



**Forman Christian College, Lahore**  
(A Chartered university)  
**Department of Mathematics**

**FALL 21**

**Instructor Information:**

**Imrana Shafique**

**Assistant Professor**

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Office Hours

M W F: 10:00 am - 01:00 pm

T R: 11:00 am - 12:25 pm

**Course Information:**

Course Code: MATH-210

Course Title: Set Theory

Credit hours: 3

Prerequisite: Math-101 / A-level / FSc pre-engineering

Timing: Tuesday & Thursday: 09:30 pm – 10:45 am (Section A, Room # S-424)

**Recommended Text:**

**Set theory and Related topics**

By Seymour Lipschutz,( Schaum's Outlines), 2<sup>nd</sup> Edition.

**Course Contents:**

Course content include the following: Sets and basic operations on sets, relations, functions, cardinal numbers, computing cardinals, denumerable and countable sets, power of continuum, cardinal arithmetic, Cantor-Bernstein theorem, ordered sets, ordinal numbers, axioms of choice, well ordering theorem, and Zorn's lemma.

**Course Requirements:**

Students are expected to attend every class and to arrive at each class on time and remain in class for the entire class period; **minimum 80% attendance is required to appear in the final term exam.** If a student arrives **10 minutes** late, he/she will not be allowed to come in the class. Instructor may choose to lower a student's grades because of tardiness. The instructor will post office hours after the semester commences. Consult the instructor during office hours. If your visit may tend to be lengthy, make an appointment with the instructor so that she may set aside some time for you. Cell phones will be turned off / on silent while the student is in the classroom. **No cell phone calculators are to be used in quizzes, mid term and final exams. After due date, assignment will not be graded.** **There will be no make up quiz, mid term or final exam.** Only make up of mid term or final can be considered if solid proof will be provided within three days after exam. In

case of make up exam there will be a **0-20% deduction** in marks depending upon case to case basis. Academic dishonesty or cheating will result in zero points (grade F) and will be referred to AIC (Academic Integrity Committee) at FCC for necessary action.

### **Learning Outcomes:**

Upon Successful completion of this course, the students will be able to

- describe membership of sets including empty set using proper notation
- determine cardinality of a given set
- describe relations between sets such as equality, subset, proper subset
- perform operations on sets such as union, intersection, composition and difference
- draw Venn diagrams of relations and operations on sets
- solve problems using Venn diagrams

### **Course Evaluation:**

Grading will be based on following criteria:

Attendance, Class participation and behavior	05%
Assignments and presentation	10%
Quizzes (4 out of 5)	15%
Mid Term	30%
Final Exam	40%

<b><u>Grades</u></b>	<b><u>Quality Points</u></b>	<b><u>Numerical Value</u></b>	<b><u>Meaning</u></b>
A	4.00	93-100	Superior
A-	3.70	90-92	
B+	3.30	87-89	
B	3.00	83-86	Good
B-	2.70	80-82	Fair
C+	2.30	77-79	
C	2.00	73-76	Satisfactory
C-	1.70	70-72	
D+	1.30	67-69	
D	1.00	60-66	Passing
F	0.00	59 or below	Failing

Attendance marks will be distributed as follows,

97% - 100 %	5 marks
93% - 96%	4 marks
89% - 92%	3 marks
85% - 88%	2 marks
81% - 84%	1 mark
below 80%	not allowed to appear in the final exam.

## Course Outline:

Week	Topics	Assessment
1	Discussion of Course Plan: course introduction, policies, requirements and grading criteria. <b>Sets and Basic Operations on Sets:</b> Introduction, Sets and elements, Universal and empty set, Venn diagram, Set operations, Algebra of sets.	
2	Finite sets, Counting principles, Classes of sets and power sets, Mathematical induction. <b>Further Theory of Sets and Functions:</b> Operations on collection of sets, Indexed collections of sets.	
3	<b>Relations:</b> Product sets, Relations, Pictorial representation of relations, composition of relations.	<b>QUIZ-1</b>
4	Types of relations, Closure properties, Partitions, Equivalence relations	
5	Partial ordering relations, n-Ary relations. <b>Functions:</b> Definition, Composition of functions.	<b>QUIZ-2</b>
6	One-to-One, Onto and Invertible functions, Mathematical functions	<b>Assignment 1</b>
7	Exponential and Logarithmic functions, Recursively defined functions.	
8	<b>Cardinal Numbers:</b> One-to-One correspondence, Equipotent sets.	<b>Mid Term</b>
9	Denumerable and Countable sets, Real numbers and power of continuum, Cardinal numbers.	
10	Ordering of cardinal numbers, Cantor's theorem, Cardinal arithmetic. <b>Ordered Sets and Lattices:</b> Ordered sets, Partially ordered sets and Hasse diagrams	<b>QUIZ-3</b>
11	Minimal and maximal elements, First and last elements, Supremum and Infimum	<b>Assignment 2</b>
12	Isomorphic ordered sets. <b>Ordinal Numbers:</b> Well-Ordered sets, Transfinite induction, Limit elements.	<b>QUIZ-4</b>

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<b>13</b>	Initial segments, Similarity between a well-ordered and its subsets, Comparison of well-ordered sets	<b>Assignment 3</b>
<b>14</b>	Ordinal numbers, Inequalities and ordinal numbers, Ordinal addition and multiplication	<b>QUIZ-5</b>
<b>15</b>	Auxiliary construction of ordinal numbers, <b>Axiom of Choice, Zorn's Lemma, well-Ordering Theorem:</b> Cartesian product and choice function, Axiom of choice, Well-Ordering theorem and Zorn's Lemma.	<b>Presentation</b>
	FINAL EXAM	