Course Specifications

Course Title:	Abstract Algebra 2
Course Code:	42041421
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 7/4th year
4. Pre-requisites for this course (if any)**:** Abstract Algebra (1)- 42041315
5. Co-requisites for this course (if any)**:** Non

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	75%
2	**Blended**	√	10%
3	**E-learning**	√	15%
4	**Correspondence**		
5	**Other**		----------

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	90
2	**Assignments**	45
3	**Library**	45
4	**Projects/Research Essays/Theses**	--------
5	**Others** (specify)	
	Total	180

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to study the introduction in abstract algebra and in particular to link the mathematical processes with sets, to access its mathematical systems and then to convert these mathematical systems into rings. And from this we recognize the types and some of its properties.

2. Course Main Objective

After studying this course, the student is expected to be familiar with the principles of abstract algebra, relations between groups and processes, and the identification of groups

Learning outcomes for this course: After studying this course, students are expected to be able to:

• Know the group and its properties and types of them.

• Learn mathematical methods of proof of mathematical issues.
• Understand some of the mathematical terms used in abstract algebra.
• Reads and concludes answers to questions in abstract algebra.
• Be responsible for self-learning.
• Communicates effectively in educational situations related to the subjects of the course.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define: Ring, Commutative ring, Integral domain, Division ring, Field, Ideal, Maximal ideal, Prime ideal, Principle ideal, Ring homomorphism, Kernel of a homomorphism, Automorphisms, Characteristic of a ring, Zero divisor element, Idempotent element, Unit element, Boolean ring, quotient rings, direct products of Rings.	
1.2	State the fundamental theorem of homomorphism, and Other related theorems.	
1.3	Recognize the polynomial rings and associated properties.	
2	Skills :	
2.1	Verify axioms of, Rings, subrings, fields, homomorphisms, isomorphisms, automorphisms, ideals, Maximal ideal, Prime ideal, Principle ideal, and quotient rings, in examples.	
2.2	Derive the proofs of main theorems and key results of Rings and Fields.	
2.3	Apply the isomorphism theorems, and other theorems.	
2.4	Demonstrate knowledge of direct products of Rings and rings of polynomials.	
2.5	Compute all maximal, prime and principle ideals, all cosets, the order, the characteristic, the set of all units and the set of all zero divisors of a given ring, the kernel of a homomorphism, tables of addition and multiplication of some rings and fields, and all solutions (zeros) of a given equation (polynomial).	
3	**Competence:**	
3.1	Take responsibility for own learning and professional development	
3.2	Work effectively in groups and exercise leadership when appropriate.	
3.3	Present information clearly in both written and oral form.	
3.4	Communicates effectively in oral and written form in educational situations related to the subjects of the course.	

C. Course Content

No	List of Topics	Contact Hours
1	**UNIT I: Basics of Rings, Special Kinds and Ideals** Rings, Zero divisors, Integral domains, Division rings, Fields, Subrings and Ideals, Congruence modulo a subring relation in a ring, Simple ring, Algebra of ideals, Ideal generated by a subset, Nilpotent ideals, Nil ideals, Quotient rings, Prime and Maximal ideals	12
2	UNIT II: Homomorphisms and Embedding of Rings Homomorphism in rings, Natural homomorphism, Kernel of a homomorphism, Fundamental theorem of homomorphism, First and second isomorphism theorems, Field of quotients, Embedding of rings, Ring of endomorphisms of an abelian group	12
3	**UNIT III: Factorization in Integral Domains** Prime and irreducible elements, H.C.F. and L.C.M. of two elements of a	12

	ring, Principal ideals domains, Euclidean domains, Unique factorization domains, Different relations between Principal ideal domains, Euclidean domains and Unique factorization domains	
4	UNIT IV: Rings of Polynomials Polynomials rings, Algebraic and transcendental elements over a ring, Factorization in polynomial ring R[x], Division algorithm in R[x], where R is a commutative ring with identity, Properties of polynomial ring R[x] if R is a field or a U.F.D., Gauss lemma, Gauss Theorem (statement only), Eisenstein irreducibility criteria and its applications, Division algorithm for polynomial ring F[x], where F is a field, Reducibility test for polynomials of degree 2 and 3 in F[x]	9
Total		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define: Ring, Commutative ring, Integral domain, Division ring, Field, Ideal, Maximal ideal, Prime ideal, Principle ideal, Ring homomorphism, Kernel of a homomorphism, Automorphisms, Characteristic of a ring, Zero divisor element, Idempotent element, Unit element, Boolean ring, quotient rings, direct products of Rings.	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	State the fundamental theorem of homomorphism, and Other related theorems.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
1.3	Recognize the polynomial rings and associated properties.		
2.0	**Skills**		
2.1	Verify axioms of, Rings, subrings, fields, homomorphisms, isomorphisms, automorphisms, ideals, Maximal ideal, Prime ideal, Principle ideal, and quotient rings, in examples.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Quiz1 & Quiz2. • Midterm exam. • Final written exam. Evaluation of assignments
2.2	Derive the proofs of main theorems	• Lectures	• Continuous evaluation

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	and key results of Rings and Fields.	• Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.3	Apply the isomorphism theorems, and other theorems.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.4	Demonstrate knowledge of direct products of Rings and rings of polynomials.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.5	Compute all maximal, prime and principle ideals, all cosets, the order, the characteristic, the set of all units and the set of all zero divisors of a given ring, the kernel of a homomorphism, tables of addition and multiplication of some rings and fields, and all solutions (zeros) of a given equation (polynomial).	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
3.0	**Competence**		
3.1	Take responsibility for own learning and professional development	Team work- Assignments- student presentation- reporting- Scientific media Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. Observation Card
3.2	Work effectively in groups and exercise leadership when appropriate.	• Working in small groups Group research	Evaluation of individual & group works.
3.3	Present information clearly in both written and oral form.	• Team work • small groups and the distribution of roles.	Oral discussion Report evaluation

