

degree	**Face to face**	Axioms of existence and occurrence, certainty, Bach's ,axiom	Describe the properties of projective planes, declarative planes, convex sets, and various types of polygons.	**4**	**7**
degree	**Face to face**	Convex set, inside and outside triangle and angles, convex quadrilateral	Describe the properties of projective planes, declarative planes, convex sets, and various types of polygons.	**4**	**8**
degree	**Face to face**	Axioms about congruence of pieces, addition and subtraction of pieces	Describe the properties of projective planes, declarative planes, convex sets, and various types of polygons.	**4**	**9**
degree	**Face to face**	Comparing pieces, matching angles, and triangles	Apply the symmetry postulates for arcs and angles to prove geometric .theorems	**4**	**10**
degree	**Face to face**	Adding and subtracting angles, comparing angles	Apply the symmetry postulates for arcs and angles to prove geometric .theorems	**4**	**11**

degree	**Face to face**	Euclid's proofs exterior -re angles theorem	Apply the symmetry postulates for arcs and angles to prove geometric .theorems	**4**	**12**
degree	**Face to face**	Right angles right -and non angles, .constructions	Construction and engineering transformations	**4**	**13**
degree	**Face to face**	Symmetry, reflection and withdrawal	Construction and engineering transformations	**4**	**14**
degree	**Face to face**	Congruence, the relationship between these .transformations	Construction and engineering transformations	**4**	**15**

Course Evaluation .11

degree

Learning and teaching resources .12

Modern Geometry	Adler. CF
Non-Euclidean	Bonola.R

Introduction to Geometry	Coxeter. HSM
Foundations Of Euclidean and Non-Euclidean Geometry	Golos. EB
Introduction To Non-Euclidean Geometry	Wolfe. HE

Course Description Form R221

89. Topology on a Straight Line
90. Course code: R221
91. Semester/Year: First Semester 2025-2026
92. 2025/9/1 : Date this description was prepared
93. Available attendance forms : face to face
94. Number of study hours (total) / Number of units (total): 60 / 3
95. supervisor (if more than one name is Name of the course mentioned): Asst. Dr. Zainab Sami Madi

Course objectives .8	
To provide a comprehensive understanding of the basic concepts and properties of real numbers. 2. To develop the ability to analyze and compare upper and lower bounds, maximum and minimum elements, minimum and maximum limits. 3. To explore Archimedes' property of real numbers and its implications. 4. To introduce students to the real line, the absolute value function, and distance in the context of real numbers. 5. To introduce the concepts of open intervals, open sets, closed sets, glued points, closure, boundary points, derived sets, interior points, exterior points, and boundary points. 6. To introduce the Bolzano-Weierstrass theorem and its importance in real analysis. 7. To provide an overview of the properties of tensor algebra. 8. To study real sequences, their convergence, divergence, algebraic operations on them, limits, and increasing. 9. To explore Cauchy sequences and the perfection of a real line. 10. To introduce the concept of limits of real functions and their algebraic properties. 11- To investigate uniform continuity and its applications. 12- Introduce the mean value theorem for continuous functions. 13- Study the derivation of real functions, the role of theorems, and the mean value theorem. 14- Introduce Riemannian integrals, their definition, and upper and lower sets, with related results.	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: Theoretical concepts and explanation of statistical techniques. 2- Problem-solving sessions: Apply concepts through solved examples. 3- Discussions: Engage students in active discussions to deepen their understanding. 4- Practical exercises: Practical practice with statistical software and data analysis. 5- Case studies: Analyze real-life scenarios to apply	**Strategy**

statistical techniques. 6- Group projects: Collaborative work to solve complex statistical problems. 7- Self-study: Read recommended textbooks and research articles to reinforce knowledge. 8- Assessments: Regular quizzes, assignments, and exams to assess understanding and progress.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Real numbers, upper (lower) constraints, largest element smallest) element), smallest upper largest lower)) constraint	Demonstrate a comprehensive understanding of the basic concepts and properties of real numbers.	4	1
degree	Face to face	,Rounding Comparison and Addition Properties of Upper (Lower) Constraints	Analyze and compare upper and lower limits, maximum and minimum elements, upper and lower limits, and maximum and .minimum limits	4	2

degree	**Face to face**	Archimedes' property of real numbers, real number line absolute value) function and distance inR .(	Apply Archimedes' property of real numbers to .solve problems	**4**	**3**
degree	**Face to face**	Topological concepts on a straight line, open intervals, ,open sets closed sets	Interpret and use the real line, the absolute value function, and the concept of distance in the context of .real numbers	**4**	**4**
degree	**Face to face**	Adjacent and , closed points end points and , derived set interior points set-and in	Identify and distinguish between open intervals, open sets, closed sets, connected points, closure, boundary points, derived sets, interior points, exterior points, and boundary points.	**4**	**5**
degree	**Face to face**	Exterior and boundary , points -Balzano Weierstrass .theorem	Apply the -Bolzano Weierstrass theorem to analyze sequences and their .convergence	**4**	**6**

degree	**Face to face**	Sequences of real numbers, convergence and divergence of sequences of real numbers	1- Demonstrate a basic understanding of the properties of tensor algebra. -2Analyze real sequences in terms of convergence, divergence, algebraic operations, restriction, and increasing.	**4**	**7**
degree	**Face to face**	Algebraic operations on , real sequences restricted and monotonic sequences	1- Demonstrate a basic understanding of the properties of tensor algebra. -2Analyze real sequences in terms of convergence, divergence, algebraic operations, restriction, and .increasing	**4**	**8**
degree	**Face to face**	Cauchy , sequences perfection of the real number . line	Defining Cauchy sequences and understanding the completeness of the real line	**4**	**9**
degree	**Face to face**	real functions and some of their algebraic properties	Evaluate the limits of real functions and apply their algebraic .properties	**4**	**10**

degree	**Face to face**	real functions , uniform continuity	Analyze functions in terms of uniform continuity and .its effects	**4**	**11**
degree	**Face to face**	Mean value theorem for .continuity	Apply the mean value theorem continuous for functions to .solve problems	**4**	**12**
degree	**Face to face**	Derivative of real functions definition) And its relationship to (continuity	Use theorems related to the differentiation of real functions, including Rolle's theorem and the mean emvalue theor.	**4**	**13**
degree	**Face to face**	Rolle's theorem, mean value .theorem	Apply Rolle's theorem for continuous functions to .solve problems	**4**	**14**
degree	**Face to face**	Riemann integral definition,) upper and lower sums with some .(related results	Understand the definition of Riemannian integration and perform upper and lower summations, along with related results.	**4**	**15**

Course Evaluation .11	
degree	
Learning and teaching resources .12	
Mathematical Analysis	Apostol.TM
Real analysis and probability	Ash RB
Real Analysis	Royden. HL
Real Analysis	Sharma, J.N and Vasishtha, A.R
Introduction to Real Analysis	Anwar Badraneh and others

Course Description Form

96. Course name
Mathematical analysis (1)
97. Course code
R331
98. Semester 2025 Semester/Year: First-2026
99. 2025/9/1 : Date this description was prepared
100. Available attendance forms : face to face

101. Number of study hours (total) / Number of units (total): 60 / 3
102. is than one name More (if applicable) Course instructor name (mentioned
Asst. Prof. Dr. Khaldoun Saad Ghaleb
Course objectives .8

