



ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. Hons. Mathematics						
Semester	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4th		Ring theory and linear algebra 1	5			6
Teacher/Instructor(s)		NEERAJ SAINI				
Session		2021				

Course Objectives: The objective of this course is to introduce the fundamental theory of two objects, namely - rings and vector spaces, and their corresponding Homomorphism.

Course Learning Outcomes: The course will enable the students to:

- i) Learn about the fundamental concept of rings, integral domains and fields.
- ii) Know about ring homomorphisms and isomorphisms theorems of rings.
- iii) Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
- iv) Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation, and the change of coordinate matrix.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.		1-2	Definition and examples of rings
		3-5	Properties of rings, Subrings.
		6-9	Integral domains and fields, Characteristic of a ring.
		10-15	Ideals, Ideal generated by a subset of a ring, Factor rings, Operations on ideals,
		16-20	Prime and maximal ideals.
		21-25	Ring homomorphisms, Properties of ring homomorphisms

		26-30	First, Second and Third Isomorphism theorems for rings, The field of quotients.
2		31-35	Vector spaces, Subspaces, Algebra of subspaces.
		34-37	Linear combination of vectors, Linear span
		38-40	Linear independence.
		41-45	Bases and dimension
		46-50	Dimension of subspaces.
		3-	
56-65	Matrix representation of a linear transformation, Algebra of linear transformations.		
66-70	Isomorphisms, Isomorphism theorems, Invertibility and the change of coordinate matrix.		

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		
	• Attendance		
	• Assignment		
2.	End Semester Examination	3 hr	75

Details of the Course

Unit	Contents	Contact Hours

1	Sample space, Events, Probability Classical, Relative frequency and axiomatic approaches to probability, Theorems of total and compound probability; Conditional probability, Independent events, Baye's Theorem; Random variables (discrete and continuous), Probability distribution, Expectation of a random variable, Moments, Moment generating functions.	25
2	Discrete and continuous distribution, Binomial, Poisson, Geometric, Normal and exponential distributions, Bivariate distribution, Conditional distribution and marginal distribution, Covariance, Correlation and regression for two variables, Weak law of large numbers and central limit theorem for independent and identically distributed random variables.	20
3	Statistical inference: Definitions of random sample, Parameter and statistic, Sampling distribution of mean, Standard error of sample mean; Mean, variance of random sample from a normal population; Mean, variance of random sample from a finite population; Chi-square distribution, F distribution and t distribution, Test of hypotheses based on a single sample.	25
	Total	70

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1-	Gallian, Joseph. A. <i>Contemporary Abstract Algebra</i> (8th ed.). Cengage Learning India Private Limited. Delhi. Fourth impression,.	(2013). 2015
2-	Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. <i>Linear Algebra</i> (4th ed.). Prentice-Hall of India Pvt. Ltd. New Delhi.	(2003).
3-	Dummit, David S., & Foote, Richard M. <i>Abstract Algebra</i> (3rd ed.). Student Edition. Wiley India.	. (2016).

4-	Herstein, I. N. <i>Topics in Algebra</i> (2nd ed.). Wiley Student Edition. India.	(2006).
5-	Hoffman, Kenneth, & Kunze, Ray Alden <i>Linear Algebra</i> (2nd ed.). Prentice-Hall of India Pvt. Limited. Delhi. Pearson Education India Reprint,	(1978). 2015
Mode of Evaluation:		Internal Assessment / End Semester Exam

Facilitating the achievement of Course Learning Outcomes

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1.	Learn about the fundamental concept of rings, integral domains and fields.	(i) Each topic to be explained with examples.	<ul style="list-style-type: none"> • Presentations and participation in discussions. • Assignments and class tests. • Mid-term examinations. • End-term examinations.
2.	Know about ring homomorphisms and isomorphisms theorems of rings.	(ii) Students to be involved in discussions and encouraged to ask questions.	
3.	Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.	(iii) Students to be given homework/assignments.	
4.	Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation, and the change of coordinate matrix.	(iv) Students to be encouraged to give short presentations.	

Keywords: Basis and dimension of a vector space, Characteristic of a ring, Integral domain, Isomorphism theorems for rings, Linear transformations, Prime and maximal ideals, Quotient field, Vector space.