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• PowerPoint presentation. Writing reports	
3.4	Communicates effectively in oral and written form in educational situations related to the subjects of the course.	• small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Practical Exam	-	-
6	Lab Reports	-	-
7	Final Written Theoretical Exam	16	50
8			

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Contemporary Abstract Algebra - Eighth Edition - Joseph A. Gallian. • Theory and Problems of ABSTRACT ALGEBRA- Second Edition - Frank Ayres, Jr., LLOYD R. JAISINGH - Schaum's Outline Series • J. B. Fraleigh, A first course in abstract algebra, Addison Westley 1999. T. W. Hungerford, Abstract Algebra An Introduction.
Essential References Materials	J. B. Fraleigh, A first course in abstract algebra, Addison Westley 1999
Electronic Materials	• https://en.wikipedia.org/wiki/Abstract_algebra • https://www.extension.harvard.edu/open-learning-initiative/abstract-algebra • https://www.mathcity.org/bsc • https://math.libretexts.org/
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	The teacher using an excel program that measure CLO's	Direct
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Dr./ Ahmed Ageeb Sayed Ahmed Elokl Dr./ Sabah Naji Dr./ Ahmed Mossa
Reference No.	
Date	

Course Specifications

Course Title:	Analytical Mechanics
Course Code:	42041419
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours: 3 hours (lecture)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑
3. Level/year at which this course is offered: Level: 7/ year: 4
4. Pre-requisites for this course (if any)**:** Vectors and Mechanics (42041219)
5. Co-requisites for this course (if any)**:** Non

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	75%
2	**Blended**	√	10%
3	**E-learning**	√	15%
4	**Correspondence**		
5	**Other**		---

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	
2	**Assignments**	
3	**Library**	
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	

***The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Students are introduced to

Definitions and basic concepts in analytical mechanics : -
Classification of mechanical systems (Scleronomic and rheonomic systems – Holonomic and non-holonomic systems - conservative and non-conservative systems – Generalized coordinates - Generalized velocities – Generalized forces – Generalized Kinetic energy – Generalized momenta), Newton's law in Cartesian coordinate and polar coordinate
Lagrange's equations ,Lagrange's equations for holonomic and non holonomic systems. Applications of Lagrange's equations, Generalized momenta, Hamiltonian's function, Hamiltonian's equations, Applications of Hamiltonian's equations, Calculus of variation - Hamiltonian's Principle, Ignorable or cyclic coordinates - Routh's function - Routh's equations.

2. Course Main Objective

1: What is the main purpose for this course?
This course has been designed as an introduction to Analytical mechanics . The student enrolled in this course should have a back-ground in vectors, mechanics, calculus and linear algebra . This course covers basic points in mechanics :

- To know Basics Concepts in analytical Mechanics.
- To know Lagrange's Equation
- To solve problems related to Lagrange's equation
- To Know the Hamilton's 's Equations
- To solve problems related to Hamilton's equations
- To Know the Routh's Equations
- To know Canonical transformation
- To classified mechanics system

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define the Basic Concepts in analytical mechanics	K1
1.2	Recognize to Lagrange's Equations, Hamiltonian's equations, Routh's Equations and canonical transformation	K2
2	**Skills :**	
2.1	Solve Problems related to Lagrange's equations problems of Hamiltonian's equations, Routh's Equations	S4
2.2	Apply the method of canonical transformations	S2
2.3	Explain To classified mechanics system	S5
2.4	Verify axioms of, Newton's law	S1
3	**Competence:**	
3.1	Take responsibility for own learning and professional development	C2
3.2	Work effectively in groups and exercise leadership when appropriate.	C3

C. Course Content

No	List of Topics	Contact Hours
1	Classification of mechanical system(scleronomic and rheonomic systems-Holonomic and Non Holonomic systems-Conservative and Non conservative systems –Generalized coordinates-Generalized Velocity , Generalized Forces-Generalized Kinetic Energy-generalized Momenta).	9
2	Lagrange's equation(Lagrange's equation for Holonomic and Non Holonomic systems-Application of Lagrange's equation).	9
3	Hamiltonian's equations (Generalized Momenta , Hamiltonian's function-Hamiltonian's equation --Application of Hamiltonian's equation)	9
4	Hamiltonian's Principle (Calculus of Variation)	9
5	Routh's equation- Routh's function – Ignorable or cyclic coordinates , Canonical(contact) transformations-condition that transformations be Canonical-Generating function-The Hamilton-Jacobi equation-Solutions of Hamilton- Jacobi equation	9
Total		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Define the Basic Concepts in analytical mechanics	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction,and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	Recognize to Lagrange's Equations, Hamiltonian's equations, Routh's Equations and canonical transformation	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.0	**Skills**		

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
2.1	Solve Problems related to Lagrange's equations problems of Hamiltonian's equations, Routh's Equations	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Quiz1 & Quiz2. • Midterm exam. • Final written exam. Evaluation of assignments
2.2	Apply the method of canonical transformations	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.3	Explain To classified mechanics system	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.4	Verify axioms of, Newton’s law	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam.

