MAHARANI LAKSHMI AMMANNI COLLEGE FOR WOMEN (AUTONOMOUS)

Affiliated to Bengaluru City University (BCU)

DEPARTMENT OF MATHEMATICS

SYLLABUS

I Year B.Sc.

Under NEP

Academic Year 2021-2022 Onwards

Department of Mathematics

Program Specific Outcome

PSO1. Apply the knowledge of mathematics in analytical, computational, and problem-solving skills in varied life situations.

PSO2. Identify the inter-connection of Physics, Mathematics, Chemistry, Electronics and Engineering.

Department of Mathematics

Program Outcome

PO1. Understand the basic concepts of science, its relevance to society and impact on the human race and environment.

PO2. Effectively communicate scientific ideas through electronic media, report writing and publication of articles.

PO3. Display the spirit of teamwork and collaboration towards building healthy interpersonal relationships.

PO4. Demonstrate the ability for critical thinking and logical reasoning towards scientific research.

PO5. Exhibit self-confidence, high self-esteem and a sense of pride for themselves and the nation.

PO6. Acquire the ability to engage in self-learning and lifelong learning towards building resilience in the dynamic macro environment.

PO7. Recognize the ethical, cross-cultural and historical context of environmental issues and the links between human and natural systems.

PO8. Identify specific issues concerning the nation, critically evaluate and find solutions through application of knowledge of science.

Syllabus for B.A./B.Sc. (Honors) Mathematics as Major

I SEMESTER

MAT-101T: Algebra - I and Calculus - I	
Teaching Hours: 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100 (SEE-60 + I.A. – 40)**

CO ID	Course Outcome
CO 1	Learn the row reduced echelon form, rank of a matrix, homogeneous and non-homogeneous system of linear equations, characteristic equation, Eigen values, Eigen vectors, limit, continuity, differentiability, statements of mean value theorems, relation between Cartesian and polar form, $\tan\phi$, polar subtangent, polar subnormal, derivative of an arc length, curvature, radius of curvature, centre of curvature, evolutes and envelopes, n^{th} derivative of standard functions, Leibnitz rule, partial derivative, asymptotes and singular points.
CO 2	To solve systems of linear equations both homogeneous and non-homogeneous, problems on Gauss elimination method, Cayley-Hamilton theorem, evaluate limit of a function, check for continuity, verify differentiability, verification of mean value theorems, evaluate limits using L'Hospitals rule, polar subtangent, angle of intersection of two curves, pedal equation (Cartesian and polar form), derivative of arc length, n^{th} derivative of product of functions, asymptotes parallel to axis, singular points, finding second order partial derivatives.
CO 3	Finding A^{-1} using row reduced echelon form, Determine the $p-r$ equations (Cartesian, parametric and polar form), Radius of curvature, Centre of curvature, evolutes, Analyze and trace standard curves like the Astroid, Cissoid, Folium of Descartes, Strophoid, Cardioid, Three-leaved rose, Four-leaved rose, and Cycloid.
CO 4	To prove the theorems on limits, continuity, differentiability, mean value theorems, Problems on Taylor's and Maclaurin's expansion evaluation of limit of all indeterminate form using L'Hospitals rule, n^{th} derivatives of Standard functions, Leibnitz rule and its applications, finding second order partial derivatives.
CO 5	To develop and promote research culture in interdisciplinary and multidisciplinary areas through project/seminar/group discussion.

CL ID	Competence Level
CL 1	*Remembering:* Definition
CL 2	*Understanding*: Properties/ Theorem
CL 3	*Apply*: Theorem/Problems
CL 4	*Evaluate*: Problems

Unit-I: Recapitulation of Matrices; Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem. Row and column reduction to Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Eigen values and Eigen vectors of square matrices, real symmetric matrices and their properties.

14 Hours

Unit-II: Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital rule.

14 Hours

Unit-III: Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), Polar subtangent and subnormal, length of perpendicular from pole to the tangent, pedal equations in cartesian and polar form. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms – centre of curvature, evolutes and envelopes.

14 Hours

Unit-IV: nth Derivatives of Standard functions e^{ax+b}, $(ax + b)^n$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax}\sin(bx + c)$, $e^{ax}\cos(bx + c)$, Leibnitz theorem and its applications. Introduction to partial derivatives, asymptote and singular points. Tracing of curves (standard curves - Astroid, Cissoid, Folium of Descartes, Strophoid, Cardioid, Three leaved rose, Four leaved rose, Cycloid)

14 Hours

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Theory of Matrices - B S Vatsa, New Age International Publishers.
3. Matrices - A R Vasista, Krishna Prakashana Mandir.
4. Elements of Real Analysis - Shanti Narayan, S. Chand & Company, New Delhi.
5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
6. Calculus – Lipman Bers, Holt, Rinehart & Winston.
7. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
8. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.

MAT-101P: Algebra - I and Calculus – I Lab-I	
Practical Hours: 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50 (SEE-25 + I.A. – 25)**

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open-Source Software (FOSS) tools for computer programming.
- Solve problem on algebra and calculus theory studied in **MAT-101T** by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS.

