Course Specification

(Postgraduate Programs)

Course Title:	Algebra-1
Course Code:	MATH 601
Program:	M.Sc. in Mathematics
Department:	Mathematics
College:	Science College
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

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A. General information about the course:

1. Course Identificationn:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (1/1)					
4. Course general Description:					
This course provides an introduction to abstract algebra, so it is designed to cover the basic Concepts of the abstract algebra and entrench the algebraic ideas in the students mind, which lead to use mathematical logic concepts to prove basic theories, which easily lead to study deeply an advanced courses. **Groups, subgroups, lattices of subgroups, cosets and normal subgroups, quotient group, homomorphism, isomorphism and related theorems. Rings, subrings, ideals, ring homomorphism, quotient rings, polynomial rings and irreducibility criteria. Fields, field extensions, algebraic extensions, algebraic closure and fundamental theorem of algebra.**					
5. Pre-requirements for this course (if any)**:**					
Math 323					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
The main objectives of this course are focused to: 1. Demonstrate basic concepts of abstract algebra, able to deal with abstract concepts as well as use mathematical logic to prove basic theories. 2. Describe algebraic construction and its conditions. 3. Discover and apply the abstract algebra is the main theory of mathematics that study the important algebraic construction such as groups, rings, fields and other.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to Groups, subgroups and their elementary properties, normal subgroups, quotient groups, homomorphism, isomorphism and related theorems. Rings, subrings, ideals, ring homomorphism and isomorphism, polynomial rings and irreducibility criteria, Fields, field extensions and fundamental theorem of algebra.	K1	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
1.2	Interrelate appropriate algebraic structures, their features and role of applications e.g. Groups, subgroups and their cyclic structures, quotient groups, fundamental theorem of homomorphism, isomorphism for groups and rings,		Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	ideals, quotient rings, polynomial rings and irreducibility criteria, Fields, field extensions, algebraic extensions and fundamental theorem of algebra.	**K2**		
1.3	Integrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollaries, lemmas and propositions related to Groups, Lagrange's theorem and related results, Rings, direct products, homomorphism, isomorphism and their different properties, quotient rings, polynomial rings and irreducibility criteria, PID, ED, Fields, field extensions, algebraic closure and fundamental theorem of algebra.	**K3**	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
2.0	**Skills**			
2.1	Discover and apply various techniques of Groups, subgroups and their cyclic structures, quotient groups, fundamental theorem of homomorphism, isomorphism for groups and rings, quotient rings, polynomial rings and irreducibility criteria,	S1	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Fields, field extensions and fundamental theorem of algebra.			
2.2	Communicate knowledge of problems-solving skills and having algebraic intuitions related to Groups concepts, rings concepts and Fields concepts with field extensions.	**S2**	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
2.3	Analyze complex problems in abstract algebra like Groups, subgroups, quotient groups, fundamental theorem of homomorphism, isomorphism for groups and rings, polynomial rings and irreducibility criteria. Fields, field extensions.	**S3**	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
2.4	Conduct scientific research on certain field of algebra e.g. groups, rings and similar concepts which is common in group and rings e.g. homomorphism, isomorphism and fundamental theorem based on them, field and field extensions.	**S4**	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate Leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				group works.
3.2	Inculcating values and ethics in thought, expression and deed.	**V2**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of the society.	**V4**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	Groups, subgroups, lattices of subgroups.	3
2.	Cosets and normal subgroups, quotient groups.	3
3.	Generating set and Cayley graph and diagraph, quotient group.	3
4.	Homomorphism, isomorphism and related theorems.	6
5.	Rings, subrings, integral domains, zero divisor ring,	3
6.	Ideals, quotient rings, polynomial rings and irreducibility criteria.	6
7.	PID, ED related to polynomial rings.	3
8.	Fields, field extensions.	6
9.	Algebraic extensions and algebraic closure.	6
10.	Fundamental theorem of algebra.	6

Total	45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. I. N. Herstein, Topics in Algebra, John Wiley and Sons, 1975. 2. J. B. Farleigh, A First Course in Abstract Algebra, Wesley Publishing Co. London, 7th ed., 2003.
Supportive References	1. D. Dummit and R. Foote, Abstract Algebra, John Wiley & Sons, 3rd ed., 2004. 2. Thomas W. Hungerford, Algebra, Springer, 2003.
Electronic Materials	Web sites dedicated to groups, rings and fields available on the internet.
Other Learning Materials	**Packages related to algebra.** **- Power point presentations and other hand-outs posted on the course web site.**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**1. Lecture room(s) for groups of 25 students.** **2. Computer laboratories for groups of 25 students in case needed.**
Technology equipment (Projector, smart board, software)	**Algebraic interface software if required.**
Other equipment (Depending on the nature of the specialty)	Mathematical laboratory

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student Assessment of Teaching Quality (NCAAA Form) assessed by Program QA Unit. - Assessment of course teaching strategies by QA Unit.	Assignments, Quizzes, Written Exam
Effectiveness of students assessment	Student questionnaires to be assessed by Program QA Unit.	Assignments, Quizzes, Written Exam
Quality of learning resources	Revision of course contents, specifications, and strategies every 5 years.	Assignments, Quizzes, Written Exam
The extent to which CLOs have been achieved	- Cross check marking by a Senior Faculty of student work. - Periodic exchange of a sample of assignments with a Faculty in a different Program.	Assignments, Quizzes, Written Exam
Other	Revision of course contents, course specifications, and strategies every 5 years.	Assignments, Quizzes, Written Exam

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	29/031446 H; 02/10/2024 AD

Course Specification

(Postgraduate Programs)

Course Title: Real Analysis-1
Course Code: Math-602
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 1/Year 1)				
4. Course general Description:				
This course introduces Real analysis, so it is designed to cover the basic concepts of the real analysis, in a systemic and rigorous manner, in the context of real-valued functions of real variables. This course develops and examines the basic materials in real analysis in a systemic and rigorous manner in the context of real-valued functions of real variables. It covers the fundamentals of real analysis: the real number system, sequences, continuity, differentiation, the Riemann-Stieltjes integral, and sequence and series of functions.				
5. Pre-requirements for this course (if any)**:**				
Math-315 or Equivalent				
6. Co-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				
After completing this course, the student will be **1. Describe the fundamental properties of the real numbers.** **2. Demonstrate an understanding of limits and how they are used in sequences & series and differentiation.** **3. Apply the properties of sequences to solve related problems.** **4. Analyze continuity of a function and distinguish between continuity and uniform continuity.** **5. Distinguish between point-wise convergence and uniform convergence.** **6. Apply the properties of the Riemann-Stieltjes integral to identify integrable functions.**				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate mathematical concepts relevant to Real Numbers, Sequences, Series, Limit of Functions, Continuity, Differentiability, Integration, Functions of Several Variables.	**K1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.2	Describe notations and concepts required for the solution of Mathematical problems in Real Numbers, Sequences, Series, Limit of Functions, Continuity, Differentiability, Integration, Functions of Several Variables	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.3	Integrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollary, lemma, and proposition related to Real Numbers, Sequences, Series, Limit of Functions, Continuity, Differentiability, Integration, Functions of Several Variables	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	Discover and apply various techniques of Real Numbers, Sequences, Series, Limit of Functions, Continuity, Differentiability, Integration, Functions of Several Variables	**S1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.2	Communicate knowledge of problem-solving skills and having algebraic intuitions related to Real Numbers, Sequences, Series, Limit of Functions, Continuity, Differentiability, Integration, and Functions of Several Variables.	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.3	Analyze complex problems in Real Numbers, Sequences, Series, Limit of Functions, Continuity, Differentiability, Integration, Functions of Several Variables.	**S3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.4	Conduct scientific research on certain field of algebra e.g. groups, rings and similar concepts which is common in Real Numbers, Sequences, Series, Limit of Functions, Continuity, Differentiability, Integration, Functions of Several Variables.	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate Leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Activities.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Activities.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Activities.
3.4	Promote mathematics in scientific development as well as in the general		Assignments, Seminars,	Dissertation and its oral

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	education of society.	V4	Reading, Group Discussion.	defense, Activities.

C. Course Content:

No	List of Topics	Contact Hours
1.	Linear and nonlinear systems	6
2.	Iterative methods.	3
3.	Interpolation.	3
4.	Approximation of solutions.	3
5.	Error estimate	3
6.	Data fitting	3
7.	Numerical differentiation and integration	3
8.	Numerical solutions of boundary value problems	6
9.	Stability and convergence of solutions	6
10.	Finite difference method	3
11.	Finite element method.	6
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. Walter Rudin,''Principle of Mathematical Analysis''; Third Edition, McGraw –Hill. Inc. ISBN 1976.
Supportive References	1. R.G. Bartle and D.G. Sherbert,'' Introduction to Real Analysis'', 3rd Edition. John Wiley and Sons, 2000Thomas W. Hungerford, Algebra, Springer, 2003. 2. Richard R. Goldberg,'' Methods of Real Analysis '', 3rd Edition, John Wiley and Sons. Inc. 1976.

Electronic Materials	Web sites dedicated to Probability and Mathematical Statistics on the internet.
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	29/031446 H; 02/10/2024 AD

Course Specification

(Postgraduate Programs)

Course Title: Complex Analysis
Course Code: Math-603
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 2/Year 1)				
4. Course general Description:				
This course introduces an introduction to complex analysis, so it is designed to cover the basic concepts of the complex analysis and entrench the complex analysis ideas in the student's mind, leading to mathematical logic concepts to prove basic theories, easily leading to studying an advanced course deeply. **The complex number system, metric and the topology in C, analytic function, Basic Functions, transformations, Mobius transformation, Integral Cauchy - Goursat's theorem, Cauchy's integral formula, Sequences and Series** **power series, Taylor and Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem,** **zeros of an analytic function, counting zeros, and Application of residues in evaluating improper integrals.**				
5. Pre-requirements for this course (if any)**:**				
Math-314 or Equivalent				
6. Co-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				
After completing this course, the student will be 1. Prove basic results relating to analytic functions. 2. Apply the Cauchy Integral formula to evaluate certain class of complex line integrals. 3. Express analytic functions in power series. 4. Find a harmonic conjugate of a given harmonic function in an appropriate domain. 5. Apply the Cauchy-Riemann equations to problems related to the differentiability of the function of complex variables. 6. Apply the properties of Mobius transformation in mappings and related problems in analytic Functions				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to the complex number system, metric and the topology in C, analytic function, Basic Functions, Mobius transformation, Integral Cauchy-Goursat's theorem, Cauchy's integral formula, Sequences and Series power series, Taylor and Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem, zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.	**K1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe appropriate algebraic structures, their features, and the role of applications e.g. the complex number system, metric and the topology in C, analytic function, Basic Functions, Mobius transformation, Integral Cauchy-Goursat's theorem, Cauchy's integral formula, Sequences and Series power series, Taylor and Maclurain series, Laurent Series,	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Residues, Cauchy's Residues theorem, zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.			
1.3	Integrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollaries, lemmas, and propositions related to the complex number system, metric and the topology in C, analytic function, Basic Functions, Mobius transformation, Integral Cauchy-Goursat's theorem, Cauchy's integral formula, Sequences and Series power series, Taylor and Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem, zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and implement various techniques of the complex number system, metric and the topology in C, analytic function, Basic Functions, Mobius transformation, Integral Cauchy-Goursat's theorem, Cauchy's integral formula, Sequences and Series power series, Taylor and Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem, zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.	**S1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge of problem-solving skills and having algebraic intuitions related to the complex number system, metric and the topology in C, analytic function, Basic Functions, Mobius transformation, Integral Cauchy-Goursat's theorem, Cauchy's integral formula, Sequences and Series power series, Taylor and	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem, zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.			
2.3	Analyze complex problems in abstract algebra like the complex number system, metric and the topology in C, analytic function, Basic Functions, Mobius transformation, Integral Cauchy-Goursat's theorem, Cauchy's integral formula, Sequences and Series power series, Taylor and Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem, zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.	**S3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain field of algebra e.g. the complex number system, metric and the topology in C, analytic function, Basic Functions, Mobius transformation, Integral Cauchy-Goursat's theorem, Cauchy's integral formula, Sequences and Series power series, Taylor and Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem, zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of the society.	**V4**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	The complex number system,	3
2.	Metric and the topology in C,	3
3.	Analytic functions	6
4.	Basic Functions	3
5.	Transformations, Mobius transformation.	6
6.	Integral Cauchy - Goursat's theorem.	3
7.	Cauchy's integral formula.	3
8.	Sequences and Series, power series.	6
9.	Taylor and Maclurain series, Laurent Series, Residues, Cauchy's Residues theorem.	6
10.	Zeros of an analytic function, counting zeros, Application of residues in evaluating improper integrals.	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	**1.** Complex Variables and Applications, J.W. Brown and R.V. Churchill, 8th Edition McGraw-Hill Company, New York,2009.
Supportive References	**1.** Jerrold E. Marsden and Michael J. Hoffman, Basic Complex Analysis, 3rd ed., W.H. Freeman, New York, 1999. **2.** John B. Conway, Function of One Complex Variable, 2nd ed., Springer, New York, 1978. **3.** Richard A. Silverman, Introductory Complex Analysis, ISBN, New York, Dover Publications, 1967.
Electronic Materials	Web sites dedicated to complex analysis on the internet.
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	29/031446 H; 02/10/2024 AD