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
		research	Final written exams.
2.5		• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
3.0	**Competence**		
3.1	Communicates effectively in oral and written form in educational situations related to the subjects of the course	Team work- Assignments- student presentation- reporting- Scientific media Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. Observation Card
3.2	Take responsibility for own learning and professional development	• Working in small groups Group research	Evaluation of individual & group works.
3.3	Work effectively in groups and exercise leadership when appropriate.	• Team work • small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Practical Exam	-	-
6	Lab Reports	-	-
7	Final Written Theoretical Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• – H. R. Fowels, Analytical Mechanics, Brace Publisher: Harcout, 1995. • [2] – L. N. Hand and J. D. Finch, Analytical Mechanics, CambridgeUniversity Press, 1998. • [3] – H. Baruh, Analytical Dynamics, McGraw-Hill, 1998. • [4] - John r. Taylor, Classical mechanics • 2- 2007 .فؤد سعيد , أبو النور عبدالله , اسماعيل حسنين – الميكانيكا التحليلية.
Essential References Materials	• M. R. Spiegel, Schaum's Outline Series of Theory and Problems of Theoretical Mechanics, McGraw-Hill Book Company, 2002. • .
Electronic Materials	
Other Learning Materials	----------

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students
Technology Resources (AV, data show, Smart Board, software, etc.)	
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	The teacher using an excel program that measure CLO's	Direct
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	1- Dr/ Abdelbagy. A.Alshikh 2- Dr/Hosni Ammar 3- Dr/Ayoub mohammed
Reference No.	
Date	27/4/2020

Course Specifications

Course Title:	Mathematical Modelling
Course Code:	42041427
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 7th Level / 4th year
4. Pre-requisites for this course (if any)**:** Ordinary Differential Equations (42041222)
5. Co-requisites for this course (if any)**:** None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100 %
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	5
2	**Assignments**	5
3	**Library**	5
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify)	
	Total	20

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to give a broad overview of general Modeling and models in life science by using the three branches of Mathematics (Pure , Applied and Computer Science).

2. Course Main Objective

The objectives of this course are to:

- introduce students to the basic concepts of Modeling;
- Studying some models and its solutions in different dimensions;
- Linking Math sciences to each other (Pure , Applied and Computer Science).

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:** At the end of the course, the student will be able to	
1.1	Define, understand and explain the concept of Modeling	K1
1.2	Recognize the exact definitive of Some Mathematical Models in different Sciences (Mechanics , Physics , …)	K2
1.3	Know the applications of ODE and PDE.	K3
1.4	Know some Numerical methods to solve the problems.	K3
2	**Skills :** At the end of the course, the student will be able to	
2.1	Write the government equations of different Models.	S1
2.2	Solve the system of equations of the model.	S2
2.3	Write steps to convert the idea and problem to studding model.	S3
2.4	Present information clearly in both written and oral form.	S4
3	**Competence:** At the end of the course, the student will be able to	
3.1	Take responsibility for own learning and professional development	C1
3.2	Work effectively in groups and exercise leadership when appropriate.	C3

C. Course Content

No	List of Topics	Contact Hours
1	Deviation of the mathematical model for initial and boundary value problems that appear in some applied sciences	6
2	Models in Mechanics of particles and rigid bodies with different dimensions	6
3	Fluid mechanics models , heat transfer in different dimension and Electromagnetic models	9
4	Modeling : E.C. and Resonance Applications in ODE and PDE	12
5	Finding the particular solutions for these models using the appropriate mathematical methods.	12
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define, understand and explain the concept of Modeling	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	Recognize the exact definitive of Some Mathematical Models in	• Lectures • PowerPoint presentation • Debate and discussion.	• Continuous evaluation through interaction, and presentation of research projects.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	different Sciences (Mechanics , Physics , …)	• Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
1.3	Know the applications of ODE and PDE.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	Midterm & final practical exam Quiz1 & Quiz2
1.4	Know some Numerical methods to solve the problems.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.0	**Skills**		
2.1	How to write the government equations of different Models.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.2	How to solve the system of equations of the model.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • Presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.3	How to write steps to convert the idea and problem to studding model.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.4	Present information clearly in both written and oral form.	*Team work *small groups and the distribution of roles. *PowerPoint presentation. *Writing reports	Oral discussion Report evaluation
3.0	**Competence**		
3.1	Take responsibility for own learning and professional development	Team work- Assignments- student presentation- reporting- Scientific media- Training on scientific drawing, and Lab work Co-operative & Individual assignments. Cooperative Learning.	*Evaluation of individual & group works. *Observation
3.2	Work effectively in groups and exercise leadership when appropriate.	*Working in small groups *Individual & group research	*Evaluation of individual & group works. *Observation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Exam	9	20
3	Quiz2	13	10
	Assignments, Activities & Attendance	During Semester	10
4	Final Written Theoretical Exam	16	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	i – Advanced Engineering Mathematics , Erwin Kreyszig : John Willy and Sons,2011. ii- Mathematical Methods in the physical sciences , John Wiely & Sons, 2013. iii- Dynamics of particle , S. L. Loney :Cambridge university press 1960 ix- Classical Electrodynamics , John David Jackson , John Wiely & Sons , Inc. , 1975.
Essential References Materials	Advanced Engineering Mathematics , Erwin Kreyszig : John Willy and Sons,2011.

Electronic Materials	• https://www.sfu.ca/~rpyke/Modelling • https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2430384/ • https://www.mathsisfun.com/algebra/mathematical-models • https://www.sace.sa.edu.au/documents/652891/.../Student+2+-+Task • www.sacema.org/uploads/ModelSlides • https://www.quora.com/What-are-the-best-examples-of-mathematical • https://math.stackexchange.com/.../examples-of-types-of-mathematic
Other Learning Materials	• CD-ROM containing the animated models. • Movies for models.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms , Computer Labs
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show , matlap program , mathematica program
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Direct
Quality of learning resources	Students, faculty and staff	Direct
Achievement of course learning outcomes	Staff and program leaders	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	Differential Geometry
Course Code:	42041425
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	7th Level , 4th year students, -----, 1st semester
4. Pre-requisites for this course (if any)**:**	Linear Algebra 42041224
5. Co-requisites for this course (if any)**:**	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	85%
2	**Blended**	√	10%
3	**E-learning**	√	5%
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	80
2	**Assignments**	40
3	**Library**	40
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	160

