

**BIRZEIT UNIVERSITY**  
**Department of Mathematics**  
**Course Outline**  
**Logic and Set Theory**

**Math 243**

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Instructor: Dr. Alaeddin Elayyan

TEXT: Peter Fletcher and C. Wayne Patty, Foundation Of Higher Mathematics (Third edition)

**Topics:** The course will cover Chapters 1-5 and Chapter 7 in the text. Precise sections covered are given in the homework exercises.

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**General Comments:**

The main purpose of this course is to teach the student how to write, read, and recognize correct mathematical proofs. The student will also be given an opportunity to learn how to present proofs verbally. Along the way, the student will be introduced to some elementary concepts of advanced mathematics including elementary propositional logic, set theory, relations, functions, and cardinality.

**Evaluation:** There will be

1) Three Hour Exams	50%
2) Final Exam	35%
3) Homework , quizzes and participation	15%

Homework will be assigned weekly ,it is extremely important that you do the homework yourself There will be a deadline for each homework and no late homework will be accepted..

Quizzes will be given after every few sections. Each quiz will cover the material since the last quiz. Quizzes will be based on both lectures and homeworks.

**Remarks**

- 1) Attending the lectures is a must.
- 2) No Late home works, no make up or incomplete exams without an acceptable excuse will be given.

## **Topics Outline:**

### **1) The logic and Language of Proofs (3 weeks)**

- 1.1 Propositions
- 1.2 Expressions and Tautologies
- 1.3 Quantifiers
- 1.4 Methods of Proof
- 1.4 The contradiction Method of Proof
- 1.5 More Proofs

### **2) Sets (2 weeks)**

- 2.1 Introduction
- 2.2 Operations on Sets
- 2.3 Indexed Families
- 2.4 An Axiomatic Approach of Sets

### **3) Mathematical Induction (2 weeks)**

- 3.1 Proofs by Induction
- 3.2 Other Principles of Induction
- 3.3 Induction and Recursion

### **4) Relations and Orders (3 weeks)**

- 4.1 Functions and Relations
- 4.2 Cartesian Graphs and Directed graphs
- 4.3 Equivalence Relations
- 4.4 Partitions and Identifications
- 4.5 Congruence
- 4.6 Composition of Relations
- 4.7 Types of Orders

### **5) Functions (2 weeks)**

- 5.1 Functions as Relations
- 5.2 Functions Viewed Globally
- 5.3 Permutations
- 5.4 Functions and Partitions
- 5.5 Real-Valued Functions
- 5.6 Images and Inverse Images of Sets
- 5.7 Functions and Indexed Families

### **7) Countable and Uncountable Sets (2 weeks)**

- 7.1 Finite and Infinite Sets
- 7.4 Countable Sets
- 7.5 Uncountable Sets

Section	Homework
1.1	2,4,6,7(b),13,14.
1.2	17,20,21,23,24,25,27,35,36,37,38,39.
1.3	41,42,44,47,48,54
1.4	57,58,61,66.
1.5	75,76,78,79,87,
1.6	92,93,94,101.
2.1	3,5,9,10,11,14,15 ,18,20
2.2	21(d,h),40,46,49,50,51,52.
2.3	53,54,55,56,57,61,62
3.1	1(d,f,g,h,j,l,q),2,5,6,15,16.
3.2	17,18,19,20,22,24.
4.1	4,5,6,7,8,9,11,12,13,16.
4.2	17,18,20,
4.3	28,30,31,32,34,35,36,37,38,39,43.
4.4	50,51,54,57,58.
4.5	69,70.
4.6	90,91,92,93.
5.1	1,2,4,6,7,11,12,14.
5.2	17,18,21,23,24.
5.4	40,42,44,45.
5.5	48,49,50,51,53,57,58.
5.6	67,69,72,73,75,77.
5.7	85,86.
7.1	4,5,6,8.
7.4	28,29
7.5	38,40