Course Specification

(Postgraduate Programs)

Course Title:	Numerical Analysis
Course Code:	Math 604
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 2/Year 1)					
4. Course general Description:					
Numerical analysis is the area of mathematics and computer science that creates, analyzes, and implements algorithms for solving numerically the problems of continuous mathematics which involves systems, approximation functions, solutions for ordinary and partial differential equations, Numerical differentiation and integration, methods to solve initial and boundary values problems, stability and convergence of the solutions that occur in different areas of sciences.					
5. Pre-requirements for this course (if any)**:**					
Math 419					
6. Course Main Objective(s):					
The main objectives of this course are focused to: **1. Solve linear and non-linear systems with different numerical methods.** **2. Distinguish between different numerical methods.** **3. Formulate appropriate method to approximate numerical solutions.** **4. Apply the appropriate method to solve mathematical problems and prove the stability and convergence of these methods.** **5. Explain some new numerical methods that have different areas of research**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to Linear and nonlinear systems; Iterative methods ; Interpolation ; Approximation of solutions ; Error estimate ; Data fitting ; Numerical differentiation and integration ; Numerical solutions of boundary value problems ; Stability and convergence of solutions ; Finite difference method ; Finite element method	**K1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.2	Describe appropriate linear and nonlinear systems; Iterative methods ; Interpolation ; Approximation of solutions ; Error estimate ; Data fitting ; Numerical differentiation and integration ; Numerical solutions of boundary value problems ; Stability and convergence of solutions ; Finite difference method ; Finite element method.	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.3	Integrate knowledge and handle complexity and formulate judgments with the results based on linear and nonlinear systems; Iterative methods ; Interpolation ; Approximation of solutions ; Error estimate ; Data fitting ; Numerical differentiation and integration ; Numerical solutions of boundary value problems ; Stability and convergence of solutions ; Finite difference method ; Finite element method	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.0	**Skills**			
2.1	Discover and apply various techniques of linear and nonlinear systems; Iterative methods ; Interpolation ; Approximation of solutions ; Error estimate ; Data fitting; Numerical differentiation and integration ; Numerical solutions of boundary value problems ; Stability and convergence of solutions ; Finite difference method ; Finite element method.	**S1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.2	Communicate knowledge of problems-solving skills and having numerical intuitions related to linear and nonlinear systems, Interpolation, differentiation and integration, Stability and convergence of solutions Finite difference method and Finite element method.	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.3	Analyze complex problems in linear and nonlinear systems, Interpolation, differentiation and integration, Stability and convergence of solutions Finite difference method and Finite element method.	**S3**	Lectures, Tutorials, Seminars,	Examinations, Quizzes, Tests, Home Works, Assignments,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			Direct Reading, Group Discussion	Seminar/Presentation
2.4	Conduct scientific research on applying many methods to new mathematical systems used in the fields of applied mathematics	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate Leadership qualities in research and innovation with sense of Commitment and accountability.	V1	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression and deed.	V2	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Responsibility for personal outputs, intellectual independence.	V3	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of the society.	V4	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1. 1	Linear and nonlinear systems	6
2. 2	Iterative methods.	6
3	Interpolation.	3
4	Approximation of solutions.	3
5	Error estimate	3
6	Data fitting	3
7	Numerical differentiation and integration	3
8	Numerical solutions of boundary value problems	6
9	Stability and convergence of solutions	6
10	Finite difference method	6
11	Finite element method.	6
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Richard Burden and J. Dougias Faires,"Numerical Anlysis",Brooks/Cole, Cengage Learning, 2011
Supportive References	Alfio Quarteroni, Riccardo Sacco and Fausto Saleri, 'Numerical Mathematics ' Springer, 2007.
Electronic Materials	Web sites dedicated to numerical analysis on the internet.
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom equipped with projector, white board, and sufficient seating arrangements. .
Technology equipment (Projector, smart board, software)	Power point presentations and other hand-outs posted on the course web site.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

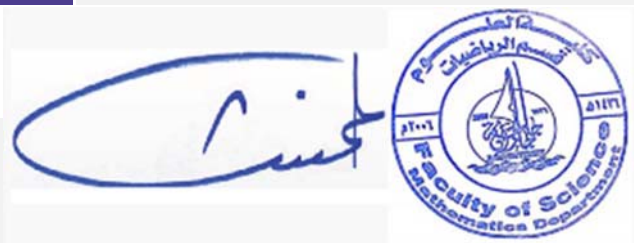
Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**



Course Specification

(Postgraduate Programs)

Course Title: Theory of Differential Equations
Course Code: Math-605
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐Elective	

3. Level/year at which this course is offered: (Level 2 /Year 1)

4. Course general Description:

This course is concern with studying the basic theory of differential equations in terms of their types and solutions, as well as the existence, uniqueness and stability of its solutions and also its practical interpretations.

5. Pre-requirements for this course (if any)**:**

Math-332 or Equivalent

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

After completing this course, the student will be able to:

1- Know the most technique of studying differential equations.
2- Solve various systems of differential equations.
3- Prove the existence and uniqueness of solutions.
4- Interpret the qualitative behavior of solutions for system of differential equations.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate ability to solve system of differential equations, classifies the differential equations with respect to their order and linearity, explains the meaning of solution of differential equation, express the existence and uniqueness theorem of differential equation, understand the basic notations of linearity, superposition, existence and uniqueness of solutions when solving a system of DE.	**K1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe and classify critical points of a first order linear differential equation, use them to describe the behavior and stability of solutions.	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Integrate knowledge to determine the interval or region of existence, uniqueness and stability of solution to differential equation or IVP.	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply as to how a regular Sturm-Liouville problem is and to be able		Lectures, Tutorials,	Assignment 1 Assignment 2

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	to put a simple linear second order equation into the Sturm-Liouville form, To recall some of the properties of Sturm-Liouville problems.	**S1**	Seminars, Direct Reading, Group Discussion	Quiz Exam Midterm Exam Final Exam
2.2	Ability to communicate knowledge for a specific equation, that its eigenfunctions and eigenvalues satisfies some Sturm-Liouville properties.	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	Ability to solve and analyze a boundary value problem use Rayleigh Ritz method to understand the different variational formulations of boundary value problems.	**S3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Assignments, Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Assignments, Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	System of differential equations	3
2.	Homogeneous and nonhomogeneous system	6
3.	Existence and uniqueness proof	3
4.	Singular points, Asymptotic behavior of solution, existence	6
5.	Stability and Uniqueness for initial value problems (IVP)	6
6.	Strum-Liouville theory	3
7.	Properties of Strum-Liouville differential equations	3
8.	Completeness of the set of eigenvalues and eigenfunctions of SL	6
9.	Stability by Liapunov second method	6
10.	Rayleizh-Rietz methods	3
	Total	45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. R. Kent Nagle, E. B. Saff and A. D. Snider, Fundamentals of Differential Equations and Boundary Value Problems, Pearson Addison-Wesley, 2008.
Supportive References	Wolfgang Walter, Ordinary Differential Equations, (Translated by Russel Thompson), Springer 1998.
Electronic Materials	Web sites or YouTube online videos related to the topic
Other Learning Materials	Power point presentations and other handouts posted on the course web site.

2. Educational and Research Facilities and Equipment Required:

Items	Resources

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Mathematical Statistics-1
Course Code:	MATH 606
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (level 2 /Year 1)					
4. Course general Description: **This is the first graduate course in mathematical statistics and it aims to use the probability techniques to build a statistical theory. It gives a rigorous mathematical foundation for Estimation theory and Testing hypothesis. It provides a firm basis for work on Statistical theory and its applications.** **Axioms and foundations of probability. Conditional probability and Bayes' theorem. Independence. Random variables and distribution functions and moments. Characteristic functions, Laplace transforms and moment generating functions. Function of random variables. Random vectors and their distributions. Convergence of sequences of random variables. Laws of large numbers and the central limit theorem. Random samples, Sampling and sampling**					
5. Pre-requirements for this course (if any)**:**					
Math 453 and Math 352 or equivalent					
6. Co-requirements for this course (if any)**: None**					
7. Course Main Objective(s): **After completing this course, the student will be** **1. Understand the language of probability theory to build Statistical Theory.** **2. Know the sampling and method of sampling and its applications.** **3. Collect data and analyze the problems in a critical manner and make decision.** **4. Take advance work on statistical theory and applications**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100 %
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Demonstrate** in-depth knowledge of the mathematical concepts related to probability. Understand the concept of Sample Space, Probability Axioms, Probability on Finite Sample Spaces, Conditional Probability	**K1**	**Lectures, Tutorials, Seminars, Direct Reading, Group Discussion**	**Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	and Baye's Theorem,			
1.2	**Describe** structures and features of mathematical problems and role of application of probability theory. Independence of Events, Random Variables, Probability functions, Distribution functions and moments. Joint Distribution Functions Explain the difference of Discrete and Continuous Random Variables	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.3	**Integrate** knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollary, lemma and proposition related to and concepts required for the solution of mathematical statistics problem. Moments of a distribution function, Laplace transforms and moment generating functions,	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
...				
2.0	**Skills**			
2.1	**Discover and apply** various techniques of probability theory. Analyze of some Multiple Random Variables, Independent	**S1**	Lectures, Tutorials, Seminars, Direct Reading, Group	Examinations, Quizzes, Tests, Home Works, Assignments,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Random Variables, Functions of, Random Variables, Random vectors and their distributions. Transformations of Random Variables.		Discussion	Seminar/Presentation
2.2	**Ability** to communicate problems-solving skills and having probabilistic intuitions and insight in thinking about problems. Apply the knowledge of Convergence of sequences of random variables. Laws of large numbers and the Central Limit Theorem.	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.3	**Analyze** complex problems of mathematical statistics problems using critical thinking in sampling and sampling distributions.	**S3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.4	**Conduct** scientific research on certain field of mathematical statistics e.g. sampling and sampling distributions, order statistics and their distributions.	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
3.0	**Values, autonomy, and responsibility**			
3.1	Leadership qualities in research and innovation with sense of Commitment and accountability.		Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.2	Inculcating values and ethics in thought, expression and deed.		Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.		Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of the society.		Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Axioms and foundations of probability.	3
2.	Conditional probability and Bayes' theorem.	3
3.	Independence Random variables and distribution functions and Moments.	6
4.	Characteristic functions	3
5.	Laplace transforms and moment generating functions	6
6.	Function of random variables. Random vectors and their distributions.	3
7.	Convergence of sequences of random variables.	6
8.	Laws of large numbers and Central Limit Theorem.	3
9.	Sampling Theory and Sampling Distributions	6
10.	Order statistics and their distributions.	6

Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. R.V. Hogg and Allen T. Craig, Introduction to Mathematical Statistics, Mcmillan, 1978, 1995. 2. R.V. Hogg, J. Mckean and A.T. Craig, Introduction to Mathematical Statistics, Prentice Hall, 2005
Supportive References	V.K. Rohatgi, Introduction to Probability Theory and Mathematical Statistics, Wiley, 1976.
Electronic Materials	Web sites dedicated to Probability and Mathematical Statistics on the internet.
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom equipped with projector, white board, and sufficient seating arrangements. .
Technology Resources (AV, data show, Smart Board, software, etc.)	Power point presentations and other hand-outs posted on the course web site.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title: Probability Theory- 1
Course Code: Math-607
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 2/Year 1)					
4. Course general Description:					
This is the first post graduate course in probability theory and measure-theoretic probability. It provides a solid background and understanding of the basic results and methods in measure and probability theory before entering into a more advance measure-theoretic probability course. It develops the measure probability basis that is required in modern probability theories. The material in this course is fundamental not only in probabilistic analysis, but also in a various applied areas such as stochastic processes, queuing theory, mathematical finance and reliability.					
5. Pre-requirements for this course (if any)**:**					
Math-352 or Equivalent					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
After completing this course, the student will be 1. Know the basic concepts and theorems in probability theory and measure. 2. Connect all probability theory concepts, techniques and theorems to measure theory. 3. Develop theoretical problems-solving skills and having probabilistic intuitions and insight in thinking about problems. 4. Have a firm basis for advanced work on probability and measure.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate mathematical concepts relevant to fundamental of probability and measure theory and define how to construct the probability space and measure space.	**K1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.2	Describe structures and features of mathematical problems and role of application of probability theory, descriptive and inferential statistics in many different fields.	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.3	Integrate knowledge required to handle complexity in notations and concepts the Borel-Cantelli lemma and strong Law of large number.	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.0	**Skills**			
2.1	Discover and apply various techniques of probability theory, theorem about sequences of events that include		Lectures, Tutorials, Seminars,	Examinations, Quizzes, Tests, Home Works,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	the first and second moment methods, Borel-Cantelli lemmas, zero-one laws, inequalities of Chebyshev and Kolmogorov's maximal inequality.	**S1**	Direct Reading, Group Discussion	Assignments, Seminar/Presentation
2.2	Communicate knowledge to Compute rates/quantities and Approximate Solutions in theoretical problems-solving skills and having probabilistic intuitions and insight in thinking about problems.	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.3	Solve and analyze mathematical problems using critical thinking and fundamental limit theorems of probability, such as the weak and strong law of large numbers, central limit theorems, Poisson limit theorem.	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.3	Show Responsibility for personal outputs, intellectual independence.	**V3**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours

1.	Foundations of probability theory.	3
2.	Fundamentals of measure theory.	3
3.	Measure-theoretic approach to definitions of probability space, construction of probability spaces, measure constructions.	6
4.	Random variables and distribution functions. Measurable functions and random variables, Independence.	6
5.	Tails events. Zero-one laws and Borel-Cantelli lemmas, Integration and Expectation.	6
6.	Modes of convergence and relations between the various modes.	3
7.	Laws of large numbers and sum of Independent variables, Convergence in distribution.	6
8.	Characteristic functions, The central limit theorem, Weak convergence of probability measures.	6
9.	Conditional expectations.	3
10.	Martingales.	3
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	**1.** Richard Durrett, Probability: Theory and Examples, Wadsworth and Brools/Cole, CA, 1995.
Supportive References	**1.** Richard Durrett, Probability: Theory and Examples, Wadsworth and Brools/Cole, CA, 1995. **2.** Patrick Billingsely, Probability and Measure, 2nd ed., Wiley, 1995. **3.** Sidney Resnick, Probability Path, Birkhauser, 1999.
Electronic Materials	Web sites dedicated to Probability and measure theory on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Algebra-2
Course Code:	MATH 620
Program:	M.Sc. in Mathematics
Department:	Mathematics
College:	Science College
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identificationn:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (4/2)				
4. Course general Description:				

This course provides an introduction to abstract algebra, so it is designed to cover the basic Concepts of the abstract algebra and entrench the algebraic ideas in the students mind, which lead to use mathematical logic concepts to prove basic theories, which easily lead to study deeply an advanced courses.Groups, subgroups, lattices of subgroups, cosets and normal subgroups, quotient group, homomorphism, isomorphism and related theorems. Rings, subrings, ideals, ring homomorphism, quotient rings, polynomial rings and irreducibility criteria. Fields, field extensions, algebraic extensions, algebraic closure and fundamental theorem of algebra.

5. Pre-requirements for this course (if any):

Math 601

6. Co-requirements for this course (if any):

None

7. Course Main Objective(s):

After completing this course, the student will be

1. Familiar with the basic concepts of abstract algebra, able to deal with abstract concepts as well as use mathematical logic to prove basic theories.
2. Familiar with the algebraic construction and its conditions.
3. Understand that the abstract algebra is the main theory of mathematics that study the important algebraic construction such as groups, rings, fields and other.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to p-groups, Sylow theorems and its applications, direct products, the classifications of finite abelian groups, Jordan–Holder theorem, solvable groups, Fermat's Euler theorem, unique factorization in polynomial rings and principal ideal domains, factorization of polynomial over a field, Galois theory, solvability of equations by radicals.	K1	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
1.2	Describe appropriate algebraic structures, their features and role of applications e.g. advanced groups		Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	theory and ring theory including Sylow theorems, Jordan–Holder theorem, solvable groups, unique factorization in polynomial, irreducible polynomials, factor rings and principal ideal domains, prime fields, ideal structures in F[x], field extensions, finite fields, existence of GF(p^n), solvability of equations by radicals.	K2		
1.3	Integrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollary, lemma and proposition related to Sylow theorems, Jordan–Holder theorem, solvable groups, unique factorization in polynomial, irreducible polynomials, factor rings and principal ideal domains, prime fields, ideal structures in F[x], field extensions, finite fields and Galois theory, solvability of equations by radicals.	K3	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
...				
2.0	**Skills**			
2.1	Discover and implement various		Lectures, tutorial, problem solving,	**Assignments, Quizzes, Written**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	techniques of applications of Sylow theorems, Jordan–Holder theorem, solvable groups, unique factorization in polynomial, irreducible polynomials, factor rings and principal ideal domains, prime fields, ideal structures in F[x], field extensions, fundamental theorem of algebra, finite fields, existence of GF(p^n), solvability of equations by radicals.	**S1**	group discussion.	**Exam**
2.2	Communicate knowledge of problems-solving skills and having algebraic intuitions related to advance group theory, ring theory, field theory, extensions of fields, Galois theory and its extensions.	**S2**	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
2.3	Analyze complex problems in abstract algebra like Kronecker's theorem, irreducible polynomials for α over F, simple extension, algebraic extensions, algebraically closed field and algebraic closure, fundamental theorem of algebra, existence of GF(p^n), solvability of radicals.	S3	Lectures, tutorial, problem solving, group discussion.	**Assignments, Quizzes, Written Exam**
2.4	Conduct scientific	S4	Lectures, tutorial,	**Assignments,**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	research on certain field of algebra e.g. Kronecker's theorem, irreducible polynomials for α over F, simple extension, algebraic extensions, algebraically closed field and algebraic closure, fundamental theorem of algebra, existence of GF(p^n), solvability of radicals.		problem solving, group discussion.	**Quizzes, Written Exam**
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Demostrate leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought, expression and deed.	**V2**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of the society.	**V4**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				group works.
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	p-groups, sylow theorems and its applications, finitely generated abelian groups.	6
2.	Series of groups, Jordan holder theorem, solvable groups, Fermat's Euler theorem.	6
3.	Polynomial rings, factorization of polynomials.	3
4.	Irreducible polynomials, factor rings, prime and maximal ideals.	3
5.	Unique factorization in polynomial rings and principal ideal domains.	6
6.	Field, field extensions, finite fields.	3
7.	Prime fields, irreducible polynomials for α over F, simple extension, algebraic extensions.	6
8.	Algebraically closed field and algebraic closure, Fundamental theorem of algebra.	3
9.	Galois theory: Problems based on Galois theory.	6
10.	Solvability of equations by radicals.	3
	Total	45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. I. N. Herstein, Topics in Algebra, John Wiley and Sons, 1975. 2. J. B. Farleigh, A First Course in Abstract Algebra, Wesley Publishing Co. London, 7th ed., 2003.
Supportive References	1. D. Dummit and R. Foote, Abstract Algebra, John Wiley & Sons, 3rd ed., 2004. 2. Thomas W. Hungerford, Algebra, Springer, 2003.

Electronic Materials	Web sites dedicated to groups, rings and fields available on the internet.
Other Learning Materials	**Packages related to algebra.** **- Power point presentations and other hand-outs posted on the course web site.**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**1. Lecture room(s) for groups of 25 students.** **2. Computer laboratories for groups of 25 students in case needed.**
Technology equipment (Projector, smart board, software)	**Algebraic interface software if required.**
Other equipment (Depending on the nature of the specialty)	Mathematical laboratory

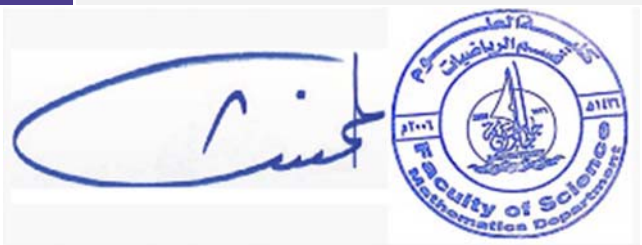
F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Student Assessment of Teaching Quality (NCAAA Form) assessed by Program QA Unit.** **- Assessment of course teaching strategies by QA Unit.**	**Assignments, Quizzes, Written Exam**
Effectiveness of students assessment	**Student questionnaires to be assessed by Program QA Unit.**	**Assignments, Quizzes, Written Exam**
Quality of learning resources	**Revision of course contents, specifications, and strategies every 5 years.**	**Assignments, Quizzes, Written Exam**
The extent to which CLOs have been achieved	**- Cross check marking by a Senior Faculty of student work.** **- Periodic exchange of a sample of assignments with a Faculty in a different Program.**	**Assignments, Quizzes, Written Exam**
Other	**Revision of course contents, course specifications, and strategies every 5 years.**	**Thesis Work**

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**



Course Specification

(Postgraduate Programs)

Course Title:	Number Theory
Course Code:	Math 621
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (03)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (Level 3/ Year 1)					
4. Course general Description:					
Number Theory, the study of integer numbers is one of the oldest branches of mathematics and yet it continues to be a very active area of research today. Number Theory is rich with beautiful theorems and elegant patterns. Its unsolved problems have challenged the greatest mathematical minds and given rise to much of modern mathematics. So, this course is designed as an introduction to number theory, suited scientifically for students interested in developing their mathematical skills, and to enhance and reinforce the student's understanding of concepts through the theory of the integers from a list of axioms.					
5. Pre-requirements for this course (if any):					
Math 601 (Abstract Algebra 1)					
6. Co-requirements for this course (if any):					
None					
7. Course Main Objective(s):					

After completing this course, the student will be able to:

- Analyze/ interpret the algebraic structure of the integers from a list of axioms.
- Write clear and precise mathematical proofs for the properties of integers.
- Apply theoretical knowledge in number theory to handle some problems in other sciences.
- Explore some current research problems in Number theory.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning	---	---

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • E-learning	----	---
4	Distance learning	----	---

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	---
3.	**Field**	---
4.	**Tutorial**	6
5.	**Others (specify)……**	---
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Demonstrate** the concepts related to Divisors, lest common multiples, linear Diophantine equations, primes numbers, solutions of congruencies, residue system, reduced residue system and Euler's Φ, polynomial congruencies, primitive roots, the Legendre symbol, quadratic reciprocity. Arithmetic functions, perfect numbers, the Möbius inversion formula, the Dirichlet product, Diophantine equations, Pythagorean triples, infinite descent method, and Fermat's conjecture.	**K1**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
1.2	**Describe** the basic algebraic structures with the method of finding solutions of congruencies,	**K2**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	the Chinese remainder theorem, residue system, reduced residue system, primitive roots, the Legendre symbol, quadratic reciprocity, and quadratic residues for prime power modulo.			Assignments, Seminar/Presentations.
1.3	**Integrate** the concepts of congruencies, residue system, reduced residue system and Euler's Φ function, polynomial congruencies, primitive roots, the group of quadratic resides, the Legendre symbol, quadratic reciprocity, quadratic residues for prime power moduli, Arithmetic functions, multiplicative arithmetic functions, linear Diophantine equations, perfect numbers, the Möbius inversion formula, Pythagorean triples, infinite descent method and Fermat's conjecture.	**K3**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentations.
2.0	**Skills**			
2.1	**Discover and Apply** the tools of Chinese remainder theorem, fundamental properties of congruencies, residue system, reduced residue system and Euler's Φ, polynomial congruencies, primitive roots, congruencies of degree two, the group of quadratic resides, the Legendre symbol, quadratic reciprocity, quadratic residues for prime power moduli. Arithmetic functions, perfect numbers, the Möbius inversion formula, the Dirichlet product, and Pythagorean triple.	**S1**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
2.2	**Communicate** the mathematical knowledge by applying them to **solve** the problems related to integers using, linear	**S2**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Diophantine equations, congruencies, the Chinese remainder theorem, residue system, reduced residue system, Euler's Φ, polynomial congruencies, primitive roots, congruencies of degree two, the Legendre symbol, quadratic reciprocity, Arithmetic functions, perfect numbers, the Möbius inversion formula, Möbius function, the Dirichlet product, Diophantine equations, and Pythagorean triple.			Seminar/Presentations.
2.3	**Analyze** complex problems **in** the residue system, Euler's Φ function, polynomial congruencies, primitive roots, Legendre symbol, quadratic reciprocity, quadratic residues for prime power moduli, Arithmetic functions, perfect numbers, Möbius function, the Dirichlet product.	**S4**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentations.
3.0	**Values, autonomy, and responsibility**			
3.1	**Demonstrate** leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.2	**Inculcating** values and ethics in thought, expression and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Activities.

