Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES AND COMMERCE

Autonomous College

Affiliated to Osmania University

Accredited with 'A' grade by NAAC

B.Sc. MATHEMATICS Course Structure

(w.e.f. Academic Year 2020-21)

Paper	Semester	Subject	Hours/ per week	Hours/per week		Max. Marks	Credits
				Theory	*Tutorials		
MT121	I	Differential & Integral Calculus	6	5	1	100	5
MT 221	II	Differential Equations	6	5	1	100	5
MT321	III	Real Analysis	6	5	1	100	5
MT421	IV	Algebra	6	5	1	100	5
MT521	V	Linear Algebra	6	5	1	100	5
MT621A	VI	Numerical Analysis	6	5	1	100	5
MT621B	VI	Integral Transforms	6	5	1	100	5
MT621C	VI	Analytical Solid Geometry	6	5	1	100	5
SEC-I SE321	III	Theory of Equations	2	2	-	50	2
SEC-II SE321A	III	Logic & Sets	2	2	-	50	2
SEC-III SE421	IV	Number Theory	2	2	-	50	2
SEC-IV SE421A	IV	Vector Calculus	2	2	-	50	2
Generic Elective GE521	V	Basic Mathematics	4	4	-	100	4
Generic Elective GE521A	V	Mathematics for Economics and Finance	4	4	-	100	4
Project/ Optional MT621_O	VI	Project/Mathematical Modelling	4	4	-	100	4

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B.Sc. MATHEMATICS I YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
SEMESTER-I
(75Hrs)
(w.e.f 2020-21)

Course Name: Differential and Integral Calculus **HPW: 5L + 1T**
Course Code: MT121 **Credits: 5**

Course Objective: The course is aimed at exposing the students to some basic notions in differential calculus and Integral Calculus.

COb1: Apply a range of techniques to solve first & second order partial differentials.

COb2: Construct mathematical expressions involving functions and their derivatives, compute mathematical quantities using differential calculus.

COb3: To acquire knowledge about Curvature and Evolutes.

COb4: Apply calculus concepts to solve problems in Volume and Surfaces of revolution.

Unit- I Partial Differentiation(20Hrs)

Introduction, Functions of two variables, Neighbourhood of a point (a, b), Continuity of a Function of two variables, Continuity at a point - Limit of a Function of two variables, Partial Derivatives, Geometrical representation of a Function of two Variables, Homogeneous Functions.

Unit- II Partial Differentiation and its Applications(20Hrs)

Theorem on Total Differentials, Composite Functions, Differentiation of Composite Functions, Implicit Functions, Equality of $f_{xy}(a, b)$ and $f_{yz}(a, b)$,Taylor's theorem for a function of two Variables,Maxima and Minima of functions of two variables, Lagrange's Method of undetermined multipliers.

Unit- III Curvature and Evolutes(20Hrs)

Introduction, Definition of Curvature, Radius of Curvature, Length of Arc as a Function, Derivative of arc, Radius of Curvature, Cartesian Equations, Newtonian Method,Centre of Curvature,Chord of Curvature.
Evolutes: Evolutes and Involutes, Properties of the evolute. Envelopes: One Parameter Family of Curves, Consider the family of straight lines, Definition, Determination of Envelope.

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Unit- IV Lengths of Plane Curves(15Hrs)

Lengths of Plane Curves: Introduction ,Expression for the lengths of curves $y = f(x)$, Expressions for the length of arcs $x = f(y)$; $x = f(t)$, $y = \phi(t)$; $r = f(\theta)$.
Volumes and Surfaces of Revolution: Introduction, Expression for the volume obtained by revolving about either axis, Expression for the volume obtained by revolving about any line, Area of the surface of the frustum of a cone ,Expression for the surface of revolution ,Pappus Theorems,Surface of revolution.

Prescribed Text Books:

1. *"Differential Calculus"* Shanti Narayan & P.K. Mittal, S. CHAND, 15th Edition
   Unit1-Chapter:11[11.1 to 11.8]
   Unit2-Chapter:11[11.9 to 11.11], Chapter-9 [9.6.&9.7]
   Unit3-Chapter:14[14.1 to 14.8], Chapter -18[18.1 to 18.4]
2. *"Integral Calculus"*, Shanti Narayan, S. CHAND, 11th Edition
   Unit 4- Chapter:9[9.1,9.2 & 9.3]; 10[10.1,10.2,10.3,10.5 & 10.6]

Reference Books:

1. William Anthony Granville, Percey F Smith and William Raymond Longley; Elements of the differential and integral calculus
2. Joseph Edwards, Differential calculus for beginners
3. Smith and Minton, Calculus
4. Elis Pine, How to Enjoy Calculus
5. Hari Kishan, Differential Calculus

Course Outcomes:
Students will be able to:
CO1: Evaluate partial derivatives and solve problems related to Homogeneous Functions.

CO2: Calculate Total Differentials, differentiation of Composite Functions and Maxima and Minima of functions of two variables.

CO3: Compute Curvature and Evolutes.

CO4: Determine Lengths of Plane Curves, Volumes and Surfaces of Revolution.