1. Provide students with a comprehensive understanding of the historical development and concepts of real analysis. **2. Introduce students to the basic properties of real numbers and their relationship to rational numbers.** **3. Explore Archimedes' theorem and its importance in the real number system.** **4. Study the completeness of real numbers as an ordered field.** **5. Determine the density of rational and irrational numbers on the real number line.** **6. Introduce students to the concepts of semimetric spaces and Euclidean spaces.** **7. Understand the concepts of convergence and limits in metric spaces.** **8. Explore different types of sequences and their properties.** **9. Study the concept of completeness in metric spaces and its implications.** **10. Introduce students to fixed-point theorems and their applications.** **11. Explore different types of infinite series and their convergence tests.** **12. Understand the concept of continuity and its various properties. 13. Study the intermediate value property and its applications.** **14. Introduce the concept of compact sets and their properties.** **15- Explore the concepts of continuous and disjoint sets.** **16- Understand the concept of derivatives and their properties.** **17- Define the area of differentiable functions and their properties.** **18- Study important theorems such as Rolle's theorem and the mean value theorem.**	**Course objectives**

9. Learning and teaching strategies

1. Lectures to explain basic concepts and theories **2. Interactive discussions to encourage active student participation** **3. Examples and problem-solving sessions to illustrate the applications of learned concepts** **4. Homework and assignments to practice and reinforce understanding** **5. Group work and peer learning to promote collaboration and exchange of ideas** **6. Use of visual aids and technology to enhance the learning experience** **7. Guided reading and self-study to explore additional resources and deepen understanding** **8. Assessments (quizzes, tests, and exams) to evaluate student progress and learning outcomes**	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face**	Historical review, real numbers, the relationship between numbers Reality and relativity	Demonstrate a comprehensive understanding of historical development and the concepts of .real analysis	**4**	**1**
degree	**Face to**	,Archimedes' propertyR	Analyze the	**4**	**2**

	face	is a complete ordered field	and properties relationships of real and rational .numbers		
degree	**Face to face**	Rational number density theory, irrational number density theory	Apply - Archimedes' theorem and understand its importance in the real number .system	**4**	**3**
degree	**Face to face**	Semimetric spaces, Euclidean spaces, ...limits Topology principles, sequences, real sequences	Explain and prove the completeness of real numbers as an ordered field	**4**	**4**
degree	**Face to face**	Convergence in metric spaces, special real sequences	density Applying theorems to rational and irrational .numbers	**4**	**5**
degree	**Face to face**	Complete metric spaces, fixed point theorem	Analyzing and working with semimetric and Euclidean spaces	**4**	**6**
degree	**Face to face**	Special infinite series, convergence tests	Understand the convergence of sequences in metric spaces and prove convergence .results	**4**	**7**
degree	**Face to face**	Historical review, real numbers, the relationship between real and rational numbers	Apply the concept of completeness in metric spaces to various prove .properties	**4**	**8**
degree	**Face to face**	Alternating series, absolute and conditional convergence Other convergence tests, limits of functions, limit theorems	Analyze and - determine the convergence of different types of .infinite series	**4**	**9**
degree	**Face to face**	Extensions of the limit concept, continuous functions equivalent	Apply convergence tests to determine .convergence	**4**	**10**

		communication theory, successive communication			
degree	**Face to face**	Uniform continuity, valued function-real property, Mean value coffee cup theorem	Absolute and .conditional	**4**	**11**
degree	**Face to face**	Compact groups, important theories of coherence Continuity and coherence, discrete groups	Analyze and apply the concept of limits of functions and .related theorems	**4**	**12**
degree	**Face to face**	Connected sets, equivalent bonding theory Continuity and interconnectedness, derivatives	Demonstrate an understanding of the concept of continuity and its .characteristics	**4**	**13**
degree	**Face to face**	Connected sets, equivalent bonding orythe Continuity and interconnectedness, derivatives	Apply the intermediate value property to solve problems in different .contexts	**4**	**14**
degree	**Face to face**	Area of differentiable functions, properties of derivative Rolle's Theorem, Intermediate Value Theorem	Analyze and work on compact sets and apply related theories	**4**	**15**

Course Evaluation .11

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
University of Baghdad	1986	First	Adel Ghassan Naoum	**Introduction to Mathematical Analysis**	1

	London	1974	2nd	Apostle. T.M	**Mathematical Analysis**	2
	New York	2000	2nd	Ash .RB	**Probability and measurement theory**	3
	Tokyo	1976	3rd	Rudin. W.	**Principles of Mathematical Analysis**	4
		1970		Kolomogorov. AN and Fomin .SV,	**Introduction to Real Analysis.**	5
	New York	1969		Burrill. C.W., & Knudsen. J.R.	**Real Variables**	6
	London	1988		Royden. HL	**Real Analysis**	7

Course Description Form

103. Course name
Algebra of groups (1)

104. Course code
R333
105. Semester 2025 Semester/Year: First-2026
106. 2025/9/1 : Date this description was prepared
107. Available attendance forms : face to face
108. Number of study hours (total) / Number of units (total): 60 / 3
109. is than one name More (if applicable) Course instructor name (mentioned
Asst. Prof. Dr. Ahmed Hussein
Course objectives .8

1. Provide students with a solid understanding of the basic concepts and properties of sets. 2. Introduce students to important examples of sets and their applications. 3. Develop the ability to apply set theory concepts to solve problems in various mathematical contexts. 4. Prepare students for advanced studies in abstract algebra and related fields.	
Learning and teaching strategies .9	
1- Lectures: Classroom lectures to introduce and explain key concepts and features. 2- Examples and Problem Solving: Work through examples and problem-solving exercises to enhance understanding and develop problem-solving skills.	**Strategy**

3- Group Discussions: Encourage student participation in group discussions to promote critical thinking and collaborative learning. 4- Tutoring: Conduct tutoring sessions to provide additional support and clarify any doubts or questions. 5- Self-Study: Encourage students to engage in independent study and explore additional resources to deepen their understanding.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Introduction to groups, binary operations, and elementary .properties	and identify Define groups, subgroups, and their .characteristics	4	1
		Examples of :groupsZn andSn .	Apply Lagrange's - theorem to determine the order .of subgroups	4	2
		Subgroups and .Lagrange's theory	Describe and - analyze the structure of specific sets, such asZn (n order - integers) andSn (n- order symmetric .(set	4	3
		Subgroups resulting from a set and their .properties	Understand and apply the concepts of natural subsets, ,quotient groups . homotopy and	4	4
		Natural subgroups and division .groups	Understand and apply the concepts of natural subsets, ,quotient groups . homotopy and	4	5
		Derived subgroups and their .properties	Demonstrate a working knowledge of group symmetries and their .properties	4	6

		groups Identical and their .properties	Apply Cayley's theory to determine the relationship between sets and their .representations	**4**	**7**
		Cayley's theory and its .applications	Apply Cayley's theory to determine the relationship sets and between their .representations Apply Cayley's theory to determine the relationship between sets and their .representations	**4**	**8**
		Basic theorems of .symmetry	Understand the concept of group center and its .importance	**4**	**9**
		Basic theorems of .symmetry	Explain and apply the concept of direct multiplication of .groups	**4**	**10**
		Group symmetries and their .properties	AnalyzeP -groups and understand the fundamental theory of finite abelian .groups	**4**	**11**
		Basic theorems of .symmetry	Understand the group concept of center and its .importance	**4**	**12**
		Direct multiplication of groups and its .properties	Understand the concept of group center and its .importance	**4**	**13**
		P groups and their .properties	AnalyzeP -groups and understand the fundamental theory finite abelian of .groups	**4**	**14**
		Fundamental theory of finite .abelian groups	AnalyzeP -groups and understand the fundamental theory of finite abelian .groups	**4**	**15**