C. Course Content:

No	List of Topics	Contact Hours
1.	Divisors, lest common multiples, linear Diophantine equations, primes numbers.	3

2.	Solutions of congruencies, the Chinese remainder theorem, fundamental properties of congruencies, residue system, reduced residue system.	6
3.	Euler's Φ, polynomial congruencies, primitive roots, congruencies of degree two, number theory from an algebraic viewpoint.	6
4.	The group of quadratic resides, the Legendre symbol, quadratic reciprocity, and quadratic residues for prime power moduli.	6
5.	Arithmetic functions,	6
6.	definition of arithmetic functions and examples, multiplicative arithmetic functions, perfect numbers,	6
7.	the Möbius inversion formula with some application, properties of the Möbius function, the Dirichlet product.	6
8.	Diophantine equations, the use of congruencies in solving Diophantine equations,	6
9.	Pythagorean triples, infinite descent method and Fermat's conjecture.	3
10.	Some applications to applied mathematics and computer security.	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Ivan Niven, Herbert S. Zuckerman, and Hugh L. Montgomery, *An Introduction to Theory of Numbers*, John Wiley and Sons, 1991.
Supportive References	Kenth Rosen, *Elementary Number Theory and its Applications*, Pearson, 2011.
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom equipped with projector, white board, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	Power point presentations and other hand-outs posted on the course web site.
Other equipment (Depending on the nature of the specialty)	Web based research articles. Saudi Digital Library.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Topics in Algebra
Course Code:	Math 622
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (03)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (Level: 4 or 5/ Year 02)					
4. Course general Description:					
The course discusses advanced topics in the field of Algebra. This course provides introduction to advance algebra, so it is designed to cover the advance concepts of algebra and entrench the algebraic ideas in the student mind, which lead to use mathematical logic and reasoning based ideas to prove theorems, which easily lead to know and develop ideas of other higher courses in algebra.					
5. Pre-requirements for this course (if any)**:**					
Math 601 (Abstract Algebra 1).					
6. Co-requirements for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
After finishing the course, the student is expected to be familiar with the following: 1. Know the basic and advance concepts of algebra. 2. Deal with abstract concepts as well as use mathematical logic to prove theorems and related results. 3. Understand the algebraic construction and its conditions. 4. Can carry out the research work on topics related to algebra.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning	---	---
3	Hybrid • Traditional classroom • E-learning	----	---
4	Distance learning	----	---

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	---
3.	**Field**	---
4.	**Tutorial**	6
5.	**Others (specify)……**	---
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Demonstrate** the concepts related to Algebra and defined topics in the course.	K1	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
1.2	**Describe** the concepts related to Algebra and defined topics in the course.	K2	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
1.3	**Integrate** the concepts related to Algebra and defined topics in the course.	K3	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
2.0	**Skills**			
2.1	**Discover** and **apply** the most appropriate techniques in Algebra.	**S1**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	**Communicate** knowledge of key mathematical concepts, both explicitly and by applying them to the solution of problems in Algebra.	**S2**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
2.3	**Analyze** complex problems in Algebra and propose solutions using research based knowledge.	**S3**	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
2.4	**Conduct** scientific research on certain fields of Algebra.	**S4**	Assignments, Seminars, Reading, Group Discussion.	Examinations, Dissertation and its oral defense, Activities.
3.0	**Values, autonomy, and responsibility**			
3.1	**Leadership** qualities in research and innovation with sense of Commitment and accountability.	**V1**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.2	**Inculcating** values and ethics in thought, expression and deed.	**V2**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.3	**Responsibility** for personal outputs, intellectual independence.	**V3**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.4	**Promote** mathematics in scientific development as well as in the general education of the society.	**V4**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	To be decided by the instructor as per research requirements.	
2.	To be decided by the instructor as per research requirements.	
3.	To be decided by the instructor as per research requirements.	
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	To be decided by the course instructor.
Supportive References	To be decided by the course instructor.
Electronic Materials	To be decided by the course instructor.
Other Learning Materials	To be decided by the course instructor.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom equipped with projector, white board, and sufficient seating arrangements.

Items	Resources
Technology equipment (Projector, smart board, software)	Power point presentations and other hand-outs posted on the course web site.
Other equipment (Depending on the nature of the specialty)	Web based research articles. Saudi Digital Library.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Real Analysis 2
Course Code:	MATH 630
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (3 or 4/Year 2)					
4. Course general Description:					
This course is the second course in real analysis and mainly covers the measure theory. It focuses on the construction of the Lebesgue measure on the real line, measurable functions, and integration with to respect to Lebesgue's measure. It also covers the monotone convergence theorem, Fatou's Lemma, dominated convergence theorem and differentiation and integration.					
5. Pre-requirements for this course (if any)**:**					
Math-602					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
After completing this course; the student will be able to: **1- Understand the concept of measurable sets and measure and how they are used integration.** **2- Construct rigorous mathematical proofs of basic results in measure theory.** **3- Apply monotone convergence theorem in proofs and in evaluating integrals.** **4- Calculate the Lebesgue integral of some functions**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate mathematical concepts relevant to pure and applied mathematics basic Concepts of the real analysis and use mathematical logic concepts to prove basic in Algebra sets, σ - Algebra, the measure, measurable sets,measurable functions, Lebesigue measure, Reimann integral , Lebesigue integral, Lebesgue integral against Rieman.	K1	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
1.2	Describe background science, features and structure of mathematical problem in the real analysis and use mathematical logic concepts to prove basic in Algebra sets, σ - Algebra, the measure, measurable sets,measurable functions, Lebesigue measure,	K2	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Reimann integral , Lebesigue integral, Lebesgue integral against Rieman.			
1.3	Integrate knowledge to explain notations and concepts required for the solution of Mathematical problem the real analysis and use mathematical logic concepts to prove basic in Algebra sets, σ - Algebra, the measure, measurable sets,measurable functions, Lebesigue measure, Reimann integral , Lebesigue integral, Lebesgue integral against Rieman.	K3	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
2.0	**Skills**			
2.1	*Discover and Apply theoretical, computational or practical aspect relevant to course Content of the real analysis and use mathematical logic concepts to prove basic in Algebra sets, σ - Algebra, the measure, measurable sets,measurable functions, Lebesigue measure, Reimann integral , Lebesigue integral, Lebesgue integral against Rieman.*	S1	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
2.2	*Communicate knowledge to compute numerical quantities for various parameters to approximate the solution in Riemann Integral, Infinite Series, and Sequences and Series of Functions.*	S2	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
2.3	Analyze various mathematical rules, techniques and theorems in Application in the real analysis and use mathematical logic concepts to prove basic in Algebra sets, σ - Algebra, the measure,	S3	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	measurable sets,measurable functions, Lebesigue measure, Reimann integral , Lebesigue integral, Lebesgue integral against Rieman.			
2.4	Conduct scientific research on certain field of real analysis and use mathematical logic concepts to prove basic in Algebra sets, σ - Algebra, the measure, measurable sets,measurable functions, Lebesigue measure, Reimann integral , Lebesigue integral, Lebesgue integral against Rieman.	S4	Lectures, Tutorials, Seminars, Reading, Group Discussion.	Examinations, Quizzes, Home Works, Assignments, Seminar/Presentation.
3.0	**Values, autonomy, and responsibility**			
3.1	Demostrate leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought, expression and deed.	**V2**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of the society.	**V4**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Algebra sets	3
2.	σ - Algebra,	3
3.	The measure	6
4.	Measurable sets,	3
5.	Measurable functions	6
6.	Lebesgue measure	3
7.	Reimann integral	6
8.	Lebesgue integral	12
9.	Lebsgue integral against Rieman	3
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. H.L. Royden and P.M. Fitzpatrick, *Real Analysis*, 4th ed., Prentice Hall, 2010.
Supportive References	1. Gerald B. Folland, Real Analysis, *Modern Techniques and their Applications*, 2nd ed., John Wiley & Sons, 2013. 2. Walter Rudin, *Real and Complex Analysis*, 3rd ed., McGraw-Hill, 1987.
Electronic Materials	Web sites dedicated to Real analysis on the internet.

Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom equipped with projector, white board, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	Power point presentations and other hand-outs posted on the course web site.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Topology
Course Code:	MATH 631
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (3 or 4 Year 2)					
4. Course general Description: **This course provides an introduction to topology, so it is designed to cover the basic** **Concepts of the topology and entrench the topological spaces ideas in the students mind, which lead to use mathematical logic concepts to prove basic theories, which easily lead to study deeply an advanced courses.** **Topological spaces, neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology.**					
5. Pre-requirements for this course (if any)**:**					
Math 602 or equivalen					
6. Pre-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s): **After completing this course, the student will be** **1. Familiar with the basic concepts of Topology, able to deal with topological spaces concepts as well as use mathematical logic to prove basic theories.** **2. Familiar with the topological and its conditions.** **3. Understand that the Topology is the main theory of mathematics that study the important topological construction such as neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology.**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100 %
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Demonstrate in-depth knowledge of the concepts related Topological spaces, neighborhood structures, continuous functions**	**K1**	**Lectures, Tutorials, Seminars, Direct Reading, Group Discussion**	**Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology.			
1.2	**Describe appropriate algebraic structures, their features and role of applications e.g. Topological spaces, neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology.**	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.3	Intergrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollaries, lemmas and propositions related to Topological spaces, neighborhood	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology			
...				
2.0	**Skills**			
2.1	Discover and implement various techniques of Topological spaces, neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology.	**S1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.2	Communicate knowledge of problems-solving skills and having algebraic intuitions related to Topological spaces, neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	types of compactness, metric spaces, product topology, quotient topology.			
2.3	Analyze complex problems in Topological spaces, neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology.	**S3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.4	Conduct scientific research on Topological spaces, neighborhood structures, continuous functions and topological homeomorphism, higher separation axioms, some types of connectedness, some types of compactness, metric spaces, product topology, quotient topology	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with sense of Commitment and accountability.		Assignments, Seminars, Reading, Group Discussion.	Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought,		Assignments, Seminars, Reading,	Research proposal,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	expression and deed.		Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.		Assignments, Seminars, Reading, Group Discussion.	Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of the society.		Assignments, Seminars, Reading, Group Discussion.	Research proposal, Dissertation and its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Topological Spaces.	3
2.	Neighborhood Structures.	3
3.	Continuous Functions.	6
4.	Topological Homeomorphism.	3
5.	Higher Separation Axioms.	6
6.	Some Types of Connectedness.	3
7.	Some Types of Compactness.	6
8.	Metric Spaces.	6
9.	Product Topology.	6
10.	Quotient Topology.	3

Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	**1- Akos Csazar, General Topology,Adm. Hilger LTD, Bristol, 1978.** **2- A. S. Farrag and S. E. Abbas, General Topology Step by Step, Lambert Academic Publishing (2018)..**
Supportive References	**1.M. A. Armstrong, Basic Topology, Springer, 1983.**
Electronic Materials	Web sites dedicated to Probability and Mathematical Statistics on the internet
Other Learning Materials	**- WinEdt , Latex, Scientific WorkPlace packages** **- Power point presentations and other handouts posted on the course web site.**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom equipped with projector, white board, and sufficient seating arrangements. .
Technology equipment (Projector, smart board, software)	Computer laboratories for groups students. -WinEdt , Latex, Scientific WorkPlace software Power point presentations and other hand-outs posted on the course web site.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students	Students, Program assessment committee	Direct/ Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
assessment		
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Functional Analysis
Course Code:	Math-632
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan university
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identifications:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (Level 3 or 4/Year 2)					
4. Course general Description:					
This course introduces Functional Analysis, so it is designed to cover the basic Concepts of Functional analysis and entrench the Real ideas in the student's mind, which lead to use of mathematical logic concepts to prove basic theories, which easily lead to studying deeply an advanced course. **Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, and Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.**					
5. Pre-requirements for this course (if any)**:**					
Math-602					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
After completing this course, the student will be 1. **Understand The metric space and convergence and divergence of sequences in the metric space.** 2. **Know the difference between complete and incomplete metric spaces; and between normed and metric space and Banach space.** 3. **Know the topology generated by the norm.** 4. **Understand the inner product space and Hilbert space.** 5. **Deal with Some open problems.**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe appropriate algebraic		Lectures Presentations	Assignment 1