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to give a broad Introduction to differential through geometrical language

2. Course Main Objective

At the end of the course, students should have a strong working knowledge of the following topics :

- ✓ Basics principals of differential geometry which related to curves and surfaces in space.
- ✓ Parametric representation of curves and surfaces.
- ✓ Recognize curves on surfaces and various types of curvatures and Geodesics, The Frenet Formulas.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge: Students should be able to:**	
1.1	**Define:** curves, **Parameterized** curves-Regular curves -Tangent vector: Tangent curves**,** Differentiable Manifolds, Coordinate charts, Maps between manifolds**,** Gauss Map, Mean **&** Gaussian Curvature.	✓ K1
1.2	**State to Describe:** In details the Frenet Formulas, Arbitrary-Speed Curves, Curvature and Torsion value means, the relationship between their topologies and the geometric structures.	✓ K2
1.3	**recognize - Discuss:** Moving frame, **Torsion** and Curvature value, smooth manifolds in the case of curves and surfaces.	✓ K3
2	**Skills :Students should be able to:**	
2.1	**Apply:** Theory of curves in space & curves in 3- dimensional- Tangent vector Systems, theory of curves in the n-dimensional- Parameterized curves-Regular curves.	✓ **S1&S2**
2.2	**Solve:** Parametric equations of a surface- tangent plane to a surface- linear element of a surface.	✓ **S3**
2.3	**Compute:** First and second fundamental quadratic forms of a surface, Normal curvature of surface, geodesics lines, , Arc length and reparametrization ,Mean Curvature, Gaussian Curvature.	✓ **S3&S4**
3	**Competence: Students should be able to:**	
3.1	**Analyze:** Curves in 3- dimensional- Tangent vector, Brincipal Normal vector and Binormal vector, Gauss map.	✓ **C1**
3.2	**Explain:** Principle of higher Dimensional Surfaces (manifold), Maps between manifolds, Tangent vectors and cotangent vectors.	✓ **C1**
3.3	**Communicate** and **React to** Present informations effectively in oral and written form in educational situations related to the subjects of the course.	✓ **C1,C2 C3**

C. Course Content

No	List of Topics	Contact Hours
	General introduction to the theory of curves in the n-dimensional, Regular curves, Parameterized curves, Tangent vector, Tangent curves, Tangent vector, Arc length and reparametrization, Curvature.	9
	Theory of curves in space, Theory of curves in 3- dimensional, Tangent vector, principal Normal vector and Binormal vector (moving frame).	9
	Curvature- Torsion- Serret-Frenet apparatus, Fundamental theorem of space curve existence and uniqueness theorem for space curve.	6
	Parametric equations of a surface, tangent plane to a surface, linear element of a surface.	6
	Local theory of surfaces, First and second fundamental quadratic forms of a surface, Normal curvature of surface, geodesics lines.	9
	Introduction to Differentiable Manifolds, Coordinate charts, The definition of a manifold, Maps between manifolds, Tangent vectors and cotangent vectors, Vector fields**,** The exterior algebra.	6

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
At the end of the course the student should be able to:			
1.0	**Knowledge**		
1.1	**Define:** curves, Parameterized curves-Regular curves -Tangent vector: Tangent curves**,** Differentiable Manifolds, Coordinate charts, Maps between manifolds**,** Gauss Map, Mean **&** Gaussian Curvature.	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). • Working in small groups	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • 1st Midterm exam. • 2nd Midterm exam. • Final written exams.
1.2	**Describe:** In details the Frenet Formulas, Arbitrary-Speed Curves, Curvature and Torsion value means, the relationship between their topologies and the geometric structures.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • 1st Midterm exam. • 2nd Midterm exam. • Final written theoretical exam.
1.3	**Discuss:** Moving frame, Torsion and Curvature value, smooth manifolds in the case of curves and surfaces.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• 1st Midterm exam. • 2nd Midterm exam. & final practical exam
2.0	**Cognitive Skills**		
2.1	**Apply:** Theory of curves in space & curves in 3- dimensional-Tangent vector Systems, theory of curves in the n-dimensional-Parameterized curves-Regular curves.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • Presentation of summaries and reports during lectures. • 1st Midterm exam. • 2nd Midterm exam. • Final written theoretical exam. • Evaluation of

			assignments
2.2	**Solve:** Parametric equations of a surface- tangent plane to a surface- linear element of a surface.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • 1st Midterm exam. • 2nd Midterm exam. - Final written theoretical exam.
2.3	**Compute:** First and second fundamental quadratic forms of a surface, Normal curvature of surface, geodesics lines, , Arc length and reparametrization ,Mean Curvature, Gaussian Curvature.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups • Individual & group research	• Continuous evaluation through interaction, and presentation of research projects. • presentation of summaries and reports during lectures. • Evaluation of assignments. • 1st Midterm exam. • 2nd Midterm exam. Final written theoretical exam.
3.0	**Interpersonal Skills & Responsibility**		
3.1	**Analyze:** Curves in 3- dimensional- Tangent vector, Brincipal Normal vector and Binormal vector, Gauss map.	Team work- Assignments- student presentation-reporting- Scientific media- Training on scientific drawing, reading slides and reporting-Lab work Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. • Observation Card
3.2	**Explain:** Principle of higher Dimensional Surfaces (manifold), Maps between manifolds, Tangent vectors and cotangent vectors.	• Working in small groups • Individual & group research	• Evaluation of individual & group works. • Observation Card
3.3	**Present information and communicates** effectively in oral and written form in educational situations related to the subjects of the course.	• small groups and the distribution of roles. • PowerPoint presentation. • Writing reports	• Oral discussion • Report evaluation • Observation cards.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework & Classwork Assignments	During the Semester	10%
2	Quiz 1	The 5th Week	10%
3	Mid-Term Exam	The 9th Week	20%
4	Quiz 2	The 13th Week	10%
5	The Final Examination (Written Test)	The 16-17th Week	50%
	Total		100

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- Follow-up by the head of the department.
- Define 8 office hours per week for each member of the faculty who resides in his office.
- Define 2 hours weekly as Academic guidance for each faculty member for guiding a group of students academically.
- Give guidance so encouraging in assessing the performance of a teacher.
- Creating the means to make the teacher benefit of his time during his stay in office. Non-scientific services to assist the teacher to attend office hours**.**

F. Learning Resources and Facilities

1. Learning Resources

1. List Required Textbooks

1**.** M. P. de Carmo, Differential Geometry of Curves and Surfaces, DOVER PUBLICATIONS, INC. Mineola, New York, 2017.

