Course Specification
(Bachelor)

Course Title:	**Foundations of Mathematics**
Course Code:	**MAT 1151**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**08/10/2024**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐ College	☒ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 2 / Year 1					
4. Course general Description:					
This course introduces essential mathematical concepts, including logic, set theory, and methods of proof. Students will explore binary relations, functions, and the basics of algebraic structures. This course is designed to cultivate critical thinking and problem-solving skills that are essential for advanced studies in mathematics.					
5. Pre-requirements for this course (if any)**:**					
None.					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					

- **Build a Solid Foundation: Provide students with essential knowledge in logic, set theory, proofs, relations, functions, and algebraic structures necessary for advanced mathematical studies.**
- **Develop Analytical Skills: Cultivate critical thinking and problem-solving skills applicable to mathematical reasoning with solid argument, and practical scenarios.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**100%**
2	E-learning	**0**	**0%**
3	Hybrid • Traditional classroom • E-learning	**0**	**0%**
4	Distance learning	**0**	**0%**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30

2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	30
5.	**Others (specify)**	0
Total		60

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	Reproduce proofs of basic set-theoretic identities involving unions, intersections, and Cartesian products.	K2	• 2 lecture hours\week • 2 tutorial hours\week • Self-study	• Regular Exams • Assignments • Short Quizzes
1.2	Recognize the concept of Logic including truth table logical statement, set theory, method of proofs and basics of algebraic structures.	K1	• 2 lecture hours\week • 2 tutorial hours\week Self-study	• Regular Exams • Assignments Short Quizzes
1.3	**describe the properties of functions and relations, including types and classifications.**	**K2**	- Conceptual lectures with examples of functions and relations. - Use of graphical tools for visualization. - Small group activities for classification.	- Short-answer questions on exams. - Homework categorizing and analyzing functions and relations. - Quizzes focused on identifying and describing various types.
2.0	**Skills**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	Construct proofs using a variety of proof techniques including: direct proofs, proofs by contraposition and contradiction, proofs by mathematical induction to solve a given problem.	S1, S2	• Self-study • Real-life problems	• Participations • Short Quizzes
2.2	Formulate in logical the negation, converse, and contrapositive of a quantified implication, both linguistically and in Mathematical symbolic form.	S4	Self-study Real-life problems	Participations
2.3	Analyze carefully abstract proofs to provide appropriate instances.	S4	Self-study Real-life problems	Short Quizzes
2.4	Present proofs both orally and in written form using correct and concise English and mathematical grammar.	S5	Self-study Real-life problems	Participations
3.0	**Values, autonomy, and responsibility**			
3.1	Aspire to improve and develop, learning from mistakes;	V1, V3	Class discussion	Participation
3.2	Engage in group discussions and critical interactions.	V1, V2	Team work and class discussion.	Homework and Mini-projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Logic:** Statements, Negation, and Compound Statements, Truth Tables and Logical Equivalences, Conditional and Biconditional Statements, Open Statements and Quantifiers.	**10**
2.	**Set Theory:** Sets and Subsets, Operations on Sets, Generalized Set Union and Intersection, Cartesian Product.	**10**
3.	**Methods of Proofs:** Direct proof method; Contrapositive proof method; Proof by contradiction; If and only if proof; Proof by cases, Existence proof and counterexample method; Mathematical induction and its strong version.	**10**
4.	**Relations:** Binary Relations, Reflexive, Symmetric, antisymmetric, and Transitive Relations, Equivalence Relations, Equivalence Classes, and Partitions, The Order Relations.	**10**
5.	**Functions:** Functions, Onto Functions, One-to-One Functions, The bijection function, Inverse of a Function, Images and Inverse Images of Sets, Denumerable and Countable Sets, Uncountable Sets.	**10**
6.	**Basics of Algebraic Structures:** Binary operations; Semigroups and Groups; Subgroups and Cyclic Groups; Rings, Integral Domains and Fields.	**10**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	During the term	10%
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15-16	40%

*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. ***Introduction to Mathematical Proofs: A Transition***, C. Roberts; Champan & Hall/CRC 2010. **(Main Reference)** 2. *A Primer for Logic and Proof,* **H. P. Hirst and J. L. Hirst, webdraft, (2011-2012 Ed.), 2012.**
Supportive References	1. ***Mathematical Thinking & Writing: A transition to Abstract Math***, R. Maddox, Academic Press, 2002.

	2. **Mathematical Proofs: *A Transition to Advanced Mathematics*,** 3rd Edition, Gary Chartrand, Albert D. Polimeni, Ping Zhang, Pearson, 2014.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires
Effectiveness of Students assessment	Course Coordinator	Peer Reviews
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	**8/1446**
DATE	**05/04/1446 (08/10/2024)**