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B.Sc. MATHEMATICS I YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
SEMESTER-II
(75Hrs)
(w.e.f 2020-21)

Course Name: Differential Equations **HPW: 5L + 1T**
Course Code: MT221 **Credits: 5**

Course Objectives: This course is aimed at familiarising students with differential equations.

COb1: To identify and learn the first-order ODEs, methods of integrating factors and linear differential equations.

COb2: To acquire knowledge of solving Differential Equations first order but not of first degree.

COb3: To find the general solution of Higher order linear differential equations with constant coefficients.

COb4: To find the general solution of Higher order linear differential equations with nonconstant coefficients and Partial differential equations.

Unit- I Differential Equations of First Order and First Degree (25Hrs)

Introduction, Equations in which Variables are Separable, Homogeneous Differential Equations, Differential Equations Reducible to Homogeneous Form, Linear Differential Equations, Differential Equations Reducible to Linear Form, Exact differential equations, Integrating Factors, Change in variables, Total Differential Equations, Simultaneous Total Differential Equations, Equations of the form $dx/P = dy/Q = dz/R$.

Unit- II Differential Equations First Order but not of First Degree(20Hrs)

Equations Solvable for p Equations Solvable for y, Equations Solvable for x, Equations that do not contain x (or y) Equations Homogeneous in x and y, Equations of the First Degree in x and y, Clairaut's equation.
Applications of First Order Differential Equations: Growth and Decay, Dynamics of Tumour Growth, Radioactivity and Carbon Dating, Compound Interest, Orthogonal Trajectories.

Unit- III Higher order Linear Differential Equation-I (15Hrs)

Solution of homogeneous linear differential equations with constant coefficients, Solution of non-homogeneous differential equations $P(D)y = Q(x)$ with constant coefficients by means of

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polynomial operators when $Q(x) = be^{ax}$, bsinax ,bcosax , x^k, xv , ve^{ax}, Method of undetermined coefficients.

Unit- IV Higher order Linear Differential Equation-II & Partial Differential Equations (15Hrs)

Method of variation of parameters, Linear differential equations with non- constant coefficients The Cauchy-Euler Equation, Legendre's Linear Equations, Miscellaneous Differential Equations.
Partial Differential Equations: Formation and solution, Equations easily integrable, Linear equations of first order.

Prescribed Text Book:

1. *"Differential Equations and Their Applications"*, Zafar Ahsan, Prentice Hall of India Learning Pvt .Ltd, 3rd Edition, 2016.
   Unit 1- Chapters:2[2.1 to 2.12]
   Unit 2- Chapters:3[3.1&3.2]; 4[4.1 to 4.4 &4.20]
   Unit 3-Chapters:5[5.1 to 5.4]
   Unit 4-Chapters:5[5.5 to 5.8]; 9[9.1 to 9.4]

Reference Books:

1. Frank Ayres Jr, Theory and Problems of Differential Equations.
2. Ford, L.R ; Differential Equations.
3. Daniel Murray, Differential Equations.
4. S. Bala Chandra Rao, Differential Equations with Applications and Programs.
5. Stuart P Hastings, J Bryce McLead; Classical Methods in Ordinary Differential Equations.

Course Outcomes:
Students will be able to:
CO1: Solve Differential equations of first order and first degree.

CO2: Calculate solutions of Differential Equations of first order but not of first degree and interpret applications of Differential Equations of first order & first degree.

CO3: Evaluate general solution of Higher order linear differential equations with constant coefficients.

CO4: Evaluate general solution of Higher order linear differential equations with nonconstant coefficients and formulate Partial Differential equations.

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B.Sc. MATHEMATICS II YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
SEMESTER-III
(75Hrs)
(w.e.f 2021-22 for the students admitted from the year 20-21)

Course Name: Real Analysis **HPW: 5L + 1T**
Course Code: MT321 **Credits: 5**

Course Objectives: This course is aimed at familiarising students with concepts of Real Analysis.

COb1: To learn basic properties of Sequences of Real numbers and their limits.

COb2: To acquire knowledge about Continuity and Limits of Real functions.

COb3: To explain the concepts of Derivatives of a Real function.

Cob4: To analyse concepts of Riemann Integration.

Unit- I Sequence and series (25Hrs)

Sequences: Limits of Sequences- A Discussion about Proofs-Limit Theorems for Sequences, Monotone Sequences and Cauchy Sequences , Subsequences, Lim sup's and Lim inf's, Alternating Series and Integral Tests.

Unit- II Continuity (15Hrs)

Continuity: Continuous Functions ,Properties of Continuous Functions ,Uniform Continuity -Limits of Functions.

Unit- III Differentiation (20Hrs)

Differentiation: Basic Properties of the Derivative , The Mean Value Theorem - * L'Hospital Rule ,Taylor's Theorem.

Unit- IV Integration (15Hrs)

Integration: The Riemann Integral - Properties of Riemann Integral (Theorems without proof),Fundamental Theorem of Calculus.