2. R. S. Millman and G. D. Parker, Elements of Differential Geometry, Prentice-Hall, Englewood Cliffs, NJ, 1977.

2. List Essential References Materials (Journals, Reports, etc.)

1- J. A. Thorpe, Elementary Topics in Differential Geometry, Springer-Verlag, New York, 1994.

2- Anant R. Shastri, Elements of Differential Topology, CRC Press, Taylor & Francis Group, 2011.

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

1- T. Shifrin, Differential Geometry: A First Course on Curves and Surfaces, 2008.

2- B. O'Neill, Elementary Differential Geometry. (Revised Second Edition), Elsevier/Academic Press, San Diego CA, 2006.

4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)

- http://people.maths.ox.ac.uk/~joyce/Nairobi2019/Hitchin-DifferentiableManifolds.pdf
- Several web sites are already exists concerning Geometry of curves and surfaces, which are of great help in getting some lecture notes, examples and exercises. Some of these sites are exists on the web page of the course teacher.

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

- Some computer programs exist showing the shape of curves and surfaces in the three-dimensional space, such as Maple, ScientificWorkPlace, and Matematica.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students, Math lab.
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course, Maple, ScientificWorkPlace, and Matematica software
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	The teacher using an excel program that measure CLO's	Direct
Quality of learning resources	Students and Program Leaders	Direct
Effectiveness of teaching	Students	Indirect (Questionnaires)
Exams.	Program committee	Direct (Discussion Meeting)

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	Introduction to Topology
Course Code:	42041423
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3 Hours (Lecture)**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Level: 7 / year: 4**
4. Pre-requisites for this course (if any)**:**	Fundamentals of Mathematics (42041221)
5. Co-requisites for this course (if any)**:**	Non

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	**80%**
2	**Blended**	√	**5%**
3	**E-learning**	√	**5%**
4	**Correspondence**		
5	**Other**	√	**10%**

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	**45**
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	**45**
Other Learning Hours*		
1	**Study**	**90**
2	**Assignments**	**45**
3	**Library**	**45**
4	**Projects/Research Essays/Theses**	--------
5	**Others** (specify)	--------
	Total	**180**

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course introduces topology, covering topics fundamental to modern analysis and geometry. It also deals with subjects like basic concepts of general topological spaces and continuous functions: topological space, comparing topologies; subspace, and product topologies; closed sets, limit points, boundary points, exterior points, interior operator, closure operator, continuous functions, open and closed function, topological property, metric topology, quotient, connectedness in general spaces, components, compactness in general spaces, countability axioms, separation axioms, normal spaces, regular spaces and Urysohn's Lemma.

2. Course Main Objective

To introduce basic concepts of point set topology, basis and sub basis for a topology and order topology. Further, to study continuity, homeomorphisms, open and closed maps, product and box topologies and introduce notions of connectedness, path connectedness, local connectedness, local path connectedness, countability axioms and compactness of spaces.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:** After studying this course, the student will be able to	
1.1	define the basic concepts of topological spaces.	**K1**
1.2	state the fundamental theorems of topological spaces.	**K2**
1.3	recognize open and closed sets, interior and closure operators, limit points, exterior points, boundary points, continuous functions, open and closed functions.	**K3**
2	**Skills:** After studying this course, the student will be able to	
2.1	check whether a collection of subsets is a basis for a given topological spaces or not, and determine the topology generated by a given basis	**S3**
2.2	identify the continuous maps between two spaces and maps from a space into product space and determine common topological property of given two spaces.	**S2**
2.3	Determine the connectedness and path connectedness of the product of an arbitrary family of spaces..	**S1**
2.4	Find Hausdorff spaces using the concept of net in topological spaces and learn about first and second countable spaces, separable and Lindelöf spaces.	**S4**
2.5	prove Bolzano-Weierstrass property of a space and prove Tychonoff theorem	**S1**
3	**Competence:**	
	After studying this course, the student will be able to	
3.1	use information and communication technologies to gather, interpret and communicate information and ideas.	**C1**
3.2	develop their self-learning skills.	**C2**
3.3	demonstrate the work either independently or being a part of a team.	**C4**