Practical/Lab Work to be performed in the Lab using FOSS

Introduction to the software and commands related to the topic.

1. Computation of Rank of matrix and Row reduced Echelon form.
2. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
3. Solving the system of homogeneous and non-homogeneous linear algebraicequations.
4. Programs on Mean value theorems.
5. Finding the Taylor's and Maclaurin's expansions of the given functions.
6. Finding the angle between the radius vector and tangent.
7. Finding the curvatures of the given curves.
8. Finding the nth Derivative of e^{ax}, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$, trigonometric and hyperbolic functions, algebraic andlogarithmic functions.
9. Programs on Limits, differentiability, and continuity.
10. Tracing of Cartesian curves.
11. Tracing of Polar and parametric curve.

Open Elective Course
(For students who have not chosen Mathematics as one of Core subjects)

MAT-OEC-102: Corporate Mathematics	
Teaching Hours: 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. – 40)**

CO ID	**Course Outcome**
CO 1	Learn types of equations, quadratic equations, raw data, attributes and variables, classification of data, frequency distribution, cumulative frequency distribution, histogram, requisites of ideal measures of central tendency, empirical relation among mean, median and mode, geometric mean, harmonic mean, linear inequalities, characteristics of standard form of LPP, classification of solutions.
CO 2	Learn simple linear equations, solution of simultaneous equations by elimination method, substitution method and rule of cross multiplication method, arithmetic mean, median and mode for ungrouped and grouped data, combined mean, harmonic mean, merits and demerits of measures of central tendency, choice of A.M., G.M., and H.M., range, variance, standard deviation, tabulation, Bar graphs, linear inequalities and their graphs, characteristics of standard form of LPP, solution of system of linear equations – basic feasible, degenerate solutions.
CO 3	Learn quadratic equation by factorization method and formula method, harmonic mean, measures of dispersion and types, Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, coefficient of range, and coefficient of variation, pie charts, line graphs, solution of LPP by graphical method.

CL ID	**Competence Level**
CL 1	*Remembering:* Definition
CL 2	*Understanding*: Formula
CL 3	*Apply*: Interpret through graphs/ Problems
CL 4	*Evaluate*: Problems

Unit I: Theory of Equations:

Introduction meaning and types of equations. Simple linear equations, simultaneous equations (only two variables) elimination method, substitution method and rule of cross multiplication (RCM). Quadratic equations, factorization method, formula method and application problems.

14 Hours

Unit II: Statistical Methods:

Frequency distribution: Raw data, attributes and variables, classification of data, frequency distribution, cumulative frequency distribution, histogram. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency. Geometric mean: definition, merits and demerits.

Harmonic mean: definition, merits and demerits. Choice of A.M., G.M. and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD. Measures of relative dispersion: coefficient of range, coefficient of variation. Examples and problems.

14 Hours

Unit III:

Data Interpretation:

Tabulation, Bar graphs, Pie charts, line graphs and application problems.

Linear Programming:

Meaning, linear inequalities and their graphs, Formation of LPP and solution of linear programming problems by graphical method. (Only two variables)

14 Hours

Reference Books:

1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi.
2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill, London.
3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.
4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi

SEMESTER – II

MAT-201T: Algebra - II and Calculus – II	
Teaching Hours: 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100 (S.A.-60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Recognize the mathematical objects called Groups.
- Link the fundamental concepts of groups and symmetries of geometrical objects.
- Explain the significance of the notions of Cosets, normal subgroups and factor groups.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.

Unit-I: Binary operation with examples**.** Definition of a group with examples and properties, finite groups, congruence and problems. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Index and its related theorems. Lagrange's theorem, and its consequences. Fermat's theorem and Euler's ϕ function. Permutation group.

14 Hours

Unit-II: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables.

14 Hours

Unit III: Recapitulation of definite integrals and its properties, Reduction formulae**,** Rectification, Quadrature, Differentiation under the integral sign by Leibnitz rule**.** Definition of line integral and basic properties, examples on evaluation of line integrals.

14 Hours

Unit-IV: Double integral: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Application of double integral.
Triple integral: Definition of triple integrals and evaluation-change of variables, Application of triple integral.

14 Hours

Reference Books:

1. Topics in Algebra, I N Herstein, Wiley Eastern Ltd., New Delhi.
2. Higher algebra, Bernard & Child, Arihant, ISBN: 9350943199/ 9789350943199.
3. Modern Algebra, Sharma and Vasista, Krishna Prakashan Mandir,Meerut, U.P.
4. Differential Calculus, Shanti Narayan, S. Chand & Company, NewDelhi.
5. Integral Calculus, Shanti Narayan and P K Mittal, S. Chand and Co.Pvt. Ltd.,
6. Schaum's Outline Series, Frank Ayres and Elliott Mendelson,5th ed. USA: Mc. Graw Hill., 2008.
7. Mathematical Analysis, S C Malik, Wiley Eastern.
8. A Course in Abstract Algebra, Vijay K Khanna and S KBhambri, Vikas Publications.
9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.