Prescribed Text Book:

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Kenneth A Ross, Elementary Analysis –The Theory of Calculus, 2nd Edition, Springer Publishers

Unit 1-Chapters: 2[7,8,9(without proofs),10.1 to 10.11{10.4 to 10.7(without proofs)}, 11.1 to 11.8(11.2 without proofs),12(without proofs),14,15]

Unit 2- Chapters: 3[17.1,17.2,17.3 to 17.5(without proofs),18.1 to 18.6(18.1,18.3,&18.6 without proofs),19.1 to 19.5, 20.1 to 20.10(20.4 &20.5without proofs)]

Unit 3- Chapters:5[28.1,28.2, 29.1,29.2,29.3,29.4 to 29.8(without proofs),30.1, 30.2(without proofs),31.1 to 31.6]

Unit 4- Chapters:6[32.1 to 32.9, 33.1,33.2,33.5,33.7, 34.1]

Reference Text Book:

1. Introduction to Real Analysis by Robert G. Bartle& Donald R. Sherbert, John Wiley & Sons, Inc.(Third Edition)
2. A course of Real Analysis by Shanti Narayanan & PK Mittal.
3. William .F. Trench , Introduction to Real Analysis.
4. Lee Larson, Introduction Real Analysis.

Course Outcomes:

After completion of course students will be able to:

CO1: Interpret properties of Sequences of Real numbers.

CO2: Analyse Continuity and Uniform continuity of Real functions and evaluate their Limits

CO3: Interpret the concept of Derivability of Real functions.

CO4: Summarise and synthesise the concepts Riemann Integration.

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B.Sc. MATHEMATICS II YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
SEMESTER-IV
(75Hrs)
(w.e.f 2021-22 for the students admitted from the year 20-21)

HPW: 5L + 1T
Credits: 5

Course Name: Algebra
Course Code: MT421

Course Objectives:

This course is aimed at familiarising students with concepts in Abstract Algebra

COb1: To learn basic algebraic structures like groups.

COb2: To acquire knowledge about Permutation Groups and Factor groups.

COb3: To explain the concepts of Homomorphisms, Isomorphism and Rings.

COb4: To analyse various concepts of Rings and Fields.

UNIT-I GROUPS-I(20Hrs)

Groups: Definition and Examples of Groups, Elementary Properties of Groups, Finite Groups Subgroups -Terminology and Notation, Subgroup Tests, Examples of Subgroups.Cyclic Groups: Properties of Cyclic Groups, Classification of Subgroups Cyclic Groups.

UNIT-II GROUPS-II (20Hrs)

Permutation Groups: Definition and Notation, Cycle Notation, Properties of Permutations, A Check Digit Scheme Based on D5.Cosets and Lagrange's Theorem: Properties of Cosets, Lagrange's Theorem and Consequences, An Application of Cosets to Permutation Groups, The Rotation Group of a Cube and a Soccer Ball.Normal Subgroups and Factor Groups: Normal Subgroups, Factor Groups, Applications of Factor Groups

UNIT- III: GROUPS III & RINGS I(20Hrs)

Group Homomorphisms: Definition and Examples, Properties of Homomorphisms, The First Isomorphism Theorem, Cayley's Theorem Isomorphisms, Automorphisms
Introduction to Rings: Motivation and Definition, Examples of Rings, Properties of Rings, Subrings

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UNIT- IV: RINGS II (15Hrs)

Integral Domains: Definition and Examples , Fields ,Characteristics of a Ring.
Ideals and Factor Rings: Ideals , Factor Rings , Prime Ideals and Maximal Ideals.
Ring Homomorphisms: Definition and Examples, Properties of Ring, Homomorphisms.

Prescribed Text Book:

"Contemporary Abstract Algebra", Joseph A Gallian, Cengage learning publishers, 9th edition.

Unit 1-Chapters: 2, 3 & 4
Unit 2-Chapters: 5, 7 & 9
Unit 3-Chapters: 10, 6 &12
Unit 4-Chapters: 13,14 &15

Reference Books:

1. B.S.c Second Year Mathematics, Algebra, SEM IV Telugu Academy, Edition2021.
2. A First Course in Abstract Algebra, Fraleigh J.B, Pearson publications,7th Edition.
3. Topics in Algebra, Herstein , I.N, Wiley India Pvt. Limited, 2nd Edition.
4. Basic Abstract Algebra, Robert B. Ash, Dover Publications, 1st Edition.
5. Finite Group Theory, I Martin Isaacs, American Mathematical Soc., 1st Edition.
6. Advanced Modern Algebra, Joseph J Rotman, American Mathematical Soc ,2nd Edition.
7. Basic Abstract Algebra, Bhattacharya, P.B Jain, S.K; and Nagpaul, S.R, Cambridge University Press, 2nd Edition.

Course Outcomes:

After completion of course students will be able to

CO1: Interpret properties of basic Algebraic structures.

CO2: Compute and calculate permutations and factor groups

CO3: Evaluate Homomorphisms , Isomorphism and Rings.

CO4: Summarise and synthesise the concepts in Ring Theory

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B.Sc. MATHEMATICS II YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
Skill Enhancement Course-I
SEMESTER-III
(30Hrs)
(w.e.f. 2021-22 for the students admitted from the year 20-21)

Course Name: Theory of Equations **HPW:2L**
Course Code: SE321 **Credits: 2**

Course Objective: To familiarize the concept of Polynomial equation and its roots.