Course Evaluation .11

degree

12. Learning and teaching resources

Publishing House	year	Edition	Authors	the address	T
London	1967		Burton DM	**Introduction to Modern Abstract Algebra**	**1**
Boston	1973	2nd	Rotman JJ	**The Theory of Groups**	**2**
Oxford	1968		Macdonald I.,	**The Theory of Groups**	**3**
WM.C. Brown Publishers,	1988		David M. Burton	**Abstract Algebra**	**4**
			S. Lange	**Algebra**	**5**
			Fralyh	**A First Course in Abstract Algebra**	**6**
Ministry of Higher Education and Scientific -Research Iraq	1982		Basil Atta Abdul Majeed and others	**Introduction to Group Theory**	***7**
University of	1993		Hadi Jaber	**algebra**	**8**

Iraq -Basra			Mustafa and others		
University of Iraq - Mosul	1982		, .Burton D. M translated by Abdul Aal Jassim Mohammed and Sanaa Abdul Mohammed	**Introduction to Modern Abstract Algebra**	**9**

Course Description Form

110. name Course :
Sports Statistics (2)
111. Course code
R341
112. Semester/Year: First Semester 2025-2026
113. Date this description was prepared: 12/9/2025
114. Available attendance forms : face to face
115. Number of study hours (total) / Number of units (total): 60 / 3
is than one name More (if applicable) Course instructor name (mentioned
Asst. Prof. Dr. Hoda Zaki
Course objectives .8

1. Understand the concept of intervals and their role in statistical inference. 2. Learn how to construct confidence intervals for means, mean differences, variances, variance ratios, probabilities, and probability differences. 3. Understand general concepts related to hypothesis testing, critical regions, statistical tests, and their applications. 4. Explore advanced topics in hypothesis testing, including the Neyman-Pearson theorem, the uniformly strongest test, the likelihood ratio test, and the sequential test.	**Course objectives**

Learning and teaching strategies .9

1- Lectures: Classroom lectures to introduce and explain concepts and theories related to intervals, confidence intervals, hypothesis testing, and advanced topics. **2- Practical Sessions: Practical exercises and problem-solving sessions to apply learned concepts to real-world situations.** **3- Case Studies: Analyze and discuss case studies to understand the practical implications of confidence intervals and hypothesis testing.** **4- Group Discussions: Engage students in discussions to enhance critical thinking and better understand topics.** **5- Independent Study: Encourage students to explore additional resources, read relevant literature, and solve practical problems outside of class.**	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	Introduction to periods and their .importance	Create random -1 intervals and interpret their .meaning Calculating -2 and interpreting	4	1
		Confidence intervals for differences in		4	2

		means: calculation and .interpretation	confidence intervals for means, differences between means, variances, ratios between ,variances probabilities, and differences between .probabilities Applying -3 hypothesis testing techniques and selecting appropriate tests for different .scenarios Understanding -4 the concepts of critical areas, statistical tests, and their .importance nd Explain a -5 apply the Pearson -Neyman theory, the most powerful test, the likelihood ratio test, and the .sequential test		
		Confidence intervals for variances: and calculation .interpretation		4	3
		Confidence intervals for the ratio between two variances: calculation and .interpretation		4	4
		Confidence intervals for probabilities: calculation and .interpretation		4	5
		Confidence intervals for probability :differences calculation and .interpretation		4	6
		General concepts of hypothesis testing: type of test, critical region, and best .critical region		4	7
		Statistical Tests: Understanding Different Types of Tests and Their .Applications		4	8
		Pearson -Neyman and theory uniformly .strongest test		4	9
		Likelihood ratio test: concept and .importance		4	10
		Serial testing: advantages and .applications		4	11
		Review and training sessions. Week		4	12
		Case studies and		4	13

		practical applications			
		Evaluation and .assessment		4	14
		Notes and discussion on the .unit		4	15

Course Evaluation .11

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
University of Iraq - Mosul	1990	First	Amir Hanna Hormuz	**Mathematical statistics**	1
University of Iraq - Mosul	1991	First	Basil Younis Dhnoon	**Probability and random variables**	2
University of Iraq - Basra	1989	First	Good morning, David	**Introduction to Mathematical Statistics**	3
Tokyo	1986	First	Degroot MH	**Probability and Statistics**	4
Macmillan Publishing Co. , Inc, New York	1998	Sixth	Robert V. Hogg & Allen T. Craig	**Introduction to Mathematical Statistics**	5
Tokyo	1974	First	Mood. AM et .al	**Introduction to The Theory of Statistics**	6
Thomson Brooks/cole	2008	Seventh	Dennis D. Wackerly & William Mendenhall &	**Mathematical Statistics with Application**	7

			Richard L. Scheaffer		
Springer New York Dordrecht Heidelberg London	2012	Second	Jay L. Devore & Kenneth N. Berk	**Modern Mathematical Statistics with Applications**	**8**
Pearson Education, Inc.	2012	Fifth Edition	Richard J. Larsen & Morris L. Marx	**An Introduction to Mathematical Statistics and its Applications**	**9**

Course Description Form

116. Course name

Ordinary Differential Equations Theory of (2)	
117. Course code	
R336	
118. Semester/Year: First Semester 2025-2026	
119. 2025/9/1 : Date this description was prepared	
120. Available attendance forms : face to face	
121. Number of study hours (total) / Number of units (total): 60 / 3	
is than one name More (applicable if) Course instructor name (mentioned	
Prof. Dr. Hossam Lotti	
Course objectives .8	
1. Understand and apply the fundamental matrix solution to linear ordinary differential equations. **2. Calculate the fundamental matrix solution to general linear ordinary differential equations using relevant theories.** **3. Analyze the stability of linear ordinary differential systems.** **4. Use the Jordan transform method to solve and classify linear ordinary differential equations.** **5. Study nonlinear ordinary differential equations and their properties.** **6. Apply the Poincaré-Bendixson theorem to analyze**	**Course objectives**

second-order nonlinear systems and limit cycles. **7. Define and analyze affine solutions, periodic solutions, and limit cycles.** **8. Study the stability of nonlinear differential equations around fixed points, critical points, and limit cycles.** **9. Apply Lyapunov stability methods, including the first and second Lyapunov methods, to second-order linear differential equations. 10. Understand the existence and uniqueness theorems in ordinary differential equations.** **11. Use Picard's successive approximations to study the existence theory of differential equations.** **12. Analyze the effects of Lipschitz conditions on the existence and uniqueness theories.** **13. Understand Grönwald's inequality and its importance in existence theory.** **14. Determine the maximum existence interval and explore the general theory of differential equations.**	

9. Learning and Teaching Strategies

1. Lectures to introduce theoretical concepts and derivations. **2. Private lessons and problem-solving sessions to practice solving linear and nonlinear differential equations.** **3. Computer simulations and numerical methods for analyzing differential equations.** **4. Group discussions and presentations to enhance understanding and critical thinking.** **5. Assignments and assessments to evaluate students' understanding and problem-solving skills.** **6. Use of textbooks, research, and electronic resources for further reading and self-study.** **7. Office hours and consultations to provide individualized guidance to students.**	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	**Face to face**	**Introduction to Ordinary Linear Differential Equations**	**Solve linear -1 ordinary differential equations using**	**4**	**1**