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	structures, their features and role of applications e.g. Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.	**K2**		Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Integrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollaries, lemmas and propositions related to Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology generated by Normed. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply various techniques of Metric Space: Metric Space, Continuous functions and Convergence		Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	in metric space, Complete Metric Space, Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.	**S1**		Midterm Exam Final Exam
2.2	Communicate knowledge of problem-solving skills and having algebraic intuitions related to Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, and Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	Analyze complex problems in abstract algebra like Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, and Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.			
2.4	Conduct scientific research on certain fields of algebra e.g. Metric Space: Metric Space, Continuous functions and Convergence in metric space, Complete Metric Space, Topology generated by Metric. Normed Space: Linear Space, Linear subspace, Normed Spaces, Relationship between Metric and Normed Spaces, Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm. Inner Product Space: Inner product Space, Hilbert Spaces. Operators, Linear and Bounded operators, Continuous operator, Relationship between linear bounded operator and continuous operator.	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific		Assignments, Seminars,	Dissertation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	development as well as in the general education of the society.	V4	Reading, Group Discussion.	and its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Metric Space, Continuous functions	3
2.	Convergence in metric space,	3
3.	Complete Metric Space,	6
4.	Topology generated by Metric	3
5.	Linear Space, Linear subspace,	6
6.	Normed Spaces, Relationship between Metric and Normed Spaces,	3
7.	Banach Space, Continuity and Convergence in Normed Spaces, Topology Generated by Norm.	6
8.	Inner product Space, Hilbert Spaces.	6
9.	Operators, Linear and Bounded operators.	3
10.	Continuous operator.	3
11.	Relationship between linear bounded operator and continuous operator.	3
	Total	45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	**1.** E. Kreyzig, *Introduction to Functional Analysis with Applications*, John Wiley and Sons, 1989.
Supportive References	1. John B. Conway, *A Course in Functional Analysis*, 2nd ed., Springer, Berlin, 1990. 2. C. Goffman and G. Pedrick, *First Course in Functional Analysis*, Prentice-Hall of India, 1995. 3. Balmohan V. Limaye, *Functional Analysis*, 2nd ed., New Age International, New Delhi, 1996. 4. Angus E. Taylor and David Lay, *Introduction to Functional Analysis*, Wiley, New York, 1980.
Electronic Materials	Web sites dedicated to complex analysis on the internet.
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Topics in Analysis
Course Code:	Math-633
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan university
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identifications:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (Level 3 or 4/Year 2)				
4. Course general Description:				

This course is designed to cover important and advanced topics Analysis that may be desired from time to time for specific students in the graduate program. It may also be used as a vehicle for development of new analysis courses for graduate program students.

Syllabus:

a- Theoretical side:

Variable contents can be changed from year to year

b- The practical side (if applicable):

5. Pre-requirements for this course (if any)**:**

Math-314 or Equivalent

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

After completing this course, the student will be

1. **Know more advanced and further topics in Analysis.**
2. **Apply theories and methodologies to solve problems that arise in research.**
3. **Have a firm basis for advanced courses or research work.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to methods discussed in the class.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe appropriate structures, their features, and the role of applications by which Students will be able to apply advanced methods discussed in the class to research questions.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Ingrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollary, lemma, and proposition that is taught in the class.	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply various techniques of applications of the methods discussed in the class.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge of problems-solving skills and having analytic intuitions that will be taught in the	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	class.			Midterm Exam Final Exam
2.3	Analyze complex problems in analysis that will be covered in the class.	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain field of analysis.	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Variable contents and Topics change from year to year. Variable contents based on research interests.	6
2.	Variable contents and Topics change from year to year. Variable contents	6

	based on research interests.	
3.	Variable contents and Topics change from year to year. Variable contents based on research interests.	3
4.	Variable contents and Topics change from year to year. Variable contents based on research interests.	3
5.	Variable contents and Topics change from year to year. Variable contents based on research interests.	6
6.	Variable contents and Topics change from year to year. Variable contents based on research interests.	3
7.	Variable contents and Topics change from year to year. Variable contents based on research interests.	6
8.	Variable contents and Topics change from year to year. Variable contents based on research interests.	3
9.	Variable contents and Topics change from year to year. Variable contents based on research interests.	6
10.	Variable contents and Topics change from year to year. Variable contents based on research interests.	3
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	
Supportive References	
Electronic Materials	Web sites dedicated to Probability and Mathematical Statistics on the internet.
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

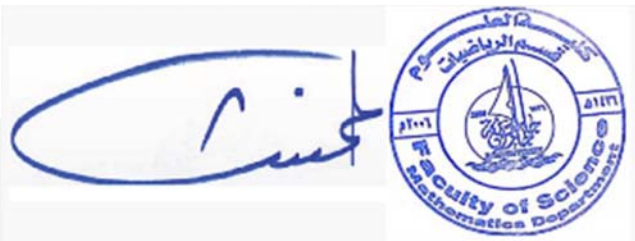
Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**



Course Specification

(Postgraduate Programs)

Course Title:	Numerical Methods for Ordinary Differential Equations
Course Code:	Math 640
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (…3…)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (…2 or 3\2….)					
4. Course general Description:					
The term "numerical methods for ordinary differential equations" refers to techniques for estimating numerically the solutions of ODEs. "Numerical integration" is another name for the process of using them, while it can also be used to describe the computation of integrals. Numerous differential equations have non-exact solutions. However, a numerical approximation of the solution is frequently adequate for practical applications. **One-step methods. Runge-Kutta methods. Multistep and predictor-corrector methods.، other numerical solutions including stability. Convergence and error analysis. Boundary-value problems.**					
5. Pre-requirements for this course (if any)**:**					
Math-604 Numerical Analysis					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
After completing this course, the student will be able to **1. Know the concept of numerical methods to solve ordinary differential equations.** **2. Distinguish between the different types of numerical methods to solve ordinary differential equations.** **3. Choose the appropriate method to solve ordinary differential equations.** **4. Apply the appropriate methods to solve mathematical problems and prove the stability and convergence of the approximated solution.** **5. Conclude the advantages of the methods used to solve ordinary differential equations in various fields.**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%

No	Mode of Instruction	Contact Hours	Percentage
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to single step methods. Runge-Kutta methods, Multistep predictor-corrector methods for IVP, Other numerical solutions including stability. Convergence and error analysis. Boundary-value problems.	**K1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.2	Describe appropriate numerical methods, their features and the role of applications related to single-step methods, Runge-Kutta methods, Multistep predictor-	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion.	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	corrector methods for IVP, Other numerical solutions including stability, Convergence and error analysis, and Boundary-value problems.			
1.3	Integrate knowledge, handle complexity, and formulate judgments with notations and concepts required to solve odes related to single step methods. Runge-Kutta methods, Multistep predictor-corrector methods for IVP, Other numerical solutions including stability, Convergence and error analysis, Boundary-value problems.	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.0	**Skills**			
2.1	Discover and apply various techniques for solving odes related to single-step methods. Runge-Kutta methods, Multistep predictor-corrector methods for IVP, and Other numerical solutions including stability. Convergence and error analysis, Boundary-value problems.	**S1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.2	Communicate knowledge of problem-solving skills and having related to single-step methods. Runge-Kutta methods, Multistep predictor-corrector methods for IVP, and Other numerical solutions including stability. Convergence	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	and error analysis. Boundary-value problems.			
2.3	Analyze ordinary differential equation problems to single step methods. Runge-Kutta methods, Multistep predictor-corrector methods for IVP, Other numerical solutions including stability. Convergence and error analysis. Boundary-value problems.	**S3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.4	Conduct scientific research on certain field of numerical method for single step methods. Runge-Kutta methods, Multistep predictor-corrector methods for IVP, Other numerical solutions including stability. Convergence and error analysis. Boundary-value problems.	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate Leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought, expression and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.
3.3	Promote mathematics in scientific development as well as in the general education of the society.	**V3**	Assignments, Seminars, Reading, Group Discussion.	Dissertation and its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Single step methods for IVP-Taylor series method, Euler's and modified Euler's method.	6
2.	Runge- Kutta 2nd and fourth order method.	3
3.	Higher order ODE and system of ODE.	6
4.	Multi step method for IVP: Predictor-Corrector method, Euler PC method, Milne-Simpson method.	6
5.	Adam Bashforth- Moulton method.	6
6.	Stability, Error and Convergence analysis.	3
7.	Boundary Value Problem: Finite difference method.	6
8.	Shooting method.	3
9.	Galerkin method.	3
10.	Cubic spline method.	3
	Total	45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. David **Griffiths** and Desmond J. Higham, *Numerical Methods for Ordinary Differential Equations*, Springer, 2010. 2. Richard Burden and J. Dougias Faires, Numerical Analysis, Brooks/Cole Cengage Learning, 2011.
Supportive References	1. Alfio Quarteroni, Riccardo Sacco and Fausto Saleri, Numerical Mathematics, Springer, 2007. 2. Fauset L. V. , Applied Numerical Analysis Using Matlab, 3. M.K. Jain and S.R.K. Iyenger , Numerical methods for scientific and Engineering computation, John Wiley & Sons Canada
Electronic Materials	Web sites dedicated to Probability and Mathematical Statistics on the internet.

Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom equipped with projector, whiteboard, and sufficient seating arrangements. Computer Lab with software installed.
Technology equipment (Projector, smart board, software)	Powerpoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the speciality)	Numerical Methods software (Matlab/Maple)

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)-Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
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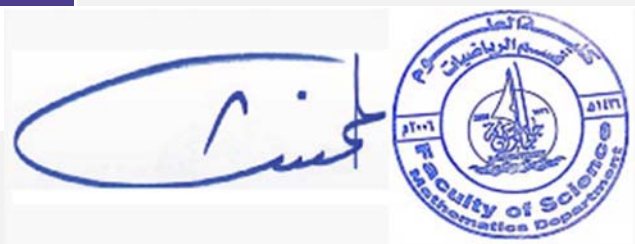

Course Specification

(Postgraduate Programs)

Course Title:	Numerical Method for Partial Difference Equations
Course Code:	Math - 641
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (…3…)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	
B.	☐Required		☒ Elective		

3. Level/year at which this course is offered: (…3/2….)

4. Course general Description:

Numerical methods for partial differential equations are methods used to find numerical approximations to the solutions of (PDEs). Many partial differential equations cannot be solved analytically, and a numeric approximation to the solution is often sufficient for some applications. The methods studied in this course can be used to compute an explicit approximation for the solution and provide an error analysis to test how far from the exact solution.

This course is designed to provide students with:

- **Some basic definitions, concepts and results.**
- **Finite difference method for elliptic equations.**
- **Boundary valued problems.**
- **Iterative methods.**
- **Successive ever relaxation method.**
- **Explicit and implicit methods for parabolic equations.**
- **Error analysis.**
- **Stability analysis.**
- **Convergence analysis.**
- **The method of characteristics for quasi-linear hyperbolic equations.**

5. Pre-requirements for this course (if any)**:**

Math-640
Numerical Method for Ordinary Differential Equations.