COb1: To learn the concepts of finding the roots of the polynomial equations and Descarte's rule of signs in finding the number of positive and negative roots of a polynomial equation.

COb2: To acquire knowledge about relation between roots and coefficients of a polynomial equation and find Symmetric functions of the root.

UNIT I (15 Hrs)

Graphic representation of a polynomial, Maxima and minima of polynomials, Theorems relating to the real roots of equations, Existence of a root in the general equation, Imaginary roots, Theorem determining the number of roots of an equation, Equal roots, Imaginary roots enter equation in pairs, Descartes' rule of signs for positive roots- Descartes' rule of signs for negative roots.

UNIT II (15 Hrs)

Relations between the roots and coefficients, Theorem, Application of the Theorem, Depression of an equation when a relation exists between two of its roots, The cube roots of unity, Symmetric Functions of the roots, Examples.

Prescribed Book:

"*The Theory of Equations*", W.S Burnside and A.W. Panton, Ponsonby & Gibbs, University Press, Dublin. 8th Edition.
UNIT1- Chapter:1[10,11], 2[12 to 20]
UNIT2- Chapter:3[23 to 27]

Reference Books:

1. C.C. Mac Duffee, *Theory of Equations*
2. Hall and Knight , *Higher Algebra*

Course Outcomes:

At the end of the course Students will be able to:

CO1: Compute the roots of the polynomial equations.

CO2: Interpret relation between roots and coefficients of a polynomial equation and evaluate Symmetric functions of the root.

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B.Sc. MATHEMATICS II YEAR

Programme Name - B Sc (MECs, MPCs, MSCs)

Skill Enhancement Course-II

SEMESTER-III

(30Hrs)

(w.e.f. 2021-22 for the students admitted from the year 20-21)

Course Name: Logic and Sets **HPW:2L**
Course Code: SE321A **Credits: 2**

Course Objective: To familiarize the concept of Logic and Sets theory.

COb1: To learn the concepts in logic, Determine the truth value of a statement.

COb2: To acquire knowledge about the basic concepts of set theory and probability.

UNIT I (15 Hrs)

Basic connectives and truth tables, logical equivalence: Laws of logic, Rules of inference, The use of quantifiers, Quantifiers, Definitions and proofs of theorems.

UNIT II (15 Hrs)

Sets and subsets, set operations and the laws of set theory, Counting and Venn diagrams, The axioms of probability, Conditional probability, independence, Discrete Random Variables.

Prescribed Books:

1. *"Discrete and Combinatorial Mathematics"*,Ralph P Grimaldi , 5th edition
   Unit-I: Chapter2[2.1, 2.2, 2.3, 2.4, 2.5]
   Unit-II:Chapter3[3.1, 3.2, 3.3, 3.5, 3.6, 3.7]

2. *"Discrete mathematics for computer scientists and Mathematicians"*, Joe L. Mott, Abraham Kendel, Prentice Hall of India.

Reference Books:

1. Seymour Lipschutz, Marc Lars Lipson, Discrete Mathematics, Tata McGraw-Hill.
2. Kenneth H. Rosen: Discrete Mathematics, Mc Graw Hill Editions.

Course Outcomes:

At the end of the course Students will be able to:

CO1: Compute logical reasoning to solve a variety of problems.

CO2: Evaluate the operations on sets, represent sets in Venn diagrams and compute problems in Probability.

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B.Sc. MATHEMATICS II YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
Skill Enhancement Course-III
SEMESTER-IV
(30Hrs)
(w.e.f. 2021-22 for the students admitted from the year 20-21)

Course Name: Number Theory **HPW :2L**
Course Code: SE421 **Credits: 2**

Course Objective: The course is aimed at familiarising students with the properties of number theory and their uses.

COb1. To learn concepts related to properties of congruences.

COb2. To acquire knowledge about Fermat's Theorem, Euler's Phi function.

Unit- I (15Hrs)

The Goldbach conjecture, Basic properties of congruences, Binary and Decimal Representation of integers, Number Theoretic Functions, The Sum and Number of divisors, The Mobius Inversion Formula, The Greatest integer function.

Unit- II (15Hrs)

Euler's generalization of Fermat's Theorem, Euler's Phi function, Euler's theorem, Some Properties of the Euler's Phi function.

Prescribed Books:

- *"Elementary Number Theory"* David M Burton, 7th Edition
  Unit I 3.5, 4.2, 4.3,6.1, 6.2, 6.3
  Unit II 7.2, 7.3, 7.4

References Books:

- Thomas Koshy, *Elementary Number Theory and its Applications*
- Kenneth H Rosen, *Elementary Number Theory*

Course Outcomes:

At the end of the course Students will be able to:

CO1: Summarise about properties of Number Theoretic Functions.

CO2: Interpret the results of Fermat's Theorem, Euler's Phi function

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Programme Name - B Sc (MECs, MPCs, MSCs)
Skill Enhancement Course-III
SEMESTER-IV
(30Hrs)
(w.e.f. 2021-22 for the students admitted from the year 20-21)

Course Name: Vector Calculus **HPW :2L**
Course Code: SE421A **Credits: 2**

Course objectives: To familiarize the concepts like Gradient, Divergence, Curl and their physical relevance.