		Solving the basic matrix and its properties	fundamental matrix solution and related .theorems	4	2
		Fundamental matrix solution theorems	Determining the -2 stability of linear ordinary .differential systems	4	3
		Stability analysis of linear ordinary differential systems	Solving and -3 classifying linear ordinary	4	4
		Jordan transform method for solving and classifying linear ordinary differential equations	ntial differe equations using the Jordan transform .method	4	5
		Introduction to Nonlinear Ordinary Differential Equations	Analysis of -4 nonlinear ordinary differential equations using the Bendixson -Poincaré theorem and studying their final cycles and periodic .solutions	4	6
		-Poincaré Bendixson theory order -for second nonlinear systems	Application of -5 Lyapunov stability -methods to second order linear differential .equations	4	7
		Terminology, definitions of attraction, and periodic solutions		4	8
		Stability analysis of nonlinear differential equations	Applying -6 Picard's successive approximations to establish the existence theory of differential .equations	4	9
		Lyapunov stability methods (first and second methods) order -for second linear differential equations	Evaluating the -7 impact of Lipschitz's conditions on the theory of existence and the theory of .singularity	4	10
		Existence and uniqueness theorems of ordinary differential equations	Use Grönwald's -8 inequality and existence theorems to analyze differential .equations	4	11
		Effects of Lipschitz's conditions on the theory of existence and individuation	Analysis of the -9	4	12

		Grönwald's inequality and the theory of existence	maximum period of existence and exploration of the comprehensive theory of differential .equations	4	13
		Maximum period of existence and the general theory of differential equations		4	14
		Review and prepare for assessments		4	15

Course Evaluation .11

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
London	1982		Arrowsmith. DK & Place. CM	**Ordinary Differential Equations**	1
	1972		Rabenstein. AL	**Introduction to Ordinary Differential Equations**	2
London, Amsterdam	1973		Brauer F. & Nohel JA	**Ordinary Differential Equations: A First course , 2nd**	3
New York	1972		Stein. R.	**Introduction To Ordinary Differential Equations "2 nd**	4
University of , Technology Iraq	1990		Khalil Ismail Taha	**Ordinary differential equations and stability theory**	5
University of Baghdad	1985		Saeed Mohsen Khazai and -Al Khaled Ahmed Samarrai-Al	**Ordinary Theory of Differential Equations**	6

Course Description Form

122. Course name
Applied Mathematics
123. Course code

R337
124. Semester/Year: First Semester 2025-2026
125. 2025/9/1 : Date this description was prepared
126. Available attendance forms : face to face
127. Number of study hours (total) / Number of units (total): 60 / 3
is than one name More (if applicable) Course instructor name (mentioned
Samaher Adnan Abdulghani .Asst. Prof. Dr
Course objectives .8

	Course objectives
Learning and teaching strategies .9	
1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies will be analyzed to apply the concepts and methods taught to practical situations.** **3- Group Discussions: Students will participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students will be assigned assignments to practice the methods and techniques they have**	**Strategy**

learned in the module. **5- Practical Exercises: Students will participate in practical exercises to develop practical skills in solving operations research problems.** **6- Tutorials: Tutorials will be conducted to answer any questions or difficulties students may have in understanding the module content.**	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	Properties of the gamma function, .examples		4	1
		Properties of the ,beta function .examples		4	2
		Properties of the error function, .examples		4	3
		Bessel equation and functions for other simple relationships		4	4
		The generating function of a Bessel function		4	5
		Recursive relationships		4	6
		Integral form of Bessel functions, modified Bessel functions		4	7
		Legendre's equation and Legendre's .polynomials		4	8
		Roderick's formula for Legendre polynomials, the generating function, and recurrence relations for Legendre polynomials		4	9
		Orthogonality of Legendre polynomials		4	10

		Laplace transform of some functions		4	11
		Some Laplace Transform Theorems		4	12
		step function-One		4	13
		Inverse Laplace and its Transform Calculation for Some Examples		4	14
		Solving differential equations using the Laplace transformation		4	15

Course Evaluation .11

degree

Learning and teaching resources .12

1. **University of Basra, Iraq, ,authored by Dr. Basil Yaqoub Yousef , Methods in Applied Mathematics .1989**

2. WW Bell, Special functions for scientists and engineers, D. Van Nostrand Company, Ltd, 1968.

3. Murray R. Spiegel, Schaum's outline of theory and problems of Laplace transforms, McGraw-Hill, 1965.

4. Murray R. Spiegel, Schaum's outline of theory and problems of Fourier analysis, McGraw-Hill, 1974.

Course Description Form

128. Course name

Operations Research	
129. Course code	
R338	
130. Semester/Year: First Semester 2025-2026	
131. 2025/9/1 : Date this description was prepared	
132. Available attendance forms : face to face	
133. Number of study hours (total) / Number of units (total): 60 / 3	
(is mentioned than one name More (if applicable) Course instructor name	
Jassim Jabbar Asst. Prof. Dr. Maher	
Course objectives .8	
1. Understand the concept and history of operations research. **2. Explore the various models and methods used in operations research, such as transportation models, allocation models, and inventory control models.** **3. Develop skills in finding initial and optimal solutions for various types of models.** **4. Understand the principles and techniques of matching, single and mixed strategies, and solution methods such as analytical, graphical, and simplex methods.**	**objectives Course**

Learning and teaching strategies .9

1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. 2- Case Studies: Real-life case studies will be analyzed to apply the concepts and methods taught to practical situations. 3- Group Discussions: Students will participate in group discussions to enhance their understanding and problem-solving skills. 4- Assignments: Students will be assigned assignments to practice the methods and techniques they have learned in the module. 5- Practical Exercises: Students will participate in practical exercises to develop practical skills in solving operations research problems. 6- Tutorials: Tutorials will be conducted to answer any questions or difficulties students may have in understanding the module content.	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	Introduction to Operations Research: Definition Historical and Background	Explain the -1 definition of operations research and its historical .background Describe the -2 steps of operations .research study Understanding -3 the structure of transportation models and their .components Applying -4 h as methods suc the north angle method, the minimum cost method, and the Vogel method to find initial	4	1
		Steps of studying .operations research		4	2
		Transport models: structure and .components		4	3
		Methods for finding initial solutions: Method		4	4
		Methods for finding optimal solutions for transportation models: continuous ,path method modified distribution .method		4	5
		Assignment Models: Structure and		4	6

		Components	solutions to transportation .models Use methods -5 such as the continuous path method and the modified distribution method to find optimal solutions on for transportati .models Define -6 appointment models and explain their .structure Applying -7 appropriate methods to find solutions to assignment .models Understanding -8 the structure of inventory control .models Apply -9 appropriate methods to find solutions for ntory control inve .models Define -10 matching and explain the structure of the .matching matrix Applying -11 individual and mixed strategies in .solving problems Use analytical, -12 graphical, and simple methods to find solutions to different types of .models		
		Ways to find solutions to .assignment models Week 7: Ways to find solutions to .assignment models		4	7
		Inventory control models: structure .and components		4	8
		Methods for finding solutions to inventory control .models		4	9
		Matching: Define and match the structure of the .array		4	10
		Single and mixed strategies in problem solving		4	11
		Analytical method .for finding solutions		4	12
		Graphical method .for finding solutions		4	13
		Simplex method for .finding solutions		4	14
		Review and revise .unit content		4	15