6. Co-requirements for this course (if any)**:**

Math-604
Numerical Analysis

7. Course Main Objective(s):

Students after studying the course are expected to:

1. **Know the concept of numerical methods to solve partial differential equations.**
2. **Distinguish between the different types of numerical methods to solve partial differential equations.**
3. **Chose the appropriate method to solve partial differential equations.**

4. **Apply the appropriate methods to solve mathematical problems and prove the stability and convergence of the approximated solution.**
5. **Conclude the advantages of the methods used to solve partial differential equations in various fields.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to fundamental principles and theories of Finite difference techniques for elliptic equations. Treatment of boundary conditions. Iterative methods. Successive ever	**K1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	relaxation method. Explicit and implicit method for parabolic equations. Error analysis, stability analysis and convergence. The method of characteristics for quasi-linear hyperbolic equations.			
1.2	Describe required notations, and define the concepts of Finite difference techniques for elliptic equations. Treatment of boundary conditions. Iterative methods. Successive ever relaxation method. Explicit and implicit method for parabolic equations. Error analysis, stability analysis and convergence. The method of characteristics for quasi-linear hyperbolic equations.	**K2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion.	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
1.3	Integrate knowledge of required notations, and define the concepts of Finite difference techniques for elliptic equations. Treatment of boundary conditions. Iterative methods. Successive ever relaxation method. Explicit and implicit method for parabolic equations. Error analysis, stability analysis and convergence. The method of characteristics for quasi-linear hyperbolic equations.	**K3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion.	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.0	**Skills**			
2.1	Discover and apply various techniques for the concepts and classification of partial differential equations,	**S1**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion.	Examinations, Quizzes, Tests, Home Works, Assignments,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	finite difference techniques for elliptic equations, treatment of boundary valued problems, iterative method, successive ever relaxation method, explicit implicit method for parabolic equations, the method of characteristics for quasi linear hyperbolic equations.			Seminar/Presentation
2.2	Communicate knowledge of problem-solving skills and having related to approximating the numerical computation for partial differential equations, errors analysis, stability analysis and convergence analysis.	**S2**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion.	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.3	Analyze the various math rules, techniques and theorems in numerical analysis for partial differential equations, finite difference techniques for elliptic equations, treatment of boundary value problems, iterative method, successive ever relaxation method, the explicit implicit method for parabolic equations, the method of characteristics for quasi-linear hyperbolic equations.	**S3**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion.	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation
2.4	Conduct scientific research on certain field in numerical analysis for partial differential equations, finite difference techniques for elliptic equations, treatment of boundary valued problems, iterative method, successive ever	**S4**	Lectures, Tutorials, Seminars, Direct Reading, Group Discussion.	Examinations, Quizzes, Tests, Home Works, Assignments, Seminar/Presentation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	relaxation method, explicit implicit method for parabolic equations, the method of characteristics for quasi linear hyperbolic equations.			
3.0	**Values, autonomy, and responsibility**			
3.1	Demostrate leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought, expression and deed.	**V2**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of the society.	**V4**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Finite difference techniques for elliptic equation	9
2.	Treatment of boundary conditions	9

3.	Iterative methods. Successive relaxation method	9
4.	Explicit and implicit methods for parabolic equations	6
5.	Error analysis, stability analysis and convergence.	6
6.	The method of characteristics for quasi-linear hyperbolic equations.	6
Total		33

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	• K. W. Morton and D. F. Mayer's, 'Numerical Solution of Partial Differential Equations'', Cambridge University Press, 2005 • Richard Burden and J. Douglas Faires,"Numerical Analysis", Brooks/Cole, Cengage Learnng 2011 .
Supportive References	AlfioQuarteroni ,Riccardo Sacco and Fausto Saleri, 'Numerical Mathematics ' Springer, 2007.
Electronic Materials	Websites dedicated to numerical solutions of PDEs materials and videos available on the internet
Other Learning Materials	- MatLab, CPP –programming, - Power point presentations and other handouts posted on the course web site.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom equipped with projector, whiteboard, and sufficient seating arrangements. Computer Lab with software installed.
Technology equipment (Projector, smart board, software)	Powerpoint presentations and other hand-outs are posted on the course website.

Items	Resources
Other equipment (Depending on the nature of the specialty)	MatLab/Mapple

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)-Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Approximation Theory
Course Code:	Math-642
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan university
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (Level 4/Year 2)					
4. Course general Description:					
Approximation theory is concerned with how functions can best be approximated with simpler functions, and with quantitatively characterizing the introduced errors. The students, through this course will learn skills to prove convergence and existence for the solutions, and will be used to prove and conclude new results of mathematical theories.					
5. Pre-requirements for this course (if any)**:**					
Math-604 or Equivalent					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
After completing this course, the student will be 1. Know the concept of convergence. 2. Distinguish between theories of convergence. 3. Choose the appropriate mathematical approximation of the problem. 4. Apply appropriate theories to solve mathematical problems and prove the stability and convergence of the solutions. 5. Deduce some theories that can be applied in various numerical methods courses.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to Chebyshev polynomials and series, Weierstrass Approximation Theorem Convergence for differentiable functions, Convergence for analytic functions, Best approximation, Best and near-best, Linear approximations, Nonlinear approximations, Spectral methods rational best approximation, Rational interpolation and least-squares.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe appropriate algebraic structures, their features and role of applications e.g. Chebyshev polynomials and series, Weierstrass Approximation Theorem, Convergence for differentiable functions, Convergence for analytic functions, Best approximation, Best and near-best, Linear approximations, Nonlinear	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	approximations, Spectral methods rational best approximation, Rational interpolation and least-squares.			
1.3	Integrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, related to Chebyshev polynomials and series, Weierstrass Approximation Theorem, Convergence for differentiable functions, Convergence for analytic functions, Best approximation, Best and near-best, Linear approximations, Nonlinear approximations, Spectral methods rational best approximation, Rational interpolation and least-squares.	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply various techniques of Chebyshev polynomials and series, Weierstrass Approximation Theorem, Convergence for differentiable functions, Convergence for analytic functions, Best approximation, Best and near-best, Linear approximations, Nonlinear approximations, Spectral methods rational best approximation, Rational interpolation and least-squares.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge of problems-solving skills for polynomial approximations, Convergence of functions (pointwise, uniform and continuous), Convergence for differentiable functions, Convergence for analytic functions.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	Analyze complex problems in Approximation Theory like Weierstrass Approximation Theorem, Convergence for differentiable functions, Convergence for analytic functions,	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Best approximation, Best and near-best, Linear approximations, Nonlinear approximations, Spectral methods rational best approximation, Rational interpolation and least-squares.			
2.4	Conduct scientific research on certain field of Approximation Theory like Chebyshev polynomials, Convergence for functions, Convergence for analytic functions, Best approximation, Best and near-best, Linear approximations, Nonlinear approximations, Spectral methods rational best approximation, Rational interpolation and least-squares.	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction to Approximation	3
2.	Chebyshev polynomials and series	6
3.	Weierstrass Approximation Theorem	6
4.	Convergence for differentiable functions	6
5.	Convergence for Analytical functions	3
6.	Best approximation, Best and near-best,	3
7.	Linear approximations, Nonlinear approximations,	6
8.	Spectral methods, rational best approximation,	6
9.	Rational interpolation and least-squares.	6
	Total	45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	**1.** Nick Trefethen ,'' Approximation theory and approximation practice'', Siam, 2013.
Supportive References	**1.** Elliott Ward Cheney, Jr,'' A course in approximation theory' 'MMS Chelsea 2000. **2.** Michael J. D. Powell, 'Approximation theory and methods''. Press of U. Cambridge, 1996.
Electronic Materials	Web sites related to Approximation Theory available on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Optimization
Course Code:	Math-643
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan university
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☒ Elective	

3. Level/year at which this course is offered: (Level 4/Year 2)

4. Course general Description:

Problems in optimization are the most common applications of mathematics. The main aim of this course is to present different methods of solving optimization problems in the area of linear and nonlinear programming. In addition to theoretical treatments, there will be some introduction to numerical methods for optimization problems.

5. Pre-requirements for this course (if any)**:**

Math-604 or Equivalent

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

After completing this course, the student will be

Unconstrained Optimization Optimality Conditions ,Convex Unconstrained ,Optimization Optimality Conditions, Newton's Method, Quadratic Forms, Steepest Descent Method, Constrained Optimization Optimality Conditions, Projection Methods for Equality Constrained Problems, Projection, Methods/Penalty Methods, Barrier Methods, Conditional Gradient Method, Interior-Point Methods for Linear Optimization, Analysis of Convex Sets and Convex functions, Duality Theory, Sub gradient Optimization, Semi definite Optimization.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Demonstrate** in-depth knowledge of the mathematical concepts related to optimization problem. Recognize the fundamental principles and theories of optimization. Formulation of optimization problem and classification of optimization problem.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	**Describe** structures and features of mathematical problems and application of optimization. Unconstrained optimization and optimality conditions.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	**Discover and apply** various techniques of unconstrained optimization, Newton's method, Quadratic form and Steepest descent method.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	**Ability** to communicate knowledge of		Lectures	Assignment 1

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	problems-solving skills for Constrained optimization problem, Lagrange Multiplier method, KKT method	**S2**	Presentations	Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	**Analyze** complex problems of constrained optimization , optimality conditions, Newton's Raphson method, Projection, Methods/Penalty Methods, Barrier Methods, Conditional Gradient Method, Interior-Point methods for Linear optimization	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	**Conduct** scientific research on certain field of optimization and Analysis of convex sets and convex functions, Duality theory.	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate Leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show Responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Presentation, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction and basic concept of optimization, Formulation of optimization problems, classification of optimization problem.	3
2.	Unconstrained optimization and optimality conditions.	3
3.	Convex unconstrained optimization problem and optimality conditions.	6
4.	Newton's method, Quadratic form, Steepest Descent method.	3
5.	Constrained optimization and optimality conditions.	6
6.	Projection methods for equality constrained problems.	3
7.	Projection methods / Penalty methods, Barrier Methods	6
8.	Linear optimization, Conditional Gradient Method, Interior – Point Methods for Linear Optimization	6
9.	Analysis of convex sets and Convex functions	3
10.	Duality theory	3
11.	Sub gradient and Semi definite Optimization	3
	Total	**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. Weny u Sun, Ya-Xiang Yua, Optimization Theory and Methods: Nonlinear Programming, Springer. (2010)
Supportive References	**1.** David G. Luenberger, Yinyu Ye, *Linear and Nonlinear Programming*, International Series in Operations Research & Management Science, Springer 2013. **2.** Using Matlab, or Mathematica software or any other programming software.
Electronic Materials	Web sites related to Approximation Theory available on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Integral Differential Equations
Course Code:	Math-650
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan university
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (Level 4/Year 2)					
4. Course general Description:					
This course is designed to provide students with • Integral equations and Picard's method, Existence and Uniqueness • Homogeneous and non-homogeneous linear equations • The Fredholm theory, Alternative-Hilbert-Schmidt theory, Transform Methods • Green's functions and boundary value problems, Wiener-Hopf integral equation • Elements of theory of Fredholm integral equation, Volterra integral equation, Nonlinear integral equations.					
5. Pre-requirements for this course (if any)**:**					
Math-605 or Equivalent					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
After finishing the course, the student is expected to be familiar with the following: • Know integral equations. • Choose the appropriate method that used in studying integral equations. • Solve the problem involving integral equations. Explore some integral equations that have different areas of research					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate mathematical concepts relevant to pure and applied mathematics of integral equations, recognize the fundamental principles and theories integral differential equations, Elements of Theory of Fredholm Integral Equations, Wiener-Hopf Integral Equations, Volterra Integral equations, Nonlinear Integral Equations.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe background science, features and structure of mathematical problem in integral differential equations, Elements of Theory of Fredholm Integral Equations, Wiener-Hopf Integral Equations, Volterra Integral equations, Nonlinear Integral Equations.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Integrate knowledge of notations and methods required for the solution of Mathematical problem of integral	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	equations, Picard's method, Alternative-Hilbert-Schmidt theory, Transform methods, Green's function and Boundary value problem.			Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and Apply theoretical, computational or practical aspect relevant to course content of integral equations, Picard's method, Existence and uniqueness, linear and nonlinear integral equations, Fredholm theory, Hilbert-Schmidt theory, Transform methods, Greens function and boundary value problem.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge to Compute numerical quantities for various parameters to approximate the solution in integral equations, Picard's method, Existence and uniqueness, linear and nonlinear integral equations, Fredholm theory, Hilbert-Schmidt theory, Transform methods, Green's function and boundary value problem.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	Apply and analyze various mathematical rules, techniques and theorems in Application in integral equations, Picard's method, Existence and uniqueness, linear and nonlinear integral equations, Fredholm theory, Hilbert-Schmidt theory, Transform methods, Green's function and boundary value problem.	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain field of integral equations, Picard's method, Existence and uniqueness, linear and nonlinear integral equations, Fredholm theory, Hilbert-Schmidt theory, Transform methods, Green's function and boundary value	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	problem.			
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate Leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.3	Show Responsibility for personal outputs, intellectual independence.	**V3**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Assignments, Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Integral equations, Definitions, Existence and Uniqueness	3
2.	Homogeneous and non-Homogeneous linear equations	3
3.	Green's Functions and Boundary-value Problems	3
4.	Picard's method, Transform methods	6
5.	The Fredholm theory, Elements of Theory of Fredholm Integral Equations	6
6.	Alternative-Hilbert-Schmidt Theory, Volterra Integral equations	6
7.	Wiener-Hopf Integral Equations, Nonlinear Integral Equations	3
8.	Integral equations, Definitions, Existence and Uniqueness	3
9.	Homogeneous and non-Homogeneous linear equations	6
10.	Green's Functions and Boundary-value Problems	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	**1.** Ram P. Kanwal, Linear Integral Equations: Theory and Technique, Birkhauser, Springer, Boston, 2013.
Supportive References	**1.** Michio Masujima, ''Applied Mathematical Methods in Theoretical Physics-Integral Equations and Calculus of Variations'', Wiley-Vch. Verlag GmbH & Co. KGaA, 2005 **2.** Stakgold, *Green's Functions and Boundary-value Problems.* Wiley NY, 1998.
Electronic Materials	Web sites related to Integral Differential Equations available on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer

Assessment Areas/Issues	Assessor	Assessment Methods
		evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Mathematical Modeling
Course Code:	Math-651
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan university
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (Level 4/Year 2)					
4. Course general Description:					
This course is designed to provide students with: Formulate and analyze mathematical models; Know stochastic models; Apply Monte Carlo simulation; Solve optimization problems computationally; Analyze dynamic models; Simulate models using MATLAB or Maple.					
5. Pre-requirements for this course (if any)**:**					
Math-605 or Equivalent					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
After finishing the course, the student is expected to be familiar with the following: • Main concepts of mathematical modeling • Transform applications to mathematical problems. • Use of mathematical software (MATLAB or MAPLE) for modeling applications.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate mathematical concepts relevant to optimization models, discrete optimization, dynamic system, probability models, simulations.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe background, features and structure of mathematical problems, one variable and multivariable optimization, steady state, dynamic models, discrete time system, Markov property.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Integrate knowledge and explain simulation of dynamic models, discrete programming, probability models, Monte Carlo simulation.	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply the concept of modeling with optimization, discrete programming, steady state analysis, dynamic models.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge to compute applications on dynamic system, optimization model, probability models.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				Final Exam
2.3	Apply and analyze various mathematical models, techniques and theorems in solving problems in engineering, physical, biological and social sciences.	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain field of discrete and continuous probability models, optimization models, dynamic models, fractional diffusion	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Reading, Group Discussion	Research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Optimization models (one variable and multivariable)	10
2.	Analysis of Dynamic models	8
3.	Simulation of Dynamic models	10

4.	models Probability	9
5.	Simulation of probability models	8
	Total	**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. Mark M. Meerschaert, *Mathematical Modeling*, 2nd ed., Elsevier, 2013.
Supportive References	1. Frank R. Giordano, William P. Fox, Steven B. Horton, A First Course in Mathematical Modeling, 5th ed., Brooks/Cole, Cengage Larning, 2014. 2. Amos Gilat, *MATLAB: An Introduction with Applications*, 5th ed., Wiley, 2014.
Electronic Materials	Web sites dedicated to mathematical modeling and applications which is available on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Board of Mathematics Department
REFERENCE NO.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
DATE	/04/1446 H; /10/2024 AD

Course Specification

(Postgraduate Programs)

Course Title: Mathematical Statistics - 2
Course Code: Math-660
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (Level 2/Year 1)				
4. Course general Description:				
This is the second postgraduate course in mathematical statistics and it aims to build a more advanced statistical theories and techniques. It provides a firm basis for advanced work on Statistical theory and its applications.				
5. Pre-requirements for this course (if any)**:**				
Math-606 and Math 607 or Equivalent				
6. Co-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				
After completing this course, the student will be 1. Know more advanced concepts of probability theory to build Statistical Theory. 2. Understand tools and techniques in Sampling Theory and Statistical Inference. 3. Analyze and apply Linear Models and application in regression and analysis of variance. 4. Understand concepts of decision theory and nonparametric theory. **5.** Take advanced work on Statistical Theory and applications.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate mathematical concepts relevant to Theory of point estimation, Properties of estimators, including unbiasedness, efficiency, consistency, sufficiency, minimum variance unbiased estimator.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe Rao-Blackwell theorem and Rao-Cramer inequality. Methods of moments and maximum likelihood. Bayes' and minimax estimation.	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply of sufficient and minimal sufficient statistics, Tests of hypothesis, Neyman-Pearson theory of testing of hypotheses. Evaluate UMP tests, UMPU tests, likelihood Ration tests.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge of key mathematics to compute Unbiased and invariant tests. Confidence estimation. Confidence intervals (shortest length, unbiased and Bayes')	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Know the general linear hypothesis, regression and Analysis of variance. Application on Decision theory. Nonparametric statistical inference			
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Theory of point estimation.	3
2.	Properties of estimators, including unbiasedness.	3
3.	efficiency, consistency, sufficiency, minimum variance unbiased estimator, Rao-Blackwell theorem	6
4.	Cramer-Rao inequality, Maximum likelihood estimator.	6
5.	Methods of moments, Bayes' and minimax estimation.	6
6.	Sufficient and Minimal sufficient statistics	3
7.	Tests of hypothesis, Neyman-Pearson theory of testing of hypotheses, UMP	6

	tests.	
8.	UMPU tests, likelihood Ration tests.	6
9.	Unbiased and invariant tests. Confidence estimation, Confidence estimation. Confidence intervals (shortest length, unbiased and Bayes')	3
10.	The general linear hypothesis, regression and Analysis of variance, Decision theory. Nonparametric statistical inference.	3
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	**1.** John Freund, *Mathematical Statistics*, Prentice Hall, 1992. **2.** George Casella and Roger L. Berger, *Statistical Inference*, Wadsworth and Brooks/Cole, Ca, 2001.
Supportive References	1. E.L. Lehmann and George Casella, *Theory of Point Estimation*, Springer, 2003. 2. Erich L. Lehmann and Joseph P. Romano, *Testing of Statistical Hypothesis*, Wiley, 2006. 3. Peter Bickel and K. Doksum, *Mathematical Statistics*, Holden Day 1977. 4. Thomas S. Ferguson, Z. W. Birnbaum, E. Lukacs, *Mathematical Statistics: A Decision Theoretic Approach*, Academic Press, 2014. 5. Sahai and Ageel, *ANOVA: Fixed, Random and Mixed Models*, Springer 2001.
Electronic Materials	Web sites dedicated to Mathematical Statistics and Inferential theory on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Regression and Experimental Design
Course Code:	Math-661
Program:	Master of Science
Department:	Mathematics
College:	Science
Institution:	Jazan university
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☒ Elective	

3. Level/year at which this course is offered: (Level 3 or 4/Year 2)

4. Course general Description:

This course is a global term that includes both the formal design of an experiment and the regression analysis by which the result of the experiment is analyzed. It provides the principles of experimental design and the techniques of analysis of variance in a manner that illustrates the aspects of statistical analysis. Also, it covers important topic on screening design. Least Square Methods and Properties, Simple linear regression. Testing of intercept and slope. Simple and Multiple linear regressions with matrix approach. Estimation of parameters and testing of regression coefficients. Prediction and correlation analysis. Development of Linear models, Residual Analysis and Prediction, Polynomial Regression, Dummy Variable, Model Building and Variable Selection. Analysis of variance techniques, Concepts of Statistical Designs and Linear Model. Completely randomized and randomized block designs. Latin square designs models: Fixed, random and mixed models. Incomplete block design. Factorial design, 2k factorial design and blocking and confounding in 2k factorial design.

5. Pre-requirements for this course (if any):

Math-660 or Equivalent

6. Co-requirements for this course (if any):

None

7. Course Main Objective(s):

After completing this course, the student will be able to:

1- Understand Least Squares methods and its properties
2- Work on linear regression and testing of intercept and slope.
3- Estimate and test parameters through regression analysis.
4- Construct regression analysis table to describe relationship between variables.
5- Explain the assumptions necessary to perform ANOVA.
6- Understand the importance of statistical Randomized/nonrandomized design of experiments and its benefits.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of regression, the fundamental principles and theories of Simple linear regression and multiple linear regression with matrix approach.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe appropriate statistical concepts required notation and define the concepts Simple linear regression, testing of intercept and slope, Multiple linear regression with matrix approach.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply various techniques of simple linear regression and multiple linear regression and interpret the results. Estimation parameters and testing of	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	regression coefficients.			Final Exam
2.2	Ability to communicate knowledge for problems-solving of linear regression, Prediction and correlation analysis. Development of linear models, Analysis of variance technique.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	Analyze complex problems of Statistical Designs and linear model. Completely randomized and randomized block design, Latin square design, Incomplete block design, Factorial design and 2k factorial design.	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain field of Regression and Experimental Design.	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Simple linear regression,	3
2.	Least Square Methods and Properties,	3
3.	Multiple linear regression	6
4.	Estimation parameters and testing of regression coefficients	3
5.	Prediction and correlation analysis	6
6.	Development of Linear models	3
7.	Analysis of variance technique	3
8.	Concepts of Statistical Designs and Linear Model	3
9.	Completely randomized and randomized block designs	3
10.	Latin square design	3
11.	Incomplete block design,	3
12.	Factorial design, 2k factorial design and blocking and confounding in 2k factorial design	6
	Total	**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. John O. Rawlings, *Applied Linear Regression: A Research Tool*, Wiley, 1988. 2. D. C. Montgomery, *Design and Analysis of Experiments*, John Wiley & Sons, New York, 2013.
Supportive References	
Electronic Materials	Web sites dedicated to Regression Analysis and Experimental Design on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title: Time Series Analysis
Course Code: Math-662
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☒ Elective	

3. Level/year at which this course is offered: (Level 2/Year 1)

4. Course general Description:

The course is to present important concept of time series analysis such as stationary processes, autocorrelations, moving average, ARMA models, spectral analysis, etc. Also, it provides some detail of the theoretical foundations and practical applications of bivariate time series. This course is a mixture of theory and practical applications of time series methods.

5. Pre-requirements for this course (if any)**:**

Math-606 and Math 607 or Equivalent

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

After completing this course, the student will be

1- Know concepts and theory of time series
2- Understand stationary time series models.
3- Apply Autoregressive and model averaging.
4- Work on fitting of ARMA and related models.
5- Apply ARIMA models
6- Utilize R programming or Minitab for computation and Analysis.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom		

No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate indepth the fundamental principles and theories of simple descriptive techniques, trend, seasonality, smoothing, the Correlogram, probability models for time series, estimating the autocorrelation function and fitting ARIMA models, forecasting, and Stationary processes in the frequency domain.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Integrate knowledge of structures and features of required notations, and define the concepts of simple descriptive techniques, trend, seasonality, smoothing, the correlogram, probability models for time series, estimating the autocorrelation function and fitting ARIMA models, forecasting, and	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Stationary processes in the frequency domain.			
2.0	**Skills**			
2.1	Discover and apply and interpret a general knowledge of simple descriptive techniques, trend, seasonality, smoothing, the Correlogram, probability models for time series, estimating the autocorrelation function and fitting ARIMA models, forecasting, and Stationary processes in the frequency domain.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge of problems-solving skills to compute rates/quantities and Approximate Solutions in theoretical problems-solving skills of the problems mathematically in simple descriptive techniques, trend, seasonality, smoothing, the Correlogram, probability models for time series, estimating the autocorrelation function and fitting ARIMA models, forecasting, and Stationary processes in the frequency domain.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal		Seminars,	Assignments,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	outputs, intellectual independence.	**V3**	Reading, Group Discussion	research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction: Examples, simple descriptive techniques, trend,	3
2.	Seasonality, smoothing, the correlogram.	3
3.	Probability models for time series:	6
4.	Stationarity and non-stationarity of time series.	6
5.	Autoregressive (AR), Moving average (MA).	6
6.	ARMA and ARIMA models.	6
7.	Estimating the autocorrelation function and fitting ARIMA models.	3
8.	Forecasting: Forecasting from ARIMA models.	3
9.	Stationary processes in the frequency domain: The spectral density function, the period-gram, spectral analysis.	3
10.	Bivariate time series, cross-correlations, cross-spectrum.	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. Chatfield C, 'The Analysis of times series'', 4th edition, Dover, 1993. 2. Jonathan D. Cryer, 'Time Series Analysis'', Duxbury , 1986, 2008. 3. G.E.P, Jenkins, G.M,'' Time Series Analysis, Forecasting and Control'', Box, Holden Day, 1976.
Supportive References	1. Fuller W,'' Introduction to Statistical Time series'', Wiley 1990, 2. R. Shumway and D. Stoffer, ''Times series analysis and its applications with R Examples'', 2006. 3. Kandal & Ord, J. K. ''Time Series', Kandal & Ord, J.K., 3rd edition, Wiley , 1990.
Electronic Materials	Web sites dedicated to Time series analysis on the internet.
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have	Students, Faculty members	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
been achieved		
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	29/031446 H; 02/10/2024 AD

Course Specification

(Postgraduate Programs)

Course Title: Topics in Mathematical Statistics
Course Code: Math-663
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A.	☐University	☐College	☒ Department	☐Track
B.	☐ Required		☒ Elective	

3. Level/year at which this course is offered: (Level 3/Year 2)

4. Course general Description:

This course is designed to cover important and advanced topics in mathematical statistics and statistical theory that may be desired from time to time for specific students in the post graduate program. It may also be used as a vehicle for development of new Probability course for post graduate program students.