COb1: To learn Line integral and surface integral concepts.

COb2: To acquire knowledge about Volume Integral, Gradient, Divergence and Curl.

Unit- I (15Hrs)

Line Integrals: Introductory Example, Work done against a Force,Evaluation of Line Integrals Conservative Vector Fields.

Surface Integrals: Introductory Example, Flow Through a PipeEvaluation of Surface Integrals.

Unit- II (15Hrs)

Volume Integrals: Evaluation of Volume integrals

Gradient, Divergence and Curl: Partial differentiation and Taylor series, Partial differentiation Taylor series in more than one variable, Gradient of a scalar field, Gradients, conservative fields and potentials,Physical applications of the gradient.

Prescribed Books:

- " *Vector Calculus",* P.C. Matthews,

  Unit 1-Chapter :2[2.2.1, 2.2.2, 2.2.3, 2.3.1 & 2.3.2]

  Unit 2-Chapter: 2[2.4.2]; 3[3.1& 3.2]

References Books:

- G.B. Thomas and R.L. Finney, *Calculus*
- H. Anton, I. Bivens and S. Davis; *Calculus*
- Smith and Minton, *Calculus*

Course Outcomes:

At the end of the course Students will be able to:

CO1: To evaluate Line integral and surface integral.

CO2: To compute Volume Integral, Gradient, Divergence and Curl.

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B.Sc. MATHEMATICS III YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
SEMESTER-V
(75Hrs)
(w.e.f 2022-23 for the students admitted from the year 2020-21)

Course Name: Linear Algebra **HPW: 5L + 1T**
Course Code: MT521 **Credits: 5**

Course Objectives:
This course is aimed at familiarizing students with concepts in modern mathematical subject.

COb1: To learn concepts in Vector Space and Subspace.
COb2: To acquire knowledge about Row space, Column space, Null space and Matrix of a Linear Transformation.
COb3: To explain the concepts of Eigenvalues and Eigenvectors
COb4: To analyze various concepts of Inner Product and orthogonality.

Unit – I: VECTOR SPACES I (20 Hrs)

Vector Space and Subspace, Linear combinations, Subspace spanned by a set, Linearly Independent and dependent sets, Basis, The coordinate system, The dimension of a vector space.

Unit – II: VECTOR SPACES II (20 Hrs)

Null space, Column space and Row space of a matrix, Basis and dimensions of Null space, Column space and Row space of a matrix, Rank and rank theorem, Linear Transformations, Kernel and range of Linear Transformations, Matrix of a Linear Transformations.

Unit – III: EIGENVALUES AND EIGENVECTORS (20 Hrs)

Eigenvalues, Eigenvectors, The Characteristic Equation, Diagonalization, Complex Eigenvalues, Applications to Differential Equations.

Unit – IV: INNER PRODUCT OF VECTORS (15 Hrs)

Inner Product, Length and Orthogonality, Orthogonal set, Gram-Schmidt Process, Orthonormal Basis.

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Prescribed Text Book:

David C Lay, Linear Algebra and its Applications, Pearson Publications, 4th Edition, 2012

Unit 1-Chapters: 4.1 ,4.3 & 4.5
Unit 2- Chapters: 4.2, 4.6, 4.7, 5.1 & 5.2
Unit 3-Chapters: 5.3, 5.4 , 5.5 & 5.7
Unit 4-Chapters: 6.1 to 6.4

Reference Books:

1. Introduction to Linear Algebra, S Lang, Springer Publications, 2nd Edition,1980.
2. Linear Algebra and its Applications, Gilbert Strang, Cengage Learning, 5thEdition,2014.
3. Linear Algebra, Stephen H. Friedberg, Arnold J.Insel, Lawrence E. Spence; Pearson India Publications, 4th Edition, 2011.
4. Linear Algebra, Kuldeep Singh; Oxford University Press, ISBN-13:1stEdition, 2013.
5. Linear Algebra, Sheldon Axler; Springer Publications, 3rd Edition, 2016.

COURSE OUTCOMES: After completion of the course students will be able to:

CO1: Interpret properties of Vector Space and Subspace.
CO2: Compute and calculate Rank and Nullity.
CO3: Evaluate Eigenvalues and Eigenvectors.
CO4: Summarise and synthesise the concepts in Inner Product spaces.

23.05.2022

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OF SCIENCE, HUMANITIES AND COMMERCE
SAINIKPURI, SECUNDERABAD
Affiliated to Osmania University
Autonomous College
Accredited with 'A' grade by NAAC
B.Sc. MATHEMATICS III YEAR
Programme Name - B Sc (MECs, MPCs, MSCs)
SEMESTER-VI
(75Hrs)
(w.e.f 2022-23 for the students admitted from the year 2020-21)

Course Name: Numerical Analysis **HPW: 5L + 1T**
Course Code:MT621A **Credits: 5**

Course Objectives:

The main objective of this course is to provide students with an introduction to the field of Numerical Analysis.