Course Evaluation .11

degree

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
Pearson Prentice Hall	2007	8th edition	A. Hamdy	**Operations Research an introduction**	**1**
Hill -McGraw Publishing	1988		Richard Bronson, translated by Hassan Hosni Ghabbari-Al	**Operations Research**	**2**
International House for Cultural Investments Egypt	2002		Bruton, Richard translated by Dr. Hassan -Hosni Al Ghabbari	**Schaum's Outlines of Methods in Operations Research Series**	**3**
Dar Al Manahj for Publishing and Distribution, Amman	2007		Saffar and -Al others	**Scientific research computer applications**	**4**
University of	5 198		Abdul Diab	**Operations Research**	**5**

Baghdad			Jazza		
House of Wisdom, Baghdad	1988		Jabbar Hassan and others	**Introduction to Operations Research**	**6**
Hamed -Dar Al for Publishing and Distribution	2010		Hussein Mahmoud	**The latest in operations research**	**7**

Course Description Form

134. Course name : Algebra of groups (2)
135. Course code : R339
136. Semester/Year: First Semester 2025-2026

137. 2025/9/1 : Date this description was prepared
138. Available attendance forms : face to face
139. Number of units (total): 60 / 3 / (Number of study hours (total
is than one name More (if applicable) Course instructor name (mentioned
Prof. Dr. Shukr Mahmoud

Course objectives .8	
1. Provide a comprehensive understanding of the basic concepts and properties of rings. 2. Develop knowledge and skills in analyzing the structure of rings and their various properties, such as zero divisors, integrable domains, and fields. 3. Explore the concepts of subrings, ring homomorphisms, and basic symmetry theorems. 4. Introduce students to the concept of ideals, their role in division rings, and prime/maximum ideals. 5. Study the properties and applications of logical rings.	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: Theoretical concepts and definitions will be presented through lectures to provide a foundation of knowledge. 2- Examples and Problem Solving: Work through examples and problem-solving exercises to illustrate the application of concepts and enhance understanding. 3- Group Discussions: Engage students in discussions to encourage critical thinking and collaborative learning. 4- Case Studies: Analyze real-life scenarios or applications related to the concepts and properties of loops. 5- Assignments: Assign students sets of problems and	**Strategy**

assignments to enable them to practice and apply their knowledge independently. 6- Assessment: Conduct short tests, quizzes, and exams to assess students' understanding and application of the material.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Introduction to the episodes	Demonstrate a -1 solid understanding of the properties of rings, including zero divisors, integral domains, fields, and .subrings the Apply -2 concepts of ring symmetry and basic symmetry theorems to analyze different rings and link .them Analyze and -3 identify ideals in a given cycle, and understand the role of main ideal cycles and division .cycles Distinguishing -4 between primary ltimate and u ideals, and understanding their relationships .within the circle Understand the -5 properties and applications of logical loops and	4	1
		Zero divisors and integral domains		4	2
		fields		4	3
		episodes Partial		4	4
		Properties of rings		4	5
		Include a ring in a matching ring		4	6
		-Adobetic and non adaptive elements		4	7
		rings Identical		4	8
		Fundamental symmetry theorems		4	9
		Ideals		4	10
		Main ideal rings		4	11
		Division rings		4	12
		Prime and ultimate ideals		4	13
		logical loops		4	14
		Logical loop applications		4	15

			their importance in different contexts.		

Course Evaluation .11

degree

12. Learning and teaching resources

Publishing House	year	Edition	Authors	the address	T
London	1967		Burton DM	**Introduction to Modern Abstract Algebra**	**1**
Boston	1973	2nd	Rotman JJ	**The Theory of Groups**	**2**
Oxford	1968		Macdonald I.,	**The Theory of Groups**	**3**
WM.C. Brown Publishers,	1988		David M. Burton	**Abstract Algebra**	**4**
			S. Lange	**Algebra**	**5**
			Fralyh	**A First Course in Abstract Algebra**	**6**
Ministry of Higher Education and Scientific -Research Iraq	1982		Basil Atta Abdul Majeed and others	**Introduction to Group Theory**	***7**

University of Iraq -Basra	1993		Hadi Jaber Mustafa and others	**algebra**	**8**
University of Iraq - Mosul	1982		**,** .Burton D. M translated by Abdul Aal Jassim Mohammed and Sanaa Abdul Mohammed	**Introduction to Modern Abstract Algebra**	**9**

Course Description Form

140. Course name :
Data Theory
141. Course code
R350
142. Semester/Year: First Semester 2025-2026
143. 2025/9/1 : Date this description was prepared
144. Available attendance forms : face to face

145. Number of study hours (total) / Number of units (total): 60 / 3
(is mentioned than one name More (if applicable) Course instructor name
Amer Asst. Prof. Dr. Alaa
Course objectives .8

1. Understand the basic concepts of graph theory. 2. Explore different types of graphs and their properties. 3. Analyze interconnectedness and coloring in graphs. 4. Introduce advanced topics such as graph embeddings, planar graphs, and network flows. 5. Apply graph theory concepts to real-world problems.	**Course objectives**
Learning and teaching strategies .9	
1. Lectures: The module includes lectures to introduce and explain basic concepts in graph theory, as well as advanced topics. Lectures may include visual aids, examples, and interactive discussions to enhance understanding. **2. Tutorials: Tutorials provide students with the opportunity to solve problems related to graph theory, enhancing their understanding of concepts and developing problem-solving skills.** **3. Group Discussions: Group discussions may be organized to encourage students to collaborate, exchange ideas, and discuss difficult concepts or problem-solving strategies.** **4. Practical Sessions: Practical sessions may involve using software tools or programming languages to implement graph algorithms and analyze real-world graph-based problems.** **5. Assignments: Students will be tasked with independently solving problems and applying the concepts they have learned to real-world situations.** **6. Self-Study: Students will be encouraged to engage in self-study, including reading textbooks and recommended research, to deepen their understanding of graph theory**	**Strategy**

concepts.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Introduction to Graph Theory	Define and -1 explain the basic concepts of graph theory, such as graphs, subgraphs, .and connectivity Identify and -2 analyze the properties of bipartite graphs, trees, and directed .graphs Apply graph -3 coloring techniques, including coloring .vertex and edge Understanding -4 and applying the implications of graphical and communication .coloring Analyze planar -5 graphs, including their coloring and .gender Apply network -6 flow algorithms to solve optimization .problems Applying graph -7 theory concepts to model and solve world -real .problems	4	1
		Basic concepts and examples of graphs		4	2
		Subgraphs and Embedding		4	3
		Interconnectedness of graphs		4	4
		bipartite graphs and trees		4	5
		Concepts and characteristics of trees		4	6
		Contact and edge coloring		4	7
		Coloring applications in networks		4	8
		Ramsey theory and head coloring		4	9
		coloring apps head		4	10
		Graphs on surfaces and drawings		4	11
		Coloring flat graphs		4	12
		Types of graphs and directed graphs		4	13
		Network flows and their applications Review and summary		4	14
		Practical applications of graph theory		4	15

11. Course Evaluation: Grade

Learning and teaching resources .12

Publishing House	year	Edition	Authors	the address	T
	1972		Robin Wilson, Oliver Boyd	**Introduction to Graph Theory**	1
Iraqi Ministry of Higher Education and Scientific Research	1983		Ali Aziz Ali	**Introduction to Data Theory**	2

Course Description Form

146. Course name : Contractual analysis (1)	
147. R431 Course code	
148. Semester/Year: First Semester 2025-2026	
149. 2025/9/1 : Date this description was prepared	
150. Available attendance forms : face to face	
151. Number of study hours (total) / Number of units (total): 60 / 3	
152. Asst. Prof. Dr. Shaza Ahmed Mahdi : Course Supervisor Name	
Course objectives .8	
• Understand the foundations of complex analysis and its historical development.	**Course objectives**

• Explore the algebraic properties of complex numbers and their representations. **• Study various functions and their properties in the complex plane.** **• Develop an understanding of limits, continuity, and differentiability in the context of complex functions.** **• Learn about complex integration and its applications, including Cauchy's theorem and its results.**	
Learning and teaching strategies .9	
1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations.** **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module.** **5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving**	**Strategy**

operations research problems.	

