Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES AND COMMERCE
SAINIKPURI, SECUNDERABAD
Affiliated to Osmania University
Autonomous College
Reaccredited with 'A' grade by NAAC
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, Bases, The coordinate system(No Graphical representation of coordinates, coordinate mapping and change of coordinates), 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 ,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(No Decoupling a Dynamical System).

2/4/25

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

Inner Product, Length of a vector, Orthogonal vector, Orthogonal set, Orthogonal projection, Orthonormal set, Orthonormal Basis, Gram-Schmidt Process only problems (No QR Factorization).

Prescribed Text Book:

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

Unit 1-Chapters: 4.1 ,4.3 ,4.4 & 4.5
Unit 2- Chapters: 4.2, 4.6 and 5.4
Unit 3-Chapters: 5.1 , 5.2, 5.3, 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.

***Problems based on few concepts will be done using MATLAB.**

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

MT521 CO1: Interpret properties of Vector Space and Subspace.
MT521 CO2: Compute and calculate Rank and Nullity.
MT521 CO3: Evaluate Eigenvalues and Eigenvectors.
MT521 CO4: Summarise and synthesise the concepts in Inner Product spaces.

2/4/25
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SEMESTER-V
(60 Hrs)
(w.e.f 2022-23 for the students admitted from the year 2020-21)

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:Types of Numbers,Tests of divisibility, Division Algorithm
H.C.F. & LC.M. of Numbers: Factors and Multiples, HCF, GCD, Comparison of fractions
Simplification:BODMAS rule, Expansion formulae

Unit – II (15 Hrs)

Average:Averages of numbers, Average of first n natural numbers, missing numbers given averages
Problems on Ages
Percentage:Concepts of percentages,results in population, Results on depreciation.

Unit – III (15 Hrs)

Profit & Loss:Formulae to find gain percentage, losspercentage, sellingprice, cost price.
Ratio & Proportion:Ratios, rules of multiplication and division.

Unit – IV (20 Hrs)

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

Prescribed Text Book:

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

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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.

UNIT 1-Section1:1,2,4
UNIT 2- Section1:6,8,11
UNIT 3- Section1:12,13
UNIT 4- Section1:17,18,22,23

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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Prescribed Text Book:

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 function Single Variable, Exponential and Logarithmic Functions
CO3: Evaluate determinants of various types of Matrices and their properties
CO4: Solve Linear difference Equations using differences.

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SEMESTER-VI
(75Hrs)
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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: SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS (18Hrs)

Introduction, Bisection method, Method of False Position, Iteration method, Newton-Raphson method, Muller's method.

Unit II: INTERPOLATION (20Hrs)

Finite Differences: Forward differences, Backward differences, Central differences, Symbolic relations and separation of symbols, Differences of Polynomials, Newton's formulae for Interpolation, *Central difference interpolation formulae*: Gauss central difference formulae, Stirling's formula, *Interpolation with unevenly spaced points*: Lagrange's Interpolation formula, *Divided differences and their properties*: Newton's General Interpolation formula, Inverse Interpolation.

Unit III: CURVE FITTING, NUMERICAL DIFFERENTIATION &INTEGRATION (20Hrs)

Introduction, *Least squares curve fitting procedures*: Fitting a Straight Line, Curve fitting by polynomials, Curve fitting by a sum of exponentials, Numerical Differentiation, *Numerical Integration*: Trapezoidal Rule, Simpson's 1/3rd-Rule, Simpson's 3/8th-Rule, Boole's and Weddle's Rule.

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Unit IV:NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (17Hrs)

Introduction, Solution by Taylor's Series, Picard's Method of successive approximations, Euler's Methods, Runge-Kutta Methods.

Prescribed Text Book :

Introductory Methods of Numerical Analysis, S.S.Sastry, 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 8.4[8.4.2]& 8.5

Reference Books:

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

***Problems based on few concepts will be done using MATLAB.**

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

MT621A CO1: Calculate the solutions of equations in one variable.
MT621A CO2: Evaluate Interpolating polynomials and values.
MT621A CO3: Design curves to experimental data and obtain derivative, integration of a function using Numerical techniques
MT621A 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 expose students 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 coefficients, Solutions of ordinary differential equations with variable coefficients, 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 :

Integral 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
MT621B CO1: Solve the problems using Laplace Transforms.
MT621B CO2: Demonstrate the use of Inverse Laplace Transform in Convolution theorem & Heaviside's expansion formula.
MT621B CO3: Evaluate the solutions of ordinary differential equations & Partial differential equations using Laplace transformations.
MT621B CO4: Synthesise the concepts of Fourier Transforms.

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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 description of some 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

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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

Reference Books:

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. Coordinate 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
MT621 CO1: Solve the problems on Spheres.
MT621 CO2: Demonstrate the equations of Cones and related concepts.
MT621 CO3: Formulate equations of Reciprocal Cones, Right Circular Cones & Cylinders.
MT621 CO4: Synthesise the concepts of Conicoids.

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Course Name: Mathematical Modelling **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 applications 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 (15 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.

Unit-IV (15 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.

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Prescribed Text Book:

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

Reference Books:

1. "Differential Equations", Shepley L. Ross.
2. "Elements of Partial Differential Equations", I. Sneddon.
3. "Differential Equations and their Applications",Zafar Ahsan.
4. "Mathematical Modelling" , J.N.Kapur.

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
MT621_O CO1: Understand the concept of Mathematical Modelling and analyse some Case Studies.
MT621_O CO2: Demonstrate Mathematical Modelling in population models and discuss relevant Case Studies
MT621_O CO3: Create Mathematical Models for heat and mass transport.
MT621_O CO4: Construct Boundary Value problems and Partial differential Equations for various Mathematical Models.

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