PRACTICAL

MAT-201P: Algebra -II and Calculus – II Lab-II	
Practical Hours: 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50 (S.A.-25 + I.A. – 25)**

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming
- Solve problem on algebra and calculus by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

Practical/Lab Work to be performed in the Lab using FOSS

1. Program to construct Cayley's table.
2. Program to find all possible cosets of the given finite group.
3. Programs for rectification.
4. Programs for area of plane curves.
5. Programs for surface area.
6. Programs for volume of revolution.
7. Program to evaluate the line integrals.
8. Program to evaluate the Double integrals.
9. Program to evaluate the Triple integral.

Open Elective Course

(For students who have not chosen Mathematics as one of Core subjects)

MAT-OEC-202: Commercial Mathematics	
Teaching Hours: 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100 (S.A.- 60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to,

- Learn concepts of set types of sets and Venn diagrams.
- Learn concepts of Relations and functions
- Learn concept of permutation and combination with application problems.
- Learn concept of probability, definitions of events, occurrences of events.
- Learn some rules of probability and application problems.
- Learn to calculate percentage and ratios in application problems. learn definitions of proportions and properties.
- Apply these concepts in commercial problems.

Unit-1: Set Theory

Sets, subset, empty set, power set, operations on sets, Venn diagrams, relations, types of relations, domain and range of a relations, functions, types of functions, binary operations.

14 Hours

Unit - II: Permutation, combinations, and probability

Fundamental principle of counting Factorial, permutation, and combinations, simple applications. Random experiments, Introduction to probability, sample spaces (Set representation), events; the probability of an event, some rules of probability Occurrences of events. 'not", "AND", "OR' events, exhaustive events, mutually exclusive events. Axiomatic (set theoretic) probability of "and", "or", "not", events and conditional probability.

14 Hours

Unit III: Percentage, Ratio & Proportions

Percentage Definition. Calculation of percentage, Ratios-Types of Ratios-Duplicate, Triplicate & Sub-duplicate of a ratio. Proportions Definition &properties-cross product property &reciprocal property, united proportions continued proportion-compound proportions, examples on commercial Mathematics.

14 Hours

Reference Books:

1. Practical Business Mathematics, S. A. Bari New Literature Publishing Company New Delhi
2. Mathematics for Commerce, K. Selvakumar Notion Press Chennai
3. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi
4. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill New Delhi
5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge
7. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark
8. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
9. Applied Statistics, Mukhopadhya Parimal New Central Book Agency Pvt. Ltd. Calcutta.
10. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutt.

DEPARTMENT OF MATHEMATICS

SYLLABUS

II Year B.Sc. (NEP)

Core and Open Elective

From 2022-2023 Onwards

Department of Mathematics

Program Specific Outcome

PSO1. Apply the knowledge of mathematics in analytical, computational, and problem-solving skills in varied life situations.

PSO2. Identify the inter-connection of Physics, Mathematics, Chemistry, Electronics and Engineering.

Department of Mathematics

Program Outcome

PO1. Understand the basic concepts of science, its relevance to society and impact on the human race and environment.

PO2. Effectively communicate scientific ideas through electronic media, report writing and publication of articles.

PO3. Display the spirit of teamwork and collaboration towards building healthy interpersonal relationships.

PO4. Demonstrate the ability for critical thinking and logical reasoning towards scientific research.

PO5. Exhibit self-confidence, high self-esteem and a sense of pride for themselves and the nation.

PO6. Acquire the ability to engage in self-learning and lifelong learning towards building resilience in the dynamic macro environment.

PO7. Recognize the ethical, cross-cultural and historical context of environmental issues and the links between human and natural systems.

PO8. Identify specific issues concerning the nation, critically evaluate and find solutions through application of knowledge of science.

Syllabus for Semester – III

MAT-301T: Ordinary Differential Equations and Real Analysis – I	
Teaching Hours: 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100** **(S.A.- 60 + I.A. - 40)**

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

- Solve first-order non-linear differential equations and linear differential equations.
- To model problems in nature using Ordinary Differential Equations.
- Formulate differential equations for various mathematical models.
- Apply these techniques to solve and analyze various mathematical models.
- Understand the fundamental properties of the real numbers that lead to define sequence and series, the formal development of real analysis.
- Learn the concept of Convergence and Divergence of a sequence.
- Able to handle and understand limits and their use in sequences, series, differentiation, and integration.
- Apply the ratio, root, alternating series, and limit comparison tests for convergence and absolute convergence of an infinite series.

Ordinary Differential Equations:

Unit I: Recapitulation of Differential Equations of first order and first degree.

2 Hours

Linear and reducible to linear differential equations, Exact and reducible to exact differential equations, Differential equations of the first order and higher degree: Equations solvable for p, x, y. Clairaut's equation and singular solution. Orthogonal trajectories of Cartesian and polar curves.