5. Pre-requirements for this course (if any)**:**

Math-606 and Math 607 or Equivalent

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

After completing this course, the student will be

1- Know more advanced and further topics in mathematical Statistics and Statistical Inference.
2- Apply theories and methodologies to solve problems that arise in other disciplines.
3- Have a firm basis for advanced courses or research work.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth mathematical concepts relevant to fundamental of Mathematical Statistics and Demonstrate understanding of the methods discussed in class.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Integrate knowledge of advanced methods discussed in class to research questions.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply various techniques of Mathematical statistics and student will be able to apply advanced methods discussed in class to research questions.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Solve and analyze mathematical problems using critical thinking and fundamental of Cramer Rao Inequality and Rao Blackwell Theorem.	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense		Seminars, Presentation	Assignments, research

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	of Commitment and accountability.	**V1**	Reading, Group Discussion	proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Variable contents and Topics change from year to year. Variable contents based on research interests. Maximum of 14 weeks and 42 contacted hours will be applied to this course. Variable contents and Topics change from year to year.	3
2.		3
3.		6
4.		6
5.		6
6.		6
7.		3
8.		3
9.		3
10.		6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Will be assigned based on designing contents and topics.
Supportive References	Will be recommended based on designing contents and topics.
Electronic Materials	American Mathematical Association journals; Bernoulli Society, IMS journals, Pi Epsilon journal. Teaching Statistics Journals.
Other Learning Materials	Web sites dedicated to Probability and measure theory on the internet.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title: Stochastic Processes
Course Code: Math-672
Program: Master of Science
Department: Mathematics
College: Science
Institution: Jazan university
Version: 2024
Last Revision Date: 28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (Level3/Year 2)					
4. Course general Description:					

This course is designed to provide students with

- Introduction to stochastic process.
- Random walk as approximation, Discrete time Markov chains.
- Continuous time, compound Poisson, birth-and-death chains.
- Kolmogorov's backward and forward equations.
- Diffusions as limits of birth-and-death processes.
- Examples drawn from diverse fields of application.

5. Pre-requirements for this course (if any)**:**

Math-606 and Math 607 or Equivalent

6. Co-requirements for this course (if any)**:**

None

7. Course Main Objective(s):

After finishing the course, the student is expected to be familiar with the following:

- Know the theory and basic concepts of Stochastic Processes
- Understand forms of stochastic processes and its diverse range of applications.
- Develop probabilistic Models and solving skills

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth mathematical concepts relevant to theory and concepts of stochastic process.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Integrate knowledge of background, features and structure of mathematical problems in Markov chains and its classifications, Kolmogorov's Differential Equation, Transition Probabilities, Limiting Probabilities and Time Reversibility.	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Describe simulation of stochastic processes and its diverse range of applications.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply the concept of probability theory, Poisson counting process, Different types of events, introduction to queues Non-	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	homogeneous and compound Poisson processes.			Final Exam
2.2	Communicate knowledge of problems-solving skills to applications on Renewal theory as a generalization of the Poisson process, modified and alternating renewal processes, convolutions.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	Apply and analyze results of various mathematical models, techniques and theorems in solving problems related to Markov Chains. Classification of states.	**S3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain field of Kolmogorov's Differential Equation, Stopping times and an extension of Wald's theorem Random walks, and Brownian Motion	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Review of probability theory	6
2.	Poisson counting processes and its generalization	10
3.	Markov Chains. Classification of states,	10
4.	Martingales.	9
5.	Brownian Motion	10
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. Sheldon Ross ,''Stochastic Processes'', Wiley, 1996
Supportive References	1. S. Karlin and H. Taylor ,''A First Course in Stochastic Processes'', Academic Press, 1975 2. Sidney Resnick ,''Adventures of stochastic Process'', Birkhauser, 1992 3. Cinlar, E ,''Introduction to Stochastic Processes'', , Prentice Hall, 1975.
Electronic Materials	Web sites dedicated to introduction to stochastic process available on the internet.
Other Learning Materials	Black board platform.

2. Educational and Research Facilities and Equipment Required:

Items	Resources

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peers, and program leader	Indirect (Course Evaluation Survey) - Indirect peer evaluation
Effectiveness of students' assessment	Students, Program Assessment Committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Direct/ Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	Selected Topics in Analysis
Course Code:	MATH 696
Program:	Master
Department:	Mathematics
College:	Science
Institution:	Jazan University
Version:	2024
Last Revision Date:	28/03/1446 H; 01/10/2024 AD

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (3 or 4/Year 2)					
4. Course general Description:					
It will be added at the time of offer of this course.					
5. Pre-requirements for this course (if any):					
Math 323					
6. Co-requirements for this course (if any):					
None					
7. Course Main Objective(s):					
It will be added at the time of offer of this course.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	39
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	6
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of the concepts related to methods discussed in the class.	K1	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe appropriate structures, their features and role of applications by which Students will be able to apply advanced methods discussed in the class to research questions.	K2	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Integrate knowledge and handle complexity and formulate judgments with notations and concepts required for the theorems, corollary, lemma and proposition that is taught in the class.	K3	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply various techniques of applications of the methods discussed in the class.	S1	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge of problems-solving skills and	S2	Lectures Presentations	Assignment 1 Assignment 2

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	having analytic intuitions that will be taught in the class.			Quiz Exam Midterm Exam Final Exam
2.3	Analyze complex problems in analysis that will be covered in the class.	S3	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain field of analysis.	S4	Written exam, Quizzes, Assignments	
3.0	**Values, autonomy, and responsibility**			
3.1	Demostrate leadership qualities in research and innovation with sense of Commitment and accountability.	**V1**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.2	Inculcating values and ethics in thought, expression and deed.	**V2**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.
3.4	Promote mathematics in scientific development as well as in the general education of the society.	**V4**	Presentation Seminars, Reading, Group Discussion.	Assignments Research proposal, Dissertation and its oral defense, Class Activities, group works.

C. Course Content:

No	List of Topics	Contact Hours
1.	Variable contents and Topics change from year to year. Variable contents based on research interests. Maximum of 14 weeks and 42 contacted hours will be applied to this course.	9
2.	Variable contents and Topics change from year to year. Variable contents based on research interests. Maximum of 14 weeks and 42 contacted hours will be applied to this course.	9
3.	Variable contents and Topics change from year to year. Variable contents based on research interests. Maximum of 14 weeks and 42 contacted hours will be applied to this course.	9
4.	Variable contents and Topics change from year to year. Variable contents based on research interests. Maximum of 14 weeks and 42 contacted hours will be applied to this course.	9
5.	Variable contents and Topics change from year to year. Variable contents based on research interests. Maximum of 14 weeks and 42 contacted hours will be applied to this course.	9
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment-1 / Quiz-1/ Presentations-1	3	5%
2.	Midterm Exam-1	7	20%
3.	Assignment-2 / Quiz-2/ Presentations-2	9	5%
4.	Midterm Exam-2	12	20%
5.	Final Exam	16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Selective textbook
Supportive References	Selective reference books
Electronic Materials	Web sites dedicated to selected topics in Analysis
Other Learning Materials	Black board platform.

2. Educational and Research Facilities and Equipment Required:

Items	Resources

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom, Computer lab.
Technology equipment (Projector, smart board, software)	Data show; Smart Board, Black Board platform, Mathematics software.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**

Course Specification

(Postgraduate Programs)

Course Title:	**Thesis**
Course Code:	**Math-699**
Program:	**Master of Science**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan university**
Version:	**2024**
Last Revision Date:	**28/03/1446 H; 01/10/2024 AD**

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (Level 4/Year 2)					
4. Course general Description:					
The master program is designed to expand and consolidate existing mathematics knowledge and to develop skills in undertaking research projects in mathematics. The thesis is undertaken under the direction of a supervisor and will typically involve examining and writing in a specific area of mathematics with the requirement of obtaining original results.					
5. Pre-requirements for this course (if any)**:**					
All courses are required including elective courses					
6. CO-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
The thesis work gives students the opportunity to develop broader skills in the process of organizing, communicating and presenting their work and will prepare students well for further research.					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (Scientific supervision)**	90
	Total	90

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Demonstrate in-depth knowledge of Mathematics, both in theories and applications related to your thesis topic.	**K1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.2	Describe appropriate mathematical concepts and skills to solve thesis related problems in both familiar and unfamiliar situations including those in real-life contexts as an application.	**K2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
1.3	Integrate knowledge and handle complexity, and formulate judgments with incomplete or limited information.	**K3**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.0	**Skills**			
2.1	Discover and apply the most appropriate mathematical and/or statistical techniques required the topic choses for thesis.	**S1**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.2	Communicate knowledge of key mathematical and statistical concepts, both explicitly and by applying them to the solution of research problem problems discussed in the thesis.	**S2**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
2.3	Analyze complex Mathematical/Statistical problems		Lectures Presentations	Assignment 1 Assignment 2

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	dealing in the thesis and propose solutions using research based knowledge.	**S3**		Quiz Exam Midterm Exam Final Exam
2.4	Conduct scientific research on certain fields of Mathematics/Statistics.	**S4**	Lectures Presentations	Assignment 1 Assignment 2 Quiz Exam Midterm Exam Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate Leadership qualities in research and innovation with a sense of Commitment and accountability.	**V1**	Seminars, Presentation, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.2	Inculcating values and ethics in thought, expression, and deed.	**V2**	Seminars, Presentation, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.3	Show responsibility for personal outputs, intellectual independence.	**V3**	Seminars, Presentation, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.
3.4	Promote mathematics in scientific development as well as in the general education of society.	**V4**	Seminars, Presentation, Reading, Group Discussion	Assignments, research proposal, Dissertation report and its oral defense.

C. Course Content:

No	List of Topics	Contact Hours
1.	Revision of coursework and develop computing skills (MATLAB) and Latex typing etc. to get ready for thesis work.	9
2.	Explore existing literature to develop student's interest towards the research area in particular mathematical stream i.e. pure or applied or statistics.	6

3.	Choose the area and topic for your thesis.	3
4.	Perform literature survey to explore and get latest/advanced research in the specific chosen area.	9
5.	Develop mathematical model or design experimental set up for your research problem practical/ lab work whichever applicable.	9
6.	Thesis Preparation: The following items are to be included in the bound copy of a thesis/dissertation write-up in the exact order as given below: **(a)** Title Page **(b)** Approval Page **(c)** Dedication **(d)** Acknowledgement **(e)** Table of Contents **(f)** List of Tables **(g)** List of Figures **(h)** Abstract **(i)** Main Body **(j)** Appendix **(k)** Nomenclature **(l)** References	9
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Obtain the required scientific material	1-16	5 %
2.	Result Analysis		5 %
3.	Respond to the guidance of supervisors		5 %
4.	Writing the thesis		5 %
5.	Candidate's commitment to attend and perform research		5%
6.	Presentation/Open Seminar/Viva Voce		10%
7.	Proposal for Defense		65%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	1. To be decided by concerned thesis supervisors
Supportive References	1. To be decided by concerned thesis supervisors

Electronic Materials	To be decided by concerned thesis supervisors
Other Learning Materials	To be decided by concerned thesis supervisors

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is equipped with a projector, whiteboard, and sufficient seating arrangements.
Technology equipment (Projector, smart board, software)	PowerPoint presentations and other hand-outs are posted on the course website.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of guidance	Students	Questionnaire
Effectiveness of students' assessment	Coordinator	Course Report
Quality of learning resources	Students, Faculty members	Questionnaire
Thesis Evaluation	Supervisor/ Peer Reviewer	Reviewing Thesis
Research Evaluation	Supervisor/ Peer Reviewer	Reviewing Thesis

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

Council / Committee	BOARD OF MATHEMATICS DEPARTMENT
Reference No.	MATH-2417 MEETING OF THE BOARD OF MATHEMATICS DEPARTMENT
Date	**29/031446 H; 02/10/2024 AD**