9. Course structure

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Definition of complex historical ,analysis key and , overview the applications of subject		4	1
		Complex plane, emergence of complex numbers, algebraic properties		4	2
		Cartesian representation of complex numbers		4	3
		Polar representation of complex numbers, powers and roots, in topologyC.		4	4
		purpose , Functions . and continuity		4	5
		Derivation with some special groups		4	6
		Analytic functions and Riemann -Cauchy equations, harmonic functions, universal . functions		4	7
		analytic Elementary functions , polynomials, and trigonometric functions		4	8
		theorem fundamental rational , of algebra functions		4	9
		,Exponential function ez function , hyperbolic functions		4	10
		Logarithmic functions		4	11
		, Complex integrals		4	12

		integration and contour curves			
		Definite integral, a integration over contour curve, Crane's theorem		4	13
		Cauchy's Theorem, - Theorem Cauchy's Corsa		4	14
		Cauchy's integral formulas, Moreira's Cauchy's , theorem Liouville's , inequality . theorem		4	15

Course Evaluation : Grade

resources Learning and teaching .12

	(*) Introduction to complex variables and applications
	Complex Analysis
	Complex Analysis
	Complex analysis and applications

Course Description Form

153. Name of the course : Contractual Analysis (2)

154. R432 Course code

155. First Semester 2025 :Semester/Year-2026

156. 2025/9/1 : Date this description was prepared
157. Available attendance forms : face to face
158. Number of study hours (total) / Number of units (total): 60 / 3
159. Asst. Prof. Dr. Amal Khalil Hassan : Course Supervisor Name

Course objectives .8	
• Introduce students to the concepts of sequences and complex number series. **• Develop their understanding of convergence and divergence of series.** **• Explore power series and their properties.** **• Introduce Taylor series and their applications.** **• Understand the properties of zeros of analytic functions.** **• Study Laurent series and classify singular points.** **• Introduce them to the concept of residues and their properties.**	**Course objectives**

• Explore the calculus of residues and its applications in finding real integrals. • Introduce them to conformal assignments and their applications.	
Learning and teaching strategies .9	
1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. 2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations. 3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills. 4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module. 5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.	Strategy

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Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	Definition of complex sequence, convergent sequence		4	1

		,Complex series convergence and divergence of series		4	2
		circle Convergence Power series		4	3
		Properties of power -Cauchy , series Haddard theorem		4	4
		, .R Taylor sequence M Properties of Taylor Series		4	5
		Zeros of analytic functions		4	6
		Properties of zeros of analytic functions and series Laurent		4	7
		Classification of , abnormal points definition of precipitate		4	8
		Properties of sediment ,sediments sediment , calculations theorem		4	9
		Residual calculus theorem		4	10
		Finding Improper Real Integrals Using the Residues Theorem		4	11
		Finding Improper Real Integrals Using the Residues Theorem		4	12
		apps and their saver .applications		4	13
		apps and their saver .applications		4	14
		apps and their saver .applications		4	15

Grade : Course Evaluation .11

teaching resources Learning and .12

	Complex analysis and applications
	Applied and computational complex

	analysis
	Composite functions
	Complex analysis and applications

Course Description Form

160. Course name : (1) Topology
161. R433 Course code
162. Semester/Year: First Semester 2025-2026
163. 2025/9/1 : Date this description was prepared
164. Available attendance forms : face to face
165. Number of study hours (total) / Number of units (total): 60 / 3

166. Abdulaziz Prof. Dr. Qusay Saud : Course Supervisor Name
Course objectives .8

• Introduce students to the basic concepts and properties of topological spaces. **• Develop an understanding of different types of topologies and their applications.** **• Explore the concepts of continuity, open and closed maps, isomorphism, and quotient topology.** **• Study the construction and properties of metric spaces.** **• Introduce students to different separation axioms, including T0, T1, T2 (Hausdorff), T3, T4, and T5 spaces.** **• Introduce students to the concept of counting axioms and their importance in topological spaces.**	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: This unit is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations.**	**Strategy**

3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills. **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the unit.** **5- Practical Exercises: Students participate in practical exercises to develop practical problem-solving skills.**	

Course structure .10

Evaluation method	Learning method	or Name of unit topic	Required educational outcomes	Hours	week
degree	Face to face	Topological Spaces Concepts (Definition (and Examples		4	1
		Regular (Euclidean) and A topology finite The topology complements		4	2
		The and base The basis of partial topology , metric the spaces and formation of metric relative)) , topology subspaces, (definition .(and examples		4	3
		,closed set ,Adjacencies adjacent points and		4	4

		closure			
		Target and group , derivative points group-internal and in external points , points and the border		4	5
		Relatively open and sets and ,closed sets . points in subspace		4	6
		The concept of definition) continuity the , (and examples fundamental theorem of continuity, open and closed functions		4	7
		topological equivalence, division topology, division space		4	8
		of product by base, in closure and interior topology product		4	9
		Projections, continuity in multiplication .space		4	10
		Spaces(T0, T1, T2 - (Hausdorff		4	11
		Eurison's special theorem for level		4	12
		T3½- Tikhanov) space) .		4	13
		The first axiom of , Second and counting		4	14

		.Detachable spaces		4	15

Grade : Course Evaluation .11

Learning and teaching resources .12

	Algebraic Topology
	General topology
	Fundamentals of General Topology
	Introduction to General Topology

Course Description Form

167. Name of the headquarters : (2) Topology

168. Course code : R434

169. Semester/Year: First Semester 2025-2026

170. 2025/9/1 : Date this description was prepared

171. Available attendance forms : face to face

172. Number of study hours (total) / Number of units (total): 60 / 3	
173. Prof. Dr. Hana Mortada Ali : Course Supervisor Name	
Course objectives .8	
• ..... • ..... •	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations.** **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module.** **5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.**	**Strategy**

10. Course structure

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	-non and Compact spaces compact definitions and) (examples		4	1
		Borel - Heine theorem and its weakness in topological spaces , the relationship of compact spaces to space , Hausdorff compact locally the finite , spaces intersection property and its relationship to . compact spaces		4	2
		, Connected spaces connectivity in topological spaces, . separable spaces		4	3
		Disconnected ,spaces Applications of Continuous Spaces Mean Value) (Theorem		4	4
		Vehicles, locally .connected spaces		4	5
		connected -Path . spaces		4	6
		connected -Path . spaces		4	7
		Functions and paths are . homotopic		4	8
		Functions and paths are . homotopic		4	9
		Equivalent spaces homotopia		4	10
		Equivalent spaces homotopia		4	11
		Style (type)		4	12

		. homotopy			
		Style (type) . homotopy		4	13
		the basic Building . group		4	14
		the basic Building . group		4	15

