CORE COURSES OFFERED BY DEPT. OF MATHEMATICS

BMA23205T	FINITE DIFFERENCES AND VECTOR CALCULUS	L	T	P	C
		4	0	0	4

Pre-requisite: Knowledge of polynomial and vector algebra

Course Objectives:

- To understand the importance of error analysis and their propagation and techniques of interpolation and polynomial fitting.
- To understand methods too numerical differentiation and integration
- To understand vector field and the derivatives of vector-valued functions
- To explain the concept of integration of vector functions

Course Outcome:

After successful completion of the course, the students will learn to

CO 1: calculate errors induced in the values by truncation of a series expansion.

CO 2: fit polynomials to a given set of data points.

CO 3: determine the derivatives of a vector-valued functions and apply those in physical problems

CO 4: evaluate vector integration a plane and in space

Module 1: Error Approximation and Interpolation — **15 hours**

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation; Finite differences, Newton's forward and backward interpolation formulae, Central difference interpolation formulae, Gauss's forward and backward interpolation formulae, Newton's divided difference formula, Inverse interpolation.

Module 2: Numerical Differentiation and Integration — **15 hours**

Numerical differentiation: Derivatives using Newton's forward interpolation formula, Derivatives using Newton's backward interpolation formula; Numerical Integration: Quadrature formula, Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpsons 3/8th rule, Errors in Quadrature formulae.

Module 4: Vector Differentiation — **15 hours**

Review of vectors: Vector function of scalar variables, Differentiation of vector functions, Partial derivatives of vector functions, Application to mechanics, Gradient, Divergence and Curl and their properties, Directional derivatives, Tangent plane and normal line to a surface

Module 5: Vector Integration — **15 hours**

Ordinary integration of vector functions, Vector line integrals, Vector surface integrals, Volume integrals, Green's theorem in the plane, Stokes' Theorem, The Divergence theorem of Gauss.

Total hours — **60 hours**

Text Book

1. Gerald C. F , Wheatly P. O., *Applied Numerical Analysis*, Pearson, 2008
2. Jain M. K., Iyenga S. R. K. r, Jain R.K., *Numerical Methods for Scientific and Engineering Computation*, New Age International, 2005
3. Spiegel Murray R, *Vector Analysis*, Schaum Outline Series, McGraw Hill, 1959 (E-Book)

Reference Book(s)

1. Grewal B. S., *Numerical Methods in Engineering and Science*, Khanna Publishers, 2014
2. Corral M. and Petrunin A., *Vector Calculus*, Anton Petrunin (E-book), 2016

CORE COURSES OFFERED BY DEPT. OF MATHEMATICS

BMA23206T	ANALYTICAL GEOMETRY	L	T	P	C
		4	0	0	4

Pre-requisite: Knowledge of Algebra, Trigonometry, Plane and Solid Geometry

Course Objectives:

- To introduce the basic concepts in analytic geometry, lines, circles, and other conic sections; transformation of axes; polar coordinates in two dimensional coordinate systems
- To understand the concept of three dimensional coordinates systems

Course Outcome:

After successful completion of the course, the students will be able to

CO 1: understand the characteristics and properties of two- and three-dimensional geometric shapes.

CO 2: understand conic sections and transformation of co-ordinate systems

CO 3: apply the geometric properties to solve real world problems

Module1: Analytical geometry of two dimensions — **30 Hours**

Transformation of rectangular axes. Pair of straight lines: Pair of straight lines though origin, Angle and Bisectors of the angle between the lines given by homogenous equation of 2nd degree, Condition for the general equation of second degree to represent a pair of straight lines, Pair of intersecting straight lines, Pair of parallel straight lines; General equation of second degree and its reduction to normal form. Systems of conies. Polar equation of a conic.

Module2: Analytical geometry of three dimensions — **30 Hours**

Direction cosines. Straight line. Plane. Sphere. Cone, Cylinder, Central conicoids, paraboloids, ellipsoid, hyperboloid, plane sections of conicoids; Generating lines. Reduction of second degree equations to normal form; classification of quadrics.

Total Lecture hours — **60 Hours**

Text Book(s)

1. Siceloff L. P., Wentworth G., Smith D. e., Analytic Geometry, The Athenaeum Press, Ginn and Company, 1922
2. Khan R. M., *Analytical Geometry of two and three dimension and vector analysis*, New Central Book Agency (2012)/(EBook)
3. Narayan S., Mittal P.K., Analytical Solid Geometry, S. Chand & Co. Ltd, New Delhi (EBook)

Reference Books

1. Bell R. J. T., Coordinate Solid Geometry, Macmillan (1983)
2. Chakravorty J.G., Analytical Geometry & Vector Analysis, UBS Publishers' Distributors (p) Ltd(1973)
3. Loney S. L., Elementary Coordinate Geometry (EBook)

CORE COURSES OFFERED BY DEPT. OF MATHEMATICS

BMA23207T	RING THEORY	L	T	P	C
		3	1	0	4

Pre-requisite: Knowledge of Group Theory

Course Objectives:

- To introduce the fundamental theory of rings and other related substructures.
- To introduce the concept of homomorphism of ring.

Course Outcome:

After successful completion of the course, the students will be able to

CO 1: understand and demonstrate the knowledge of rings, fields, ideals and their properties.

CO 2: apply fundamental results and solve algebraic problems using appropriate techniques.

CO 3: understand the ring homomorphisms and isomorphisms theorems of rings.