12 Hours

Unit II: Linear differential equations of higher order with constant coefficients. Particular Integrals when the RHS is of the form $e^{ax}, \sin(ax+b), \cos(ax+b), x^n, e^{ax}\,V$ and $x\,V$, where V is a function of x. Cauchy – Euler equations. Solution of second order ordinary linear differential equations with variable coefficients by the following methods, i) when a part of complimentary function is known, ii) By changing the dependent variable iii) By changing the independent variable iv) method of variation of parameters and
v) When the equation is exact. Total differential equations of the form
$P\,dx + Q\,dy + R\,dz = 0$. Simultaneous differential equations.

14 Hours

Real Analysis – I:

Unit III: Sequences: Sequences of real numbers, limit of a sequence, limit points of a sequence, limit superior and limit inferior of a sequence, convergent, divergent, and oscillatory sequences. Algebra of sequences, Bounded sequences, Monotonic sequences, Cauchy's first and second theorem on limits of a sequence. Cauchy's general principle for convergence of a sequence.

14 Hours

Unit IV: Infinite Series: Convergent, divergent, and oscillatory series, Cauchy's general principle of convergence. Geometric series, P-series. Comparison tests for series of positive terms. D'Alembert's ratio test, Raabe's test. Cauchy's Root test. Alternating series. Leibnitz's theorem. Absolute convergence and conditional convergence of a series. Summation of series: Binomial, exponential and logarithmic.

14 Hours

Reference Books:

1. M.D.Raisinghania, Ordinary Differential Equations & Partial Differential Equations,S. Chand & Company, New Delhi, 7th edition, 2003.
2. J. Sinha Roy and S Padhy: A course of Ordinary and Partial Differential Equation, Kalyani Publishers, New Delhi.
3. D. Murray, Introductory Course in Differential Equations, Orient Longman (India)
4. W. T. Reid, Ordinary Differential Equations, John Wiley, New Delhi.
5. M. L. Khanna, Differential Equations, Jai Prakash Nath & Co. Meerut.
6. S. L. Ross, Differential Equations, 3rd Ed., John Wiley, and Sons, 1984.
7. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley, and Sons (Asia) Pvt. Ltd., Singapore, 2015.
8. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.
9. K. A. Ross, Elementary Analysis: The Theory of Calculus (2nd edition), Springer, 2013
10. S. K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.
11. T. Apostol, Mathematical Analysis, Narosa Publishing House
12. M.L Khanna and L.S. Varhiney, Real Analysis by, Jai Prakash Nath & Co. Meerut.
13. Kreyzig, Advanced Engineering Mathematics, John Wiley, New Delhi.
14. P N Arora and Ranjith Singh, A first course in Real Analysis, Sultan Chand & Sons publications, 2nd Edition, 1977.

PRACTICAL

MAT-301P: Ordinary Differential Equations and Real Analysis – I Lab-I	
Teaching Hours: 4 Hours/Week	**Credits: 2**
Total Teaching Hours: 56 Hours	**Max. Marks: 50** **(S.A. - 25 + I.A. – 25)**

Course Learning Outcomes: This course will enable the students to gain hands on experience of

- Free and Open-Source software (FOSS) tools or computer programming.
- Solving exact differential equations,
- Plotting orthogonal trajectories.
- Finding complementary function and particular integral of linear and homogeneous differential equations.
- Acquire knowledge of applications of real analysis and differential equations.
- Verification of convergence/divergence of different types of series.

Practicals/Lab Work to be performed in Computer Lab

Use open-source software to executive the practical problems. (Maxima/ Scilab/Python/ Rust/Sage)

1. Verification of exactness of a differential equation
2. Solutions of differential equations that are solvable for x, y, p.
3. To find the singular solution by using Clairaut's form.
4. Plotting of orthogonal trajectories.
5. Solution of linear differential equations and plot the solutions.
6. Solutions to the Total differential equations and plot the solutions.
7. To find the nature of the sequences
8. Algebra of limit point of sequences.
9. Convergence of series of positive terms.
10. Examples on alternating series using Leibnitz's theorem.
11. Finding the convergence of series using Cauchy's criterion for partial sums.
12. Summation of series.

Open Elective Course

(For students of other than Science stream)

MAT-OEC- 301: Quantitative Mathematics	
Teaching Hours: 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A. - 60 + IA - 40)**

Course Outcomes: This course will enable the students to:

- Understand number system and fundamental operations.
- Understand the concept of linear quadratic and simultaneous equations and their applications in real life problems.
- Understand and solve the problems based on Age.
- Solve Speed and Distance related problems.

Unit-I: Number System

Numbers, Operations on Numbers, Tests on Divisibility, HCF and LCM of numbers. Decimals, Fractions, Simplification, Square roots and Cube roots - Problems thereon. Surds and Indices. Illustrations thereon.

14 Hours

Unit-II: Theory of equations

Solutions of linear equations, quadratic equations, simultaneous equations in two variables, simple application problems - Problems on Ages,

14 Hours

Unit-III: Quantitative Aptitude

Percentage, Average, Average Speed-problems. Time and distance, problems based on trains, problems on-work and time, work and wages, clock, and calendar.