Grade : Course Evaluation .11	
	General Topology
	Element of General Topology
	A First Course in Algebraic Topology
	Algebraic Topology

Course Description Form

174. 1. Course name: Optimization (1)
175. R435 Course code
176. Semester/Year: First Semester 2025-2026

177. 2025/9/1 : Date this description was prepared
178. Available attendance forms : face to face
179. Number of study hours (total) / Number of units (total): 60 / 3
180. Asst. Dr. Amani Gamal Fadel : Course Supervisor Name

Course objectives .8	
• ..... • ..... •	**Course objectives**
strategies Learning and teaching .9	
1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations.** **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods**	**Strategy**

and techniques they have learned in the module. 5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Numerical methods -for solving one dimensional problems		4	1
		Fabonasi road		4	2
		Newton's method		4	3
		False position method		4	4
		Golden cutting method		4	5
		Iterative methods for solving nonlinear systems		4	6
		steep descent method		4	7
		conjugate gradient method		4	8
		Newton's method		4	9
		Variable metric method		4	10
		Conditional conjugate gradient method		4	11
		My Lagrange Method		4	12
		Newton's progressive solution to a system of . nonlinear equations		4	13
		Newton's progressive solution to a system of . nonlinear equations		4	14
		Newton's progressive solution to a system of . nonlinear equations		4	15

Grade : Course Evaluation .11

	Introduction to optimization

	Practical methods of optimization
	The Control Handbook
	Control System Design

Course Description Form

181. Course name: Optimization (2)
182. R436 Course code
183. Semester/Year: First Semester 2025-2026
184. 2025/9/1 : Date this description was prepared
185. Available attendance forms : face to face
186. Number of study hours (total) / Number of units (total): 60 / 3
187. Ms. Haifa Asi Kawi : Course Supervisor Name
Course objectives .8

• ..... • ..... •	**Course objectives**

Learning and teaching strategies .9

1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations.** **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module.** **5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.**	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Linear control systems		4	1
		Nonlinear control systems		4	2
		Representation of .inputs and outputs		4	3

		Ricci equation		4	4
		.Feed back control		4	5
		The importance of the corresponding model		4	6
		General steps for creating the second model		4	7
		The relationship between the first and .second models		4	8
		Optimal control of linear systems		4	9
		control-control and re .nonlinear systems of		4	10
		control-control and re .nonlinear systems of		4	11
		.Optimal control time		4	12
		.Optimal control time		4	13
		.Optimal control time		4	14
		.Optimal control time		4	15

Grade : Course Evaluation .11

12. Learning and teaching resources

	Control System Design
	Optimizing theory and applications
	Operations Research an introduction
	Operations Research

Course Description Form

188. Course Name: Partial Differential Equations

189. Course code : R437
190. Semester/Year: First Semester 2025-2026
191. 2025/9/1 : Date this description was prepared
192. Available attendance forms : face to face
193. total) / Number of units (total): 60 / 3) Number of study hours
194. Prof. Dr. Alaa Hassan Abdullah : Course Supervisor Name
Course objectives .8

• ..... • ..... •	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case**	**Strategy**

studies are analyzed to apply the concepts and methods taught to practical situations. **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module.** **5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.**	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	Introductory concepts, partial linear differential equations		4	1
		linear -Quasi ,Features partial differential equations, auxiliary Lagrange system, . solved examples		4	2
		Legal ,Classification forms of partial, hyperbolic, equivalent, and elliptic equations		4	3
		the wave Rotation of Heat ,equation equation, Laplace's equation		4	4
		Classification of boundary conditions, . Cauchy's problem		4	5
		Even and odd and its functions properties		4	6
		Fourier series for sine,		4	7

		Fourier series for perfect sine			
		Applications of Fourier series to initial boundary value and problems		4	8
		Separation of variables for homogeneous linear partial differential equations with homogeneous and homogeneous -non boundary conditions(		4	9
		How to deploy special -to solve non functions homogeneous linear partial equations with homogeneous boundary conditions		4	10
		How to deploy special -functions to solve non homogeneous linear partial equations with homogeneous boundary conditions		4	11
		Coordinate systems and separation method .		4	12
		Integral transformations		4	13
		,Laplace transform transfer Instant		4	14
		Applications		4	15

Grade : Course Evaluation .11

12. Learning and teaching resources

	Control System Design
	Optimizing theory and applications

	Operations Research an introduction
	Operations Research

Course Description Form

195. Course Name: Partial Differential Equations	
196. Course code : R437	
197. Semester/Year: First Semester 2025-2026	
198. 2025/9/1 : Date this description was prepared	
199. Available attendance forms : face to face	
200. Number of study hours (total) / Number of units (total): 60 / 3	
201. Prof. Dr. Alaa Hassan Abdullah : Course Supervisor Name	
Course objectives .8	
• **.....**	

• ..... •	

Learning and teaching strategies .9

1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. 2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations. 3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills. 4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module. 5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Introductory concepts, linear partial differential equations		4	1
		linear -Quasi ,Features partial differential equations, auxiliary Lagrange system, . solved examples		4	2
		Legal ,Classification forms of partial, hyperbolic, equivalent,		4	3

		and elliptic equations			
		Rotation of the wave Heat ,equation equation, Laplace's equation		4	4
		Classification of boundary conditions, . Cauchy's problem		4	5
		Even and odd and its functions properties		4	6
		Fourier series for sine, Fourier series for perfect sine		4	7
		Applications of Fourier series to initial boundary value and problems		4	8
		Separation of variables for homogeneous linear partial differential equations with homogeneous and homogeneous -non boundary conditions(		4	9
		How to deploy special -functions to solve non homogeneous linear partial equations with homogeneous conditions boundary		4	10
		How to deploy special -functions to solve non homogeneous linear partial equations with homogeneous boundary conditions		4	11
		Coordinate systems and separation method .		4	12
		Integral transformations		4	13
		,Laplace transform transfer Instant		4	14
		Applications		4	15

Grade : Course Evaluation .11	
Learning and teaching resources .12	
	Control System Design
	Optimizing theory and applications
	Operations Research an introduction
	Operations Research

Description Form Course

202. Course name: Numerical Analysis (2)
203. R441 Course code
204. Semester/Year: First Semester 2025-2026
205. 2025/9/1 : Date this description was prepared
206. Available attendance forms : face to face

207. units (total): 60 / 3 Number of study hours (total) / Number of
208. Prof. Dr. Abeer Majeed Jassim : Course Supervisor Name
Course objectives .8

• Introduce students to various numerical methods for solving mathematical problems. **• Develop their understanding of the strengths and weaknesses of different numerical methods.** **• Provide practical experience in applying and using numerical methods through computational exercises.** **• Improve problem-solving and critical thinking skills through the application of numerical methods.**	**Course objectives**
Learning and teaching strategies .9	
1- Lectures: This unit is delivered through lectures to provide theoretical knowledge and explain concepts.	**Strategy**

2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations. **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the unit.** **5- Practical Exercises: Students participate in practical exercises to develop practical problem-solving skills.**	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face mode	Trapezoidal method, Simpson's method		4	1
		,Midpoint method Error discussion analysis, Romberg method		4	2
		Coates Open -Newton and Closed Roads		4	3
		Legendre -Gauss . integration method		4	4
		Linear and binary approximation, exponential nonlinear approximation		4	5
		Approximation of . continuous functions		4	6
		Euler's explicit and implicit method, Taylor's series method		4	7