Module1:Rings — **22Hours**

Rings, Properties of Rings, Subrings, Zero divisors, units, Integral Domains, Division rings, Fields, Characteristic of a Ring.

Module2: Ideals — **20Hours**

Ideals, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Module3: Ring Homomorphism — **18Hours**

Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of Quotients.

Total Lecture hours — **60Hours**

Text Book(s)

1. Gallian, J. A. (2013), *Contemporary Abstract Algebra* (8th Ed.) Cengage Learning India Private Limited, Delhi. Fourth impression, 2015.

Reference Books

1. Fraleigh John B., *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. Singh, S. and Zameeruddin Q., *Modern Algebra*, 8thEd.Vikash Publishing House Pvt. Ltd. 2015.
3. Bhattacharya P.B., Jain S.K., Nagpaul S. R., *Basic Abstract Algebra*, (Ebook, 2nd Ed), Cambridge University Press, (2009)
4. Herstein I. S., *Topics in Algebra* (Ebook, 2nd Ed), John Wiley & Sons, 1975

CORE COURSES OFFERED BY DEPT. OF MATHEMATICS

BMA23222T	INTRODUCTION TO STATISTICS	L	T	P	C
		4	0	0	4

Pre-requisite: Basic calculus and Linear Algebra

Course Objectives

- To provide an overview of statistics to the students
- To render the students to several examples and exercises that blends their everyday experiences with their scientific interests.

Course Outcome

After successful completion of this course, the students will be able to

CO1: measure the scale of association between two variables, and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.

CO2: understand the concepts of population and sample and various tests associated with them.

CO3: apply statistical methods for analyzing experimental data

Module 1: Basic Statistics	**15 hours**

Measures of Central tendency: Mean, Median, Mode and Range; Measures of Dispersion, Moments, Skewness and Kurtosis

Module 2: Correlation	**15 hours**

Definition, Scatter or Dot Diagram, Karl Pearson's Co-efficient of correlation, Rank correlation for non repeated and repeated ranks.

Module 3: Regression	**15 hours**

Definition, Lines of regression, Regression coefficients and their properties, Angle between two lines of regression, Curve fitting by the method of least squares- fitting of straight lines

Module 4: Descriptive Statistics	**15 hours**

Population, Sampling, Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chi- square test for goodness of fit and independence of attributes

Total Lecture hours	**60 hours**

Text Book(s)

1	Hogg R.V., McKean J. W., & Craig, A. T., Introduction to Mathematical Statistics (7th ed.). Pearson Education, Inc., 2013
2	Miller I., & Miller M., John E. Freund's Mathematical Statistics with Applications (8th ed.). Pearson, Dorling Kindersley (India), 2014

Reference Book(s)

1	Mood, A. M., Graybill, F. A. & Boes, D. C., Introduction to the Theory of Statistics (3rd ed.). McGraw-Hill Education Pvt. Ltd. Indian Edition, 2017.
2	Garg R., Engineering Mathematics, Khanna Book Publishing Company, 2022.

CORE COURSES OFFERED BY DEPT. OF MATHEMATICS

BMA23223T	DISCRETE MATHEMATICS	L	T	P	C
		4	0	0	4

Pre-requisite: Knowledge of Mathematics at Class XI & XII

Course Objectives:

- To introduce the concepts Boolean Algebra, lattices and graphs.
- To enable students to solve equations using theorems and techniques of number theory.

Course Outcome:

After successful completion of the course, the students will be able to

CO1: learn about lattices, modular and distributive lattices, sublattices and homomorphisms between lattices.

CO 2: understand Boolean algebra, Boolean homomorphism.

CO3: apply techniques of counting and number theory to solve various numerical equations.

CO4: attain a basic idea about graphs.

Module1:Permutation and Combination — **15Hours**

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and Combination. The Division algorithm: Prime Numbers, The Greatest Common Divisor, Euclidean Algorithm, The Fundamental Theorem of Arithmetic

Module2:Numbers — **15Hours**

Linear Diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues, Chinese Remainder theorem, Fermat's Little theorem, Wilson's theorem.

Module3: Boolean Algebra — **15Hours**

Boolean Algebras, De Morgan's laws, Boolean homomorphism, Representation theorem; Boolean polynomials, Boolean polynomial functions, Disjunctive normal form and conjunctive normal form, Minimal forms of Boolean polynomial.

Module4: Graph — **5Hours**

Graph: Basic terminologies, types of graphs. Degree of a vertex. Paths and circuits, trees, Eulerian and Hamiltonian graph.

Module 5:Lattice — **10 Hours**

Lattices as ordered sets, Lattices as algebraic structures, Sublattices, Products and homomorphisms; Definitions, Examples and properties of modular and distributive lattices, The M3 – N5 Theorem with applications, Complemented lattice, relatively complemented lattice, Sectionally complemented lattice. homomorphisms.

Total Lecture hours — **60Hours**

TextBook(s)

1. Davey, B. A., & Priestley, H. A. (2002). *Introduction to Lattices and Order* (2nd ed.). Cambridge University press, Cambridge
2. Goodaire, Edgar G., & Parmenter, Michael M. (2011). *Discrete Mathematics with Graph Theory (3rd ed.)*. Pearson Education (Singapore) Pvt. Ltd. Indian Reprint
3. Sarkar, S. K., *A Textbook of Discrete Mathematics*, S Chand and Company Ltd. Ram Nagar, New Delhi – 110055.

Reference Books

1. Biggs, Norman L., *Discrete Mathematics*, 2nd Edition, Oxford University Press.