C. Course Content

No	List of Topics	Contact Hours	Weeks
1	**UNIT I: Basic Concepts and Point Set Topology** Definitions of topology and topological spaces, Examples of topology including	**9**	**3**

	discrete topology, indiscrete topology, standard topology on IR, lower limit and upper limit topology, co-finite topology and co-countable topology, Topology induced by a metric, Basis for topology, Subspace topology, K-topology, Order Topology, Product Topology on X×Y, Topology generated by the sub-basis, Closed sets and limit points, Neighbourhoods, Interior, exterior and boundary points, Derived sets, Hausdorff spaces.		
2	**UNIT II: Continuity, Connectedness and Compactness** Continuous functions, Pasting lemma, Homeomorphisms, Convergence in topological spaces, Connected spaces, Connected sets in the real line, Intermediate value theorem, Components and Local connectedness, Path connected, Path components, Locally path connected spaces, Properties of Continuous functions on Connected sets, Compact spaces and their basic properties, Finite intersection property, Compact subspaces of the real line, Extreme value theorem, Lebesgue number, Uniform continuity, Limit point compactness, Sequential compactness, Local compactness, Properties of continuous functions on compact sets.	**9**	**3**
3	**UNIT III: Countability and Separation Axioms** First and second countable spaces, Lindelof spaces, T-1, T-2 (Hausdorff), T-3 (Regular), T-4 (Normal), T-3.5 (Completely regular) spaces and their characterizations and basic properties, Urysohn's lemma, Tietze extension theorem.	**9**	**3**
4	**UNIT IV: Product Spaces and Quotient Spaces** Product topology (finite and infinite number of spaces), Tychonoff product, Projection maps, Stone Cech Compactification, Comparison of the Box and Product topologies, Quotient topology, Quotient (Identification) spaces with some examples.	**9**	**3**
5	**UNIT V:** Metric spaces Definition of a metric space , The Topology of metric Space, Continuous Functions on a Metric Space	**9**	**3**
	.		
Total		**45**	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define, and give examples of the concept of topological spaces.	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	State the fundamental theorems of	• Lectures	• Continuous evaluation

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	topological spaces.	• PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
1.3	Recognize open and closed sets, interior and closure operators, limit points, exterior points, boundary points, continuous functions, open and closed functions.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.0	Skills		
2.1	Solve mathematical problems by using axioms of topology, subspaces, continuity, connectedness, and separation.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Quiz1 & Quiz2. • Midterm exam. • Final written exam. Evaluation of assignments
2.2	Derive the proofs of the main theorems and key results of topology.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.3	Apply continuity, connectedness, and compactness in solving mathematical problem.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• Working in small groups Individual & group research	• Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.4	Interpret different mathematical ideas and relationships into mathematical representation such as topological property, separation axioms, hereditary property.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.5	Compar between the Topological space and metric space	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
3.0	**Competence**		
3.1	use information and communication technologies to gather, interpret and communicate information and ideas.	Team work- Assignments- student presentation- reporting- Scientific media Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. Observation Card
3.2	develop their self-learning skills.	• Working in small groups Group research	Evaluation of individual & group works.
3.3	demonstrate the work either independently or being a part of a team.	• Team work • small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	**5**	**10**
2	Midterm Written Theoretical Exam	**9**	**20**
3	Quiz2	**13**	**10**
4	Assignments, Activities & Attendance	**During Semester**	**10**
5	Final Practical Exam	-	-
6	Lab Reports	-	-

#	Assessment task*	Week Due	Percentage of Total Assessment Score
7	Final Written Theoretical Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

In addition to lectures, there are two ways to reach the faculty members:

1- **Office hours:** faculty members assign minimum 6 office hours per week for student consultations and academic advice. The consultation time is mentioned in the faculty members' timetable and is display on the faculty member's office door.

2- **Email:** Students may also reach the faculty members through emails, which should be written in the syllabus of the course.

Each faculty member is assigned to a group of students as an academic advisor in order to:

1- review and approve his/her students' registration forms during the registration week.

2- follow-up his/her students' academic progress.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• O.Ya. Viro, O.A. Ivanov, V.M. Kharlamov and N.Yu. Netsvetaev, *Elementary Topology: Textbook in Problems*, ISBN 978-0-8218-4506-6. • Stephen Willard, *General Topology*, ISBN 0-486-43479-6. • John L. Kelley (1955) General Topology, link from Internet Archive, originally published by David Van Nostrand Company. • George F. Simmons, *Introduction to Topology and Modern Analysis*, ISBN 1-575-24238-9.
Essential References Materials	• James Munkres, Topology, ISBN 0-13-181629-2.
Electronic Materials	• https://en.wikipedia.org/wiki/General_topology • http://web.math.ku.dk/~moller/e03/3gt/notes/gtnotes.pdf • https://www.youtube.com/watch?v=ivO9_O0YSSc • The BU's Learning Management System (**Rafid**).
Other Learning Materials	----------

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course	The teacher using an excel	Direct

Evaluation Areas/Issues	Evaluators	Evaluation Methods
learning outcomes	program that measure CLO's	
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	1- Dr/ 2- Dr/ 3- Dr/
Reference No.	
Date	

Course Specifications

Course Title:	Discrete Mathematics (Elective Course (1))
Course Code:	42041429
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3 hours (lecture)**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**Level: 7/ year: 4**
4. Pre-requisites for this course (if any)**:**	**(42041221)**
5. Co-requisites for this course (if any)**:**	Non

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	75%
2	**Blended**	√	10%
3	**E-learning**	√	15%
4	**Correspondence**		
5	**Other**		----------

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	
2	**Assignments**	
3	**Library**	
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	

***The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Students are introduced to

Basic concepts of elementary logic: statements and statement forms, connectives, logical equivalence, truth tables; converse, inverse and contrapositive of a conditional statement. Tautologies and contradictions. Universal and existential statements. Methods of proof: direct proof, proof by cases, proof by contrapositive, proof by contradiction, first and second principles of mathematical induction. -Relations: general definitions, digraph and matrix of a relation; reflexive, symmetric, antisymmetric and transitive relations. Equivalence relations and partitions. Order relations and Hasse diagrams. Boolean algebras: general definitions, Boolean functions, complete sum of products form, complete product of sums form. Karnaugh maps, minimal sum of products form and minimal product of sums form. Gates and design of logic circuits. Graph theory: basic definitions and examples, paths, cycles, connected graphs, subgraphs. Regular, complete and bipartite graphs. Isomorphism of simple graphs. Trees, spanning trees, breadth-first search and depth-first search.

2. Course Main Objective

1: What is the main purpose for this course?