COb1: To solve the equations of one variable.
COb2: To solve Interpolating polynomials and values.
COb3: To fit curves to experimental data and obtain derivative, integration of a function using Numerical techniques
COb4: To analyse the solutions of differential equations using Numerical methods.

Unit – I SOLUTIONS OF EQUATIONS IN ONE VARIABLE (20Hrs)

Solutions of Equations in One Variable: The Bisection Method,The Iteration Method,The Method of False Position,Newton's Method, Muller's Method.

Unit – II INTERPOLATION (20Hrs)

Interpolation and Polynomial Approximation: Interpolation with equal spacing: Finite Differences, Differences of Polynomials, Newton's formulae for Interpolation, Gauss's central differences formulae, Stirling'sformula, Interpolation with unequal spacing: Lagrange's Interpolation Polynomial, Divided Differences,Newton's General Interpolation formula, Inverse Interpolation.

Unit – III CURVE FITTING (20Hrs)

Curve Fitting: Least Square Curve Fitting: Fitting a Straight Line, Nonlinear Curve Fitting. Numerical Differentiation. Numerical Integration: Newton's Cotes Integration Formula, Trapezoidal Rule, Simpson's 1/3rd-Rule, Simpson's 3/8th-Rule, Boole's and Weddle's Rule.

CHAIRPERSON
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Unit – IV NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS (15Hrs)

Numerical Solutions of Ordinary Differential Equations: Taylor's Series Method, Picard's Method, Euler's Methods, Runge Kutta Methods.

Prescribed Text Book :

S.S.Sastry,Introductory Methods of Numerical Analysis, PHI, 5th Edition

Unit 1-Chapters: 2.1 to 2.5 & 2.8
Unit 2- Chapters: 3.3,3.5,3.6, 3.7[3.7.1, 3.7.2], 3.9[3.9.1], 3.10[3.10.1]& 3.11
Unit 3-Chapters: 4.1, 4.2[4.2.1,4.2.4 &4.2.5],6.2, 6.4[6.4.1 to 6.4.4]
Unit 4-Chapters: 8.1 to 8.5

Reference Books:

1. Richard L. Burden and J. Douglas Faires, Numerical Analysis (9e)
2. M K Jain, S R K Iyengar and R K Jain, Numerical Methods for Scientific and Engineering computation
3. B. Bradie, A Friendly introduction to Numerical Analysis

Course Outcomes: After completion of course, students will be able to

CO1: Calculate the solutions of equations in one variable.
CO2: Evaluate Interpolating polynomials and values.
CO3: Design curves to experimental data and obtain derivative, integration of a function using Numerical techniques
CO4: Compute the solutions of differential equations using Numerical methods.

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Course Name:Integral Transforms **HPW: 5L + 1T**
Course Code: MT621B **Credits: 5**

Course Objectives: The main aim of this course is to exposeStudents to Integral Transforms and its Applications.

COb1: To learn concepts of Laplace Transforms.
COb2: To acquire knowledge about Inverse Laplace Transformations.
COb3: To apply Laplace Transforms to ordinary differential equations & Partial differential equations.
COb4: To analyse and apply Fourier Transforms.

Unit – I LAPLACE TRANSFORMATIONS (20Hrs)

Intergal transform, Laplace Transforms, Linearity property of Laplace transformation, Piecewise continuous function, Existence of Laplace transform(statement), Functions of exponential order, A function of class A, First translation theorem, Second translation theorem, Change of scale property, Laplace transforms of derivatives and integrals, Multiplication by powers of t, Division by t, Evaluation of integral, Periodic functions and some special functions(only Gamma Function).

Unit – II INVERSE LAPLACE TRANSFORMATIONS (15Hrs)

Inverse Laplace Transform, Linearity property, First translation theorem, Second translation theorem, Change of scale property, Inverse Laplace Transform of derivatives, Inverse Laplace Transform of integrals, Multiplication by powers of p, Division by powers of p, Convolution definition, Convolution theorem, Heaviside's expansion formula, Beta function.

Unit – III APPLICATIONS OF LAPLACE TRANSFORMATIONS TO SOLUTIONS OF DIFFERENTIAL EQUATIONS (20Hrs)

Solutions of ordinary differential equations with constant coefficient, Solutions of ordinary differential equations with variable coefficient, Solutions of simultaneous ordinary differential equations, Solutions of Partial differential equations.

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Unit – IV FOURIER TRANSFORMS AND FINITE FOURIER TRANSFORMS (20Hrs)

Fourier series, Fourier Integral formula, Fourier Transforms, Inversion theorem, Fourier Sine and cosine transforms, Inverse Fourier Sine and cosine Transforms, Linearity property of Fourier Transforms, Change of scale property, Shifting property, Modulation theorem, Convolution definition, Convolution theorem for Fourier Transforms, Parseval's identity for transforms, Relationship between Fourier and Laplace Transforms. Finite Fourier Sine and cosine Transforms, Inversion Formula for Fourier Sine and cosine Transforms.

Prescribed Text Book :

Laplace Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.

