

Department of Mathematical Sciences

Syllabus for Multi-Disciplinary Courses (MDC) offered by the Mathematical Sciences Department

Offered Courses:

Course Code	Course Name	L-T-P	CH	CR	Remark
MSMD 101	Basic Algebra	2-1-0	3	3	
MSMD 102		2-1-0	3	3	

MSMD: Multi-Disciplinary courses offered by the Department of Mathematical Sciences
L: Lectures T: Tutorials P: Practical CH: Contact Hours (all per week) CR: Credit

MSMD 101 Basic Algebra

(L2 -T1 -P0 -CH 3 -CR 3)

Unit-1

Group, subgroup, cyclic group, Symmetric group, Alternating group, Dihedral group, coset, Lagrange's theorem, normal subgroup and quotient group.

Unit-2

Homomorphism and isomorphism of groups, kernel of a homomorphism, isomorphism theorems, Cayley's theorem, Permutation groups as matrices.

Unit-3

Vector space, subspace, linear independence and dependence of vectors, basis and dimension, quotient space.

Unit-4

Linear transformation, range and kernel, rank and nullity, rank-nullity theorem, matrix associated with a linear transformation, eigenvalues and eigenvectors, Cayley-Hamilton theorem.

Textbook(s)

1. Gallian, J. A., *Contemporary Abstract Algebra*, 4th edition (Narosa Publishing house, New Delhi, 2009).
2. Dummit, D. S. & Foote, R. M., *Abstract Algebra*, 3rd edition (John Wiley & Sons, Indian reprint, New Delhi, 2011).

Reference book(s)

1. Fraleigh, J. B. *A First Course in Abstract Algebra*, 7th edition (Pearson Education India, New Delhi, 2008).
2. Bhattacharya, P. B., Jain, S. K. & Nagpaul, S. R. *Basic Abstract Algebra*, 2nd edition (Cambridge University Press, Cambridge, UK, 1994).
3. Herstein, I. N., *Topics in Algebra*, 2nd edition (John Wiley & Sons, Indian reprint, New Delhi, 2006).

Unit-1

Random experiment, sample space, event, event space, definition of Probability, Independence of Events, Conditional Probability and Bayes Theorem, random variable on a probability space, distribution function and its properties.

Unit-2

Discrete and continuous distribution, Definition of probability density function, probability mass function, Quantile or percentile of a probability distribution, Some important continuous and discrete distributions, Jordan decomposition of a distribution function.

Unit-3

Expectation and moments of a random variable/probability distribution. Properties of expectation and variance, Computation of moments of some important distributions, Examples of distributions with only finitely many moments, Definition and properties of moment generating function and applications, Definition and examples of heavy tailed distributions, Bivariate distribution and covariance of two random variables.

Unit-4

Weak convergence of a sequence of random variable, Definition and examples, Approximation of Binomial (n, p) distribution by Poisson distribution for large n and small p , Approximation of Student's-t distribution with n degrees of freedom by standard normal distribution for large n .

Unit-5

Central limit theorem statement (Approximation of distribution of standardized and studentized sample mean based on data from any distribution with finite variance) and its application, Distribution of sample extremes (statements of theorems only).

Textbook(s)

1. Feller, W. An introduction to Probability Theory and Its Applications, Vol. 1, 3rd Edition (Wiley Series in Probability and Statistics) January 1991.
2. Feller, W. An introduction to Probability Theory and Its Applications, Vol. 2, 2nd Edition (Wiley Series in Probability and Statistics) Paperback – 1 January 1971.
3. Rohtagi, V.K. and Saleh A.K.Md.E. (2015). An Introduction to Probability and Statistics. Third Edition. John Willey and Sons.

Reference book(s)

1. Wasserman, L. All of Statistics (A Concise Course in Statistical Inference). Springer Texts in Statistics 2004.
2. Sheldon Ross Introduction to Probability and Statistics for Engineers and Scientists. Fifth Edition. Elsevier 2014.