14 Hours

Reference Books:

1. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Limited, New Delhi- 110 055.
2. Abhijit Guha, Quantitative Aptitude, 5th Edition, Mc. Grawhillpublications.2014.
3. R V Praveen, Quantitative Aptitude and Reasoning, PHI publishers.
4. R S Aggarwal, Objective Arithmetic, S. Chand & Company Ltd.
5. Qazi Zameerddin, Vijay K Khanna, S K Bhambri, Business Mathematics-II Edition.
6. S. K. Sharma and Gurmeet Kaur, Business Mathematics, Sultan Chand & Sons.
7. Hazarika Padmalochan, A Textbook of Business mathematics for B. Com and BBA Course, Chand Publication.
8. J K Thukrol, Business Mathematics, abci book:2020 First Edition.
9. N. G. Das and J. K. Das, Business Mathematics and Statics, Mc Graw Hill Education, 2017

SEMESTER – IV

MAT-401T: Integral Transforms and Partial Differential Equations	
Teaching Hours: 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100** **(S.A. - 60 + I.A. – 40)**

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

- Solve the partial differential equations of the first order and second order.
- Formulate, classify, and transform partial differential equations into canonical form.
- Solve linear and non-linear partial differential equations using various methods; and apply these methods to solving some physical problems.
- Able to take more courses on wave equation, heat equation, and Laplace equation.
- Solve PDE by Laplace Transforms and Fourier Transforms.

Integral Transforms:

Unit I: Laplace Transforms: Definition, Basic Properties. Laplace transforms of some standard functions. Laplace transform of Periodic functions. Laplace transform of derivative and integral of a function. Heaviside function. Dirac-delta function. Convolution theorem. Inverse Laplace transforms and its properties. Solution of differential equations by using Laplace transforms.

14 Hours

Unit II: Fourier Series and Transforms: Periodic functions. Fourier Coefficients. Fourier series of functions with period 2π and period 2L. Fourier series of even and odd functions. Half range Cosine and Sine series. Fourier Transforms - Finite Fourier Cosine and Sine transform. Transforms of derivates. Applications of Fourier Transforms.

14 Hours

Partial Differential Equations

Unit III: Basic concepts–Formation of a partial differential equations by elimination of arbitrary constants and functions, Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$, Standard types of first order non-linear partial differential equations, The integrals of the non-linear equation by Charpit's method.

14 Hours

Unit IV: Homogeneous linear partial differential equations with constant coefficients. Partial differential equations of the second order. Classification of second-order partial differential equations, canonical forms. Classification of second order linear equations as hyperbolic, parabolic, and elliptic. Solutions of the Heat equation, Laplace equation and Wave equation (using separation of variables).

14 Hours

Reference Books

1. R. Murray and L. Spiegal (Schaum's Series), Laplace Transforms
2. Sudhir Kumar, Integral Transform Methods in Science & Engineering, CBS Engineering Series, 2017.
3. Murray R. Spiegal L, Fourier Transforms, Schaum' Series,
4. Earl David Rainville and Philip Edward Bedient–A short course in Differential Equations, Prentice Hall College Div; 6th Edition.
5. Sathya Prakash, Mathematical Physics, S Chand and Sons, New Delhi.
6. D. A. Murray, Introductory Course in Differential Equations, Orient and Longman
7. H. T. H.Piaggio, Elementary Treatise on Differential Equations and their Applications, CBS Publisher & Distributors, Delhi,1985.
8. G. F. Simmons, Differential Equations, Tata McGraw Hill.
9. S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
10. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi, 7th edition 2003.
11. K.Sankara Rao, Introduction to Partial Differential Equations: PHI, Third Edition, 2015.
12. I. N. Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions, 1986.
13. Debashis Dutta, Textbook of Engineering Mathematics, New Age International (P) Limited.(2006).

PRACTICALS

MAT-401P: Integral Transforms and Partial Differential Equations Lab-I	
Practical Hours: 4 Hours/Week	**Credits: 2**
Total Teaching Hours: 56 Hours	**Max. Marks: 50 (S.A.-25 + I.A. – 25)**

Mathematics practical with Free and open-Source Software (FOSS) tools for computer programs

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

- Learn Free and Open-Source software (FOSS) tools or computer programming.
- Solve problems on Partial Differential Equations and Integral Forms.
- To find Laplace transform of various functions.
- To find the Fourier Transform of periodic functions.
- To solve differential equations by using Integral transform.
- **Programs using Scilab/Maxima/Python**

Elements of Partial differential equations and Integral transforms using FOSS

1. Finding the Laplace transforms of some standard and periodic functions.
2. Finding the inverse Laplace transform of simple functions.
3. Verification of Convolution Theorem.
4. To solve ordinary linear differential equation using Laplace transform.
5. To solve Integral equation using Laplace transform.
6. To find full range Fourier series of some simple functions with period 2π and 2L
7. To find Half range sine and cosine series of some simple functions and plotting them.
8. To find Cosine Fourier transforms.
9. To find Sine Fourier transforms.
10. Solutions of Linear Partial differential equations of type1 to type4 and Lagrange's method
11. Solutions of partial differential equation using Charpit's method.
12. Solutions of Second order homogenous partial differential equation with constant coefficients.
13. Solutions to the partial differential equations using separation of variables method (Heat/ Wave/Laplace).