Unit 1-Chapter: 1
Unit 2- Chapter:2[2.1 to 2.17]
Unit 3-Chapter:3[3.1 to 3.4]
Unit 4-Chapters:6[6.1 to 6.15, 6.17 to 6.20]; 7[7.1 to 7.4]

Reference Books:

1. An introduction to Integral Transforms by Baidyanath Patra
2. Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Co., Pvt.Ltd., New Delhi.
3. Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.
4. Integral Transforms by M.D. Raisinghania, - H.C. Saxsena and H.K. Dass Published by S. Chand and Co.,Pvt.Ltd., New Delhi.

Course Outcomes: Students will be able to

CO1: Solve the problems using Laplace Transforms.
CO2: Demonstrate the use of Inverse Laplace Transform in Convolution theorem & Heaviside's expansion formula.
CO3: Evaluate the solutions of ordinary differential equations & Partial differential equations using Laplace transformations.
CO4: Synthesise the concepts of Fourier Transforms.

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SEMESTER-VI
(75Hrs)
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Course Name: Analytical Solid Geometry **HPW: 5L + 1T**
Course Code: MT621C **Credits: 5**

Course Objectives: The main aim of this course is to expose students to descriptions of some of the surfaces by using Analytical Geometry.
COb1: Learn concepts of Spheres.
COb2: Acquire knowledge about Cones.
COb3: Classify different Cones and Cylinders.
COb4: Build the concepts of Central Conicoids.

UNIT – I SPHERES (20 hrs.)

Introduction, Definition, Equation of a sphere, The Sphere through four given points, Equation of a Sphere under Different Conditions, Equation of a circle, Intersection of a Sphere and a Line, Equation of a Tangent Plane, Angle of Intersection of Two Spheres

UNIT – II CONES (20 hrs.)

Introduction, Definition, Condition that the General Equation of the Second Degree should represent a Cone,Enveloping Cone, Cone and a Plane through its Vertex.

UNIT – III CONES AND CYLINDERS (20 hrs.)

Intersection of a line with a cone, Intersection of Two Cones with a Common Vertex, Reciprocal cone, Right Circular Cone, The Cylinder, The Right Circular Cylinder, Enveloping cylinder.

UNIT – IV THE CONICOID (15 hrs.)

The general equation of the Second Degree :Intersection of the Line with a Conicoid , Plane of Contact. Enveloping Cone and Cylinder

Prescribed Text Book :

"Analytical Solid Geometry" by Shanti Narayan & Dr.P.K.Mittal, S.Chand Publications, 17th Edition.

UNIT1: Chapter: 6.1 to 6.7
UNIT2: Chapter: 7.1 to 7.6
UNIT3: Chapter: 7.7 to 7.8
UNIT4: Chapter: 8.1 ,8.3,8.4,8.5,8.6

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REFERENCE BOOK:

1. Analytical Solid Geometry by A.R Vasistha, D.C Agarwal Krishna Prakashan publications.
2. A text book of Mathematics for BA/B.Sc Vol 1, by V Krishna Murthy & Others, published by Chand & Company, New Delhi.
3. A text Book of Analytical Geometry of Three Dimensions, by K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
4. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K. Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.
5. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University

Course Outcomes: Students will be able to

CO1: Solve the problems on Spheres.

CO2: Demonstrate the equations of Cones and related concepts.

CO3: Formulate equations of Reciprocal Cones, Right Circular Cones & Cylinders.

CO4: Synthesise the concepts of Conicoids.

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SEMESTER-V
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Course Name: Basic Mathematics **HPW: 4L**
Course Code: GE521 **Credits: 4**

Course Objectives: The main aim of this course is to develop skills of students to prepare the Competitive examinations.

COb1: Develop understanding about basic concepts in Number Theory.
COb2: Enhance the problem solving skills in finding the Average and Percentage.
COb3: Understand the how to determine Ratio & Proportion and to calculate Profit & Loss.
COb4: Enhance the problem solving skills in Time, Work, Distance, Simple & Compound Interest.

Unit – I (10 Hrs)

Numbers, H.C.F. & LC.M. of Numbers, Simplification, Square Roots & Cube Roots.

Unit – II (15 Hrs)

Average, Problems on Numbers, Problems on Ages, Percentage.

Unit – III (15 Hrs)

Profit & Loss, Ratio & Proportion, Partnership.

Unit – IV (20 Hrs)

Time & Work, Time & Distance, Simple Interest, Compound Interest.

Prescribed Text Book:

R. S. Aggarwal, Quantitative Aptitude ,Reprint 2016, S. Chand.

Reference Books:

1. R.V.Praveen, Quantitative Aptitude and Reasoning, 2nd Revised Edition 2013, Prentice-Hall of India Pvt.Ltd.
2. G. K. Ranganath, C. S. Sampangiram and Y. Rajaram, A text Book of business Mathematics, 2008,Himalaya Publishing House.

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UNIT 1-Section1:1,2,4,5
UNIT 2- Section1:6,7,8,10
UNIT 3- Section1:11,12,13
UNIT 4- Section1:15,17,21,22

Course Outcomes: Students will be able to
CO1: Analyze basic concepts in Number Theory.
CO2: Solve the problems based on Average and Percentage.
CO3: Evaluate the problem based on Profit, Loss, Ratio & Proportion.
CO4: Solve the problem involving Time, Work, Distance, Simple & Compound Interest.