		Kota Methods-Rank From the second and fourth ranks, Adam's .methods are derived Step-Bashforth Multi		4	8
		correction -Estimation methods, error discussion and ranking of numerical . methods		4	9
		Higher order ordinary differential . equations		4	10
		Finite difference methods for linear . equations		4	11
		. Throwing method		4	12
		Numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations Using the specific . difference method		4	13
		Numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations Using the specific . difference method		4	14
		Numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations Using the specific . difference method		4	15
Grade : Course Evaluation .11					

Learning and teaching resources .12	
	Numerical Analysis
	Introduction To Numerical Analysis
	Principles of Numerical Analysis

Course Description Form

209. Course name: Numerical Analysis (2)
210. Course code : R441
211. Semester/Year: First Semester 2025-2026
212. 2025/9/1 : Date this description was prepared
213. Available attendance forms : face to face
214. Number of study hours (total) / Number of units (total): 60 / 3
215. Prof. Dr. Abeer Majeed Jassim : Course Supervisor Name

Course objectives .8	
• Introduce students to various numerical methods for solving .mathematical problems • Develop their understanding of the strengths and weaknesses of different .numerical methods • Providing practical experience in the application and use of numerical methods through .computational exercises • solving and -Improve problem by critical thinking skills .applying numerical methods	Course objectives
Learning and teaching strategies .9	
1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. 2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations. 3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills. 4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module. 5- Practical Exercises: Students	Strategy

participate in practical exercises to develop practical skills in solving operations research problems.	

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Trapezoidal method, Simpson's method		4	1
		,Midpoint method Error discussion analysis, Romberg method		4	2
		Coates Open -Newton and Closed Roads		4	3
		Legendre -Gauss . integration method		4	4
		Linear and binary approximation, nonlinear exponential approximation		4	5
		Approximation of . continuous functions		4	6
		Euler's explicit and implicit method, Taylor's series method		4	7
		Kota Methods-Rank From the second and fourth ranks, Adam's .methods are derived Step-Bashforth Multi		4	8
		correction -Estimation methods, error discussion and ranking . of numerical methods		4	9
		Higher order ordinary . differential equations		4	10
		Finite difference methods for linear . equations		4	11
		. Throwing method		4	12
		Numerical solutions of elliptic, parabolic, and hyperbolic partial		4	13

		differential equations Using the specific . difference method			
		Numerical solutions of parabolic, and ,elliptic hyperbolic partial differential equations Using the specific . difference method		4	14
		Numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations Using the specific . difference method		4	15

Grade : Course Evaluation .11

Learning and teaching resources .12

	Numerical Analysis
	Introduction To Numerical Analysis
	Principles of Numerical Analysis

Course Description Form

216. Course Name : Approximation Theory :

217. Course code : R443
218. Semester/Year: First Semester 2025-2026
219. 2025/9/1 : Date this description was prepared
220. Available attendance forms : face to face
221. Number of study hours (total) / Number of units (total): 60 / 3
222. Rasan Ridha-Ms. Janan Abdul : Course Supervisor Name

Course objectives .8	
• Introduce students to the field of approximation theory and its historical development. **• Explore applications of approximation theory in various disciplines, including mathematics and real-world applications.** **• Provide an understanding of modular spaces and their role in approximation theory.**	**Course objectives**

• Define approximation in function spaces and examine examples of functions that can be approximated. **• Discuss the concept of equivalent norms and their implications in approximation theory.** **• Investigate the existence and uniqueness of best approximation in various contexts.** **• Analyze approximation as a continuous mapping and the properties of convex norms.** **• Define Lp spaces and examine Minkowski's inequality in the context of approximation theory.** **• Study approximation techniques using algebraic and trigonometric polynomials.** **• Explore the concept of best approximation, Chebyshev polynomials, interpolation, and Lagrangian interpolation.** **Discuss approximation on finite sets and the use of Fourier series in approximation theory.** **• Introduction to Jackson's theorem (direct theorem), smoothing coefficients, orthogonal polynomials,**	

Gauss's quadratures, and Muntz's theorem. **• Understanding and applying Weierstrass's theorem in approximation theory.**	

Learning and teaching strategies .9

1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations.** **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module.** **5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.**	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	Definition of , approximation theory a historical overview of		4	1

		the topic			
		The most important applications of the subject to life and . mathematics		4	2
		Standard spaces of definition of , functions in approximation function spaces		4	3
		Examples of functions that can be approximated, functions that cannot be approximated, and functions that have more than one .approximation		4	4
		Equivalence of two criteria, existence and the best uniqueness of , approximation approximation as a continuous transformation		4	5
		. Convex standard		4	6
		Lp spaces , Holder and Minkowski inequalities		4	7
		Approximation using algebraic polynomials		4	8
		Approximation using trigonometric best , polynomials approximation		4	9
		Chebyshev polynomials		4	10
		Inclusion. Lagrange inclusion		4	11
		Approximation on Fourier , finite sets series		4	12
		Jackson's Theorem , (Direct Theorem) Orthogonal Polynomials		4	13
		, Gaussian squares theorem Meunt 's		4	14

		Wehrstraße's theorem		4	15

Grade : Course Evaluation .11

Learning and teaching resources .12	
	A short course on approximation theory.
	Introduction to approximation theory
	Approximation theory and functional analysis
	Lecture notes in mathematics

Course Description Form

223. Course name: Random Operations
224. Course code : R445
225. Semester/Year: First Semester 2025-2026
226. 2025/9/1 : Date this description was prepared
227. Available attendance forms : face to face

228. Number of study hours (total) / Number of units (total): 60 / 3
229. Asst. Prof. Dr. Mohammed Sari : Course Supervisor Name Kazim
Course objectives .8

• **Provide a comprehensive understanding of probability .theory and random variables** • **Introducing the concept of - random processes and their .types** • **Explore different types of - stochastic processes, such as Bernoulli processes, Wiener processes, and Poisson .processes** • **Introducing random - .ainsmatrices and Markov ch** • **Study the classification of - states in Markov chains and .analyze their transitions** • **Understanding random - .paths and their properties** • **Identify the mean value and - .variance of random processes** • **Introducing fixed operations - .and their properties**	**ourse objectivesC**

Learning and teaching strategies .9

1- Lectures: This module is delivered through lectures to provide theoretical knowledge and explain concepts. **2- Case Studies: Real-life case studies are analyzed to apply the concepts and methods taught to practical situations.** **3- Group Discussions: Students participate in group discussions to enhance their understanding and problem-solving skills.** **4- Assignments: Students are given assignments to practice the methods and techniques they have learned in the module.** **5- Practical Exercises: Students participate in practical exercises to develop practical skills in solving operations research problems.**	**Strategy**

Course structure .10

Evaluation method	Learning method	Name of unit or topic	Required educational outcomes	Hours	week
degree	Face to face	General review of probability and .random variables		4	1
		Definition of a stochastic process		4	2
		Types of stochastic operations		4	3
		Bernoulli processes		4	4
		Winer operations		4	5
		processes Poisson		4	6
		stochastic matrix		4	7
		Markov chains		4	8
		Transition matrix		4	9
		Classification of Markov chains		4	10
		move to a specific state		4	11

		Random walk		4	12
		Random walk		4	13
		Mean and variance of .a stochastic process		4	14
		Mean and variance of .a stochastic process		4	15

Grade : Course Evaluation .11

Learning and teaching resources .12

	Real Analysis and Probability
	An Introduction To Stochastic Processes
	Brownian Motion And Stochastic Calculus