This course has been designed as an introduction to discrete mathematics. The student enrolled in this course should have a back-ground in set theory. This course covers basic points in discrete mathematics:

- Studying propositional logic, conditional statements, truth tables of compound proposition, logical equivalence.
- Studying introduction to proofs, methods of the proof, direct proofs, proof by contraposition, proofs by contradiction.
- Studying terminology, hand shaking theorem, types of graphs, paths, chromatic number of graph, four color theorem, Euler and Hamilton paths and circuits, trees
- Have the knowledge of the Bolean Algebras.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define basic concepts in : Logic, Introduction to Proofs, Relations, Graph Theory, Introduction to Boolean Algebras,	K1
1.2	State the fundamental theorem of Logic, Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras.	K2
2	**Skills :**	
2.1	Draw the diagrams in Graph Theory, Introduction to Boolean Algebras .	S4
2.2	Derive the proofs of : Logic, Introduction to Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras.	S2
2.3	calculate the problems related to Logic, Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras..	S5
2.4	Verify axioms of, Logic, Introduction to Proofs Introduction to Boolean Algebras.	S1
2.5	Solve the problems related Logic, Introduction to Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras	S3
3	**Competence:**	

3.1	Communicates effectively in oral and written form in educational situations related to the subjects of the course	C1
3.2	Take responsibility for own learning and professional development	C2
3.3	Work effectively in groups and exercise leadership when appropriate.	C3

C. Course Content

No	List of Topics	Contact Hours
1	**Logic**: Propositions and Compound Statements, Basic Logical Operations, Propositions and Truth Tables, Tautologies and Contradictions, Logical Equivalence, Algebra of Propositions, Propositional Functions, Quantifiers	9
2	**Introduction to Proofs**: Methods of Proving, Direct Proofs, Proof by Contraposition, Proofs by Contradiction, Mistakes in Proofs, Looking for Counter Examples, mathematical induction	9
3	**Relations:** Relations and Their Properties, Composition of Relations**.** Types of Relations	6
4	**Introduction to Graph Theory**: terminology – hand shaking theorem – types of graphs – paths – Chromatic number of graph – four color theorem – Euler and Hamilton paths , circuits and Trees.	9
5	**Introduction to Boolean Algebras:** Basic Definitions **,** Duality **,** Basic Theorems **,** Sum-of-Products Form for Boolean Algebras**,** Logic Gates and Circuits **,** Truth Tables, Boolean Functions **,** Karnaugh Maps	12
Total		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Defining basic concepts in Logic, , Introduction to Proofs, Relations, Graph Theory, Introduction to Boolean Algebras,	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction,and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	State the fundamental theorem of Logic, Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras.	• Lectures • PowerPoint presentation • Debate and discussion.	• Continuous evaluation through interaction, and presentation of

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
		• Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.0	**Skills**		
2.1	Draw the diagrams in Graph Theory, Introduction to Boolean Algebras .	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Quiz1 & Quiz2. • Midterm exam. • Final written exam. Evaluation of assignments
2.2	Derive the proofs of : Logic, Introduction to Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.3	calculate the problems related to Logic, Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras..	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.4	Verify axioms of, Logic, : Introduction to Proofs Introduction to Boolean	• Lectures • PowerPoint presentation	• Continuous evaluation through

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	Algebras..	• Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.5	Solve the problems related Logic, : Introduction to Proofs:, Relations, Graph Theory, Introduction to Boolean Algebras	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
3.0	**Competence**		
3.1	Communicates effectively in oral and written form in educational situations related to the subjects of the course	Team work- Assignments- student presentation- reporting- Scientific media Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. Observation Card
3.2	Take responsibility for own learning and professional development	• Working in small groups Group research	Evaluation of individual & group works.
3.3	Work effectively in groups and exercise leadership when appropriate.	• Team work • small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Practical Exam	-	-
6	Lab Reports	-	-
7	Final Written Theoretical Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Ralph. P.Grimaldi, Discrete and Combinatorial Mathematics- An Applied Introduction, 5th Edition, Pearson Education, 2004 ISBN-10: 0132130807 • Trembly J.P.& Manohar .P, Discrete Mathematical Structures with applications to computer science, Tata McGraw-Hill Pub Co Ltd, New Delhi, 2007, ISBN-10: 0070651426, ISBN-13: 978-0070651425 • Mott , J.L., Kandel A and Baker T.P., Discrete Mathematics for Computer Scientists & Mathematicians, 2 Sub edition, Prentice Hall, 1986, ISBN-10: 0835913910, ISBN-13: 978-0835913911.
Essential References Materials	• kolman, Ross and Busby, Discrete Math Structure, 6th Edition, Prentice Hall, 2007, ISBN 0132297516 Addison Wesley, 2010, ISBN 0136091814.
Electronic Materials	•
Other Learning Materials	----------

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students
Technology Resources (AV, data show, Smart Board, software, etc.)	
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	The teacher using an excel program that measure CLO's	Direct
Quality of learning resources	Students and Program Leaders	Direct

Evaluation Areas/Issues	Evaluators	Evaluation Methods

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	1- Dr/ mohand mahgoub 2- Dr/ 3- Dr/
Reference No.	
Date	

Course Specifications

Course Title:	Set Theory (Elective Course (1))
Course Code:	42041431
Program:	B. Sc in Mathematics
Department:	Department of Mathematics
College:	Faculty of Science and Arts in Qilawah
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3 hours per lecture**
2. Course type	
a.	University ☐ College ☐ Department √ Others ☐
b.	Required ☐ Elective √
3. Level/year at which this course is offered:	**Level:7 / year: 4**
4. Pre-requisites for this course (if any)**:**	**Fundamentals of Math.(**42041221 **)**
5. Co-requisites for this course (if any)**:**	**Non**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	75%
2	**Blended**	√	10%
3	**E-learning**	√	15%
4	**Correspondence**		
5	**Other**		----------

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	90
2	**Assignments**	45
3	**Library**	45
4	**Projects/Research Essays/Theses**	--------
5	**Others** (specify)	
	Total	180

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The student should be familiar with the concepts of sets, subsets, set operations, the fundamental principle of counting, Venn Diagrams, cardinality, and the use of such in solving set-theoretic problems. Furthermore, the student will have mastered the use of the previously mentioned material to apply it to the real-world problem of surveying. foundations of set theory are studied in the context of their application to the construction of number systems, from the natural numbers through the reals.