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SEMESTER-V
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Course Name: Mathematics for Economics and Finance **HPW: 4L**
Course Code: GE521A **Credits: 4**

Course Objectives: Many models and problems in modern economics and finance can be expressed using the language of mathematics and analysed using mathematical techniques. The aim is to show how a range of important mathematical techniques work and how they can be used to explore and understand the structure of economic models.

COb1: Solve and sketch graphs for Linear and Quadratic Equations to relate concepts of Economics.
COb2: Analyze function of single variable, Exponential and Logarithmic Functions
COb3: Examine determinants of various types of Matrices and their properties.
COb4: Apply concepts of differences in Linear difference Equations.

Unit – I (15 Hrs)

Linear Equations: Introduction, Solution of Linear Equations, Solutions of Simultaneous Linear Equations, Graphs of Linear Equations, Budget Lines, Supply and Demand Analysis. **Quadratic Equations:** Introduction, Graphs of Quadratic Functions, Quadratic Equations, Applications to Economics.

Unit – II (15 Hrs)

Functions of a Single Variable: Introduction, Limits, Polynomial Functions, Reciprocal Functions, Inverse Functions. **The Exponential and Logarithmic Functions:** Introduction, Exponential Functions, Logarithmic Functions, Returns to Scale of Production Functions, Compounding of Interest.

Unit – III (15 Hrs)

Matrices and Determinants: Introduction, Matrix Operations, Solutions of Linear Systems of Equations, Cramer's Rule, More Determinants, Special Cases.

Unit – IV (15 Hrs)

Linear Difference Equations: Introduction, Difference Equations, First Order Linear Difference Equations.

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Vassilis. C. Mavron and Timothy N.Phillips, *Elements of Mathematics for Economics and Finance*; Springer Publishers

UNIT 1-Chapter: 2[2.1 to 2.6]; 3[3.1 to 3.4]
UNIT 2-Chapter: 4[4.1 to 4.5]; 5[5.1 to 5.5]
UNIT 3-Chapter: 10[10.1 to 10.6]
UNIT 4-Chapter: 12[12.1 to 12.3]

Course Outcomes: Students will be able to
CO1: Analyze concepts of Economics using Linear and Quadratic Equations
CO2: Evaluate functionSingle Variable, Exponential and Logarithmic Functions
CO3: Evaluatedeterminants of various types of Matrices and their properties
CO4: Solve Linear difference Equations using differences.

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Course Name: Mathematical Modeling **HPW: 4L**
Course Code: MT621_O **Credits: 4**

Course Objectives: The aim of this course is to provide the student with some basic modelling skills that will have application to a wide variety of problems.

COb1: Introduce the concept of Mathematical Modelling and analyse some Case Studies.
COb2: Apply Mathematical Modelling in population models and discuss relevant Case Studies
COb3: Formulate Mathematical Models for heat and mass transport.
COb4: Develop boundary value problems and Partial Differential Equations for various Mathematical models.

Unit-I (15 Hrs)

Introduction to Mathematical Modelling: Mathematical Models, Modelling for decision making. **Compartmental Models:** Exponential decay and radioactivity, **Case Study**: Detecting art forgeries, Lake Pollution Models, First order Linear Differential Equations, Equilibrium points and stability.

Unit-II (10 Hrs)

Models of Single Populations: Exponential growth, Density, dependent growth, Limited growth with harvesting. **Interacting Population Models:** Model for an influenza outbreak. **Case Study:** Cholera, Predators and prey, Competing Species.

Unit-III (15 Hrs)

Formulating Heat and Mass Transport Models: Some basic physical laws, Model for a hot water heater, Heat conduction and Fourier's Law, Heat conduction through a wall, Radial heat conduction, Diffusion.

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Unit-IV (10 Hrs)

Boundary Value Problems, Heat loss through a wall, Insulating a water pipe, **Introduction to Partial Differential Equations:** The heat conduction equation, Oscillating soil temperatures. **Case study:** Detecting Land Mines – Lake Pollution.

Prescribed Text Book:

B.Barnes and G.R.Fulford, *Mathematical Modelling with Case Studies* 3rd Edition, 2009, CRC press

Reference Books:

1. Shepley L. Ross, *"Differential Equations"*.
2. I. Sneddon , *Elements of Partial Differential Equations*
3. Zafar Ahsan, *"Differential Equations and their Applications"*

UNIT 1- Chapter: 1[1.1, 1.4]; 2[2.2, 2.3, 2.5, 2.10, 2.11].
UNIT 2-Chapter: 3[3.1 to 3.3]; 5[5.2 to 5.4, 5.7].
UNIT 3-Chapter: 9[9.2 to 9.6, 9.8].
UNIT 4-Chapter: 11[11.1, 11.2, 11.4]; 12[12.1 to 12.4].

Course Outcomes: Students will be able to
CO1: Understand the concept of Mathematical Modelling and analyse some Case Studies.
CO2: Demonstrate Mathematical Modelling in population models and discuss relevant Case Studies
CO3: Create Mathematical Models for heat and mass transport.
CO4: Construct Boundary Value problems and Partial differential Equations for various Mathematical Models.

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