DEPARTMENT OF MATHEMATICS

SYLLABUS

III Year B.Sc. (NEP)

Core

From 2023-2024 Onwards

Department of Mathematics

PO ID	PROGRAMME OBJECTIVES
PO1	Disciplinary knowledge
PO2	Critical thinking
PO3	Problem solving
PO4	Analytical reasoning

PSO ID	Program Specific Outcome
PSO1	Understand the basic concepts of algebra, calculus, analysis, differential equations, linear algebra, integral transforms and Numerical methods.
PSO2	Apply the knowledge of mathematics in analytical, computational, and problem-solving skills in varied life situations.
PSO3	Identify the inter-connection of Physics, Mathematics, Chemistry, Electronics and Engineering.
PSO4	The framing of the syllabus caters to the need of competitive exams like IIT JAM, CUCET to take up post-graduation, central government jobs like India Meteorological Department, banking and related jobs and CSIR NET/KSET exam post M.Sc. for Junior research fellow or lectureship.

Semester – V (Paper 5)

Subject Title	**Advanced Algebra and Complex Analysis**
Subject Code	**MAT-501T**
Teaching Hours	**4 Hours/Week**
Credits	**4**
Total Teaching Hours	**60 Hours**
Max. Marks	**100 (S.A.- 60 + I.A. - 40)**

CO ID	**Course Outcomes**
CO1	Explain the concepts and use equations, formulae and mathematical expressions and relationships in a variety of contexts
CO2	Apply the knowledge in solving problems
CO3	Ability to solve problems and evaluate them.
CO4	Analyze and demonstrate mathematical skill

Semester – V Syllabus for Paper 5 (Theory)

Sl. No.	**Module Title**	**Module content**	**No. of Hours**	**Skills Developed**
		Advanced Algebra		
1	Groups II	**Normal Subgroups** – properties, examples and problems, **Quotient group**, **Homomorphism and Isomorphism of groups** – properties examples and problems, Kernel and image of a homomorphism, Normality of the kernel, Fundamental theorem of homomorphism, Properties related to isomorphism, **Permutation group** – Cayley's Theorem.	15	Mathematical Researching

2	Rings, Integral Domains, Fields	Rings – definition and properties of rings, Rings of integers modulo n, Subrings, Ideals - Principal, Prime and Maximal ideals in a commutative ring - examples and standard properties following the definition, **Homomorphism**, **Isomorphism** – properties, Quotient **rings, Integral Domain**, **Fields** – properties following the definition, Fundamental Theorem of Homomorphism of Rings, Every field is an integral domain, Every finite integral domain is a field with examples.	15	Mathematical Researching
<u>Complex Analysis</u>				
3	Complex numbers & Functions of Complex variables	Complex numbers- Cartesian and polar form-geometrical representation- complex - Plane- Euler's formula $e^{i\theta} = \cos\theta + i\sin\theta$. Functions of a complex variable-limit, continuity and differentiability of a complex function. Analytic function, Cauchy-Riemann equations in Cartesian and Polar Forms- Sufficiency conditions for analyticity (Cartesian form only)- Harmonic function-standard properties of analytic functions-construction of analytic function when real or imaginary part is given-Milne Thomson method.	15	Analytical Skills
4	Transformation & Complex Integration	Transformations: Definition- Jacobian of a transformation- Identity transformation- Reflection- Translation- Rotation- Stretching- Inversion- Linear transformation- Definitions- Bilinear transformations- Cross-ratio of four points- Cross-ratio preserving property- Preservation of the family of straight lines and circles- Conformal mappings- Discussion of the transformations $w = z^2, w = \sin z, w = e^z$,	15	Transformation Skills

		$w = \frac{1}{2}\left(z + \frac{1}{z}\right), w = \frac{1}{z}$. Complex integration– definition, Line integral, properties and problems. Cauchy's Integral theorem-proof using Green's theorem-direct consequences. Cauchy's Integral formula with proof-Cauchy's generalized formula for the derivatives with proof and applications for evaluation of simple line integrals.		