2. Course Main Objective

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Define: Binary operation, relations, functions and interpret their representations.	1.1
1.2	State the fundamental theorem of Well-ordered theorem, Zorn's lemma, Cantor theorem, continuum hypothesis-Schroeder's theorem.	1.2
1.3	Compare between Lattices and Boolean algebra.	
2	**Skills:**	
2.1	Draw the sets Venn diagrams.	
2.2	Derive the proofs of main theorems and key results of sets.	
2.3	Distinguish between the different types of cardinal numbers and ordinal numbers.	
2.4	Apply Well-ordered theorem, Zorn's lemma, Cantor theorem, continuum hypothesis-Schroeder's theorem.	
3	**Competence:**	
3.1	Take responsibility for own learning and professional development	
3.2	Work effectively in groups and exercise leadership when appropriate.	
3.3	Present information clearly in both written and oral form.	
3.4	Communicates effectively in oral and written form in educational situations related to the subjects of the course.	

C. Course Content

No	List of Topics	Contact Hours
1	Fundamental concepts in set theory, Introduction to binary operations, Sets and elements (Universal set, empty set, subsets and Venn diagram, Set operation and algebra of sets).	9
2	Philosophy of set relations, Functions, Relations and their representations (Ordered pairs. The definition of a relation. Functions. Inverses and composites. Partial orders. Lower bounds and upper bounds. The infimum and the supremum.).	9
3	Ordinal numbers, partially ordered sets, Minimal and maximal elements, Well-ordered set-ordinal sum-ordinal product Isomorphic(similar) ordinal set	9
4	The structure of ordinal numbers, Axiom of choice, Well-ordered theorem, Zorn's lemma,	6
5	Cardinal number, Arithmetic of cardinal numbers, Countable set, Cantor theorem, continuum hypothesis-Schroeder's theorem	6
6	Lattices, basic definitions, duality, Boolean algebra, Boolean algebra as Lattices	6
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define: Binary operation, relations, functions and interpret their representations.	• Lectures • Debate and discussion • Assignments (Co-operative & Individual assignments). Working in small groups	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
1.2	State the fundamental theorem of Well-ordered theorem, Zorn's lemma, Cantor theorem, continuum hypothesis-Schroeder's theorem.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
1.3	Compare between Lattices and Boolean algebra.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.0	**Skills**		
2.1	Draw the sets Venn diagrams.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Quiz1 & Quiz2. • Midterm exam.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		research	• Final written exam. Evaluation of assignments
2.2	Derive the proofs of main theorems and key results of sets.	• Lectures • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exam.
2.3	Distinguish between the different types of cardinal numbers and ordinal numbers.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
2.4	Apply Well-ordered theorem, Zorn's lemma, Cantor theorem, continuum hypothesis-Schroeder's theorem.	• Lectures • PowerPoint presentation • Debate and discussion. • Assignments (Co-operative & Individual assignments). • Cooperative Learning • Working in small groups Individual & group research	• Continuous evaluation through interaction, and presentation of summaries and reports during lectures. • Evaluation of assignments. • Quiz1 & Quiz2. • Midterm exam. Final written exams.
3.0	**Competence**		
3.1	Take responsibility for own learning and professional development	Team work-Assignments-student presentation-reporting-Scientific media Co-operative & Individual assignments. Cooperative Learning.	• Evaluation of individual & group works. Observation Card
3.2	Work effectively in groups and exercise	• Working in small	Evaluation of

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	leadership when appropriate.	groups Group research	individual & group works.
3.3	Present information clearly in both written and oral form.	• Team work • small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation
3.4	Communicates effectively in oral and written form in educational situations related to the subjects of the course.	• small groups and the distribution of roles. • PowerPoint presentation. Writing reports	Oral discussion Report evaluation

2. Assessment Tasks for Students

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6	Lab Reports	-	-
7	Final Written Theoretical Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Introduction to Set Theory, Third Edition, Revised and Expanded by Karel Hrbacek and Thomas Jech, Marcel Dekker, Inc., New York, Basel, 1999. • A first course in mathematical logic and set theory, Michael L.O'Leary- Wiley, September 2015. • Schaum's outline of theory and problem of set theory and related topic-second relation, 1998. • Elements of set theory, Herbert-B-Enderton, Academic press, New York, 1970. • Yiannis Moschovakis' notes on set theory, New York: Springer Verlag, 1994.

	• Math 2100 Lecture Notes – Edward Farrell, Department of Mathematics & Computer Science, • 2nd edition, (2008). • Solved Problems in Abstract Algebra – Edward Farrell, Department of Mathematics & • Computer Science, (2009). **Other Reference Texts:** • Modern Abstract Algebra – Frank Ayres, Mc Graw -Hill, , ISBN 978007002651, (2009).
Essential References Materials	
Electronic Materials	• https://www.youtube.com/watch?v=rRk0d6P4oUI&list=PLa5fRh6uTXwOyJ6_VVy8ypNf6AyFRDCXp. • https://www.youtube.com/watch?v=yCwnifwVjIg
Other Learning Materials	----------

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-------

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	The teacher using an excel program that measure CLO's	Direct
Quality of learning resources	Students and Program Leaders	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	