Reference Books:

1. I N Herstein (1990), Topics in Algebra, 2nd Edition, Wiley Eastern Ltd., New Delhi.
2. Vijay K Khanna and S K Bhambri (1998), A Course in Abstract Algebra, Vikas Publications.
3. Michael Artin (2015), Algebra, 2nd ed., Pearson.
4. Joseph A, Gallian (2021), Contemporary Abstract Algebra, 10th ed., Taylor and Francis Group.
5. L. V. Ahlfors, Complex Analysis, 3rd Edition, McGraw Hill Education
6. Bruce P. Palka, Introduction to the Theory of Function of a Complex Variable, Springer
7. Serge Lang, Complex Analysis, Springer
8. Shanthi Narayan, Theory of Functions of a Complex Variable, S. Chand Publishers.
9. S. Ponnu swamy, Foundations of Complex Analysis, 2nd Edition, Alpha Science International Limited.
10. R.V. Churchil & J.W. Brown, Complex Variables and Applications, 5th ed, McGraw Hill Companies

Semester – V

Syllabus for Paper 5 (Practical)

Subject Title (Practical)	**Advanced Algebra and Complex Analysis Lab**
Subject Code	**MAT-501P**
Teaching Hours	**4 Hours/Week**
Credits	**2**
Total Teaching Hours	**60 Hours**
Max. Marks	**50 (S.A.- 25 + I.A. - 25)**

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open-Source Software (FOSS) tools for computer programming.
- Solve problem on Advanced Algebra and Complex Analysis studied in **MAT-501T by** using FOSS software's.
- Acquire knowledge of applications of Advanced Algebra and Complex Analysis through FOSS.

FOSS tools – Maxima/Scilab/Python/R-programming

1. Examples on Normal subgroup of a group
2. Examples on homomorphism of a group
3. Examples on different types of rings.
4. Examples on integral domains and fields.
5. Homomorphism and isomorphism of rings- illustrative examples.
6. Program on verification of Cauchy – Riemann equations (Cartesian form) or test for analyticity.
7. Program on verification of Cauchy – Riemann equations (Polar form) or test for analyticity.
8. Program to check whether a function is harmonic or not.
9. Program to construct analytic functions (through Milne–Thomson method)
10. Program to find Cross ratio of points and related aspects.
11. Program to find fixed points of bilinear transformations.

Web Resources

- Web Math
- Wolfram Math work

Semester – V (Paper 6)

Subject Title	**Advanced Vector Calculus**
Subject Code	**MAT-502T**
Teaching Hours	**4 Hours/Week**
Credits	**4**
Total Teaching Hours	**60 Hours**
Max. Marks	**100 (S.A.- 60 + I.A. - 40)**

CO ID	**Course Outcomes**
CO1	Explain the concepts and use equations, formulae and mathematical expressions and relationships in a variety of contexts
CO2	Apply the knowledge in solving problems
CO3	Ability to solve problems and evaluate them.
CO4	Analyze and demonstrate mathematical skill

Semester – V Syllabus for Paper 6 (Theory)

Sl. No.	Module Title	Module content	No. of Hours	Skills Developed
1	Analytical Geometry	Equation of line in different forms, collinearity of three given points, perpendicular from a point on to a line. The plane, particular forms of the equation of the plane, perpendicular distance from a point on to a plane, angle between two planes, line of intersection of two planes, planes coaxal with given planes, planes bisecting the angle between two planes, coplanarity of two lines, shortest distance between skew lines. Sphere, right circular cone, right circular cylinder, conicoids.	15	Analytical Skills
2	Geometry of space curves	Vector function of a single scalar variable - its interpretation as a space curve – derivative - tangent, normal and binomial vectors to a space curve - Serret Frenet formulas with proof - simple geometrical applications. Finding curvature and torsion - parametric forms. Vector function of two scalar variables - its interpretation as a surface - Tangent plane and Normal to a surface - Normal line – parametric curves on a surface – parametric curves on the surfaces of a right circular cylinder and sphere – cylindrical to spherical and spherical polar coordinates.	15	Analytical Skills
		Vector Calculus		
3	Vector Algebra	**Vector Algebra** –Multiple product – scalar triple product, vector triple product, geometrical interpretation, related problems; **Scalar field** - Gradient of a scalar field, geometrical meaning, directional derivative, unit normal using surfaces - tangent plane and normal to the surface; Vector field - divergence	15	Reasoning and Analytical skills

		and curl of a vector field, geometrical meaning, solenoidal and irrotational fields; Laplacian of a scalar field; Vector identities.		
4	Vector Integration	**Vector Integration** – Definition and basic properties, vector line integral, surface integral and volume integral; **Green's theorem in the plane** – Proof and related problems, Direct consequences of the theorem; **Gauss' Divergence theorem** – Proof and related problems, Direct consequences of the theorem; **Stokes' theorem** – Proof and related problems, Direct consequences of the theorem.	15	Skill developed problems solving and Analytical skills

Reference Books:

1. M. D. Raisinghania, Vector Calculus, S Chand Co. Pvt. Ltd., 2013.
2. M. Spiegel, Vector Analysis, 2nd Edition, Schaum's Outline Series, Mc-Graw Hill, Education, 2017.
3. C. E. Weatherburn, Elementary Vector Analysis, Alpha edition, 2019.
4. P. N. Wartikar and J. N. Wartikar, A Textbook of Applied Mathematics, Vol. II, Pune Vidyarthi Griha Prakashan, Pune, 2009.
5. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
6. G. E. Andrews, R. Askey and R. Roy, Special Functions, Cambridge University Press
7. S. Kanemitsu and H. Tsukada, Vistas of special functions, World Scientific.
8. G. B. Thomas, Thomas Calculus, 13th Edition, Pearson publication.
9. B. S. Grewal, Higher Engineering mathematics, Khanna Publications
10. K. F. Riley, M. P. Hobson and S. J. Bence, Mathematical Methods for Physics and Engineering, Third Edition, Cambridge University Press.
11. H. K. Das, Higher Engineering Mathematics, S. Chand publishers.
12. A.S. Gupta (2004). Calculus of Variations with Applications. PHI Learning.
13. D. Chatterjee (2009). Analytical Geometry: Two and Three Dimensions. Narosa Publishing House.
14. Shanthi Narayan and P. K. Mittal, Analytical Solid Geometry, S. Chand Publications.
15. A. N. Das, Analytical Geometry of Two and Three Dimensions, New Central Book Agency Pvt. Ltd.

Semester – V Syllabus for Paper 6 (Practical)

Subject Title (Practical)	**Advanced Vector Calculus Lab**
Subject Code	**MAT-502P**
Teaching Hours	**4 Hours/Week**
Credits	**2**
Total Teaching Hours	**60 Hours**
Max. Marks	**50 (S.A.- 25 + I.A. - 25)**

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open-Source Software (FOSS) tools for computer programming.
- Solve problems related to Vector Calculus, Improper integrals and Calculus of variations using FOSS software.

FOSS tools – Maxima/Scilab/Python/R-programming

1. Program to find equation and plot sphere, cone and cylinder.
2. Program to find distance between a straight line and a plane.
3. Program to construct and plot some standard surfaces.
4. Program to find kappa and Tau
5. Program on multiple products of vectors – Scalar and Cross product.
6. Program on vector differentiation and finding unit tangent.
7. Program to find curvature and torsion of a space curve.
8. Program to find the gradient and Laplacian of a scalar function, divergence, and curl of a vector function.
9. Program to demonstrate the physical interpretation of gradient, divergence, and curl.
10. Program to evaluate a vector line integral.
11. Program to evaluate a surface integral.
12. Program to evaluate a volume integral.
13. Program to verify Green’s theorem.

Web Resources

- Web Math
- Wolfram Math work

Semester – VI (Paper 7)

Subject Title	**Linear Algebra, Beta and Gamma Functions and Calculus of Variation**
Subject Code	**MAT-601T**
Teaching Hours	**4 Hours/Week**
Credits	**4**
Total Teaching Hours	**60 Hours**
Max. Marks	**100 (S.A.- 60 + I.A. - 40)**

CO ID	**Course Outcomes**
CO1	Explain the concepts and use equations, formulae and mathematical expressions and relationships in a variety of contexts
CO2	Apply the knowledge in solving problems
CO3	Ability to solve problems and evaluate them.
CO4	Analyze and demonstrate mathematical skill

Semester – VI Syllabus for Paper 7 (Theory)

Sl. No.	**Module Title**	**Module content**	**No. of Hours**	**Skills Developed**
1	Linear Algebra	**Vector spaces** - Definition, examples and properties; **Subspaces** - Examples, criterion for a sub- set to be a subspace and some properties; **Linear Combination** - Linear span, Linear dependence and Linear independence, basic properties of linear dependence and independence, techniques of determining linear dependence and independence in various vector spaces and related problems; **Basis and dimension** - Co-ordinates, ordered basis, some basic properties of basis and dimension and subspace spanned by given set of vectors.	15	Computational skills

2	Linear Transformation	**Linear transformation** - Definition, examples, equivalent criteria, some basic properties and matrix representation and change of basis and effect on associated matrix, similar matrices; **Rank - Nullity theorem** - Null space, Range space, proof of rank nullity theorem and related problems. Non-singular linear transformations. **Eigenvalues and Eigenvectors** - Computation of Eigenvalues, algebraic multiplicity, some basic properties of eigenvalues, determination of eigenvectors and eigenspace and geometric multiplicity. **Diagonalizability of linear transformation** - Meaning, condition based on algebraic and geometric multiplicity (mentioning) and related problems (Only verification of diagonalizability).	15	Computational skills
3	Beta-Gamma Functions	Definitions, Properties and examples, relations between beta and gamma functions, standard theorems, applications of evaluations of definite integrals, duplication formula and applications.	15	Problems and Analytical Skills
4	Calculus of Variation	Introduction, Problem of Brachistochrone problem, problem of geodesics, isoperimetric problem, variation and its properties, functions and functionals, Variational Problems with Fixed Boundaries Euler's equation for functional containing first order and higher order total derivatives, Functionals containing first order partial derivatives, Variational problems in parametric form, Invariance of Euler's equation under coordinates transformation.	15	Problem solving Skills

Reference Books:

1. I. N. Herstein, Topics in Algebra, 2nd Edition, Wiley.
2. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2003), Linear Algebra (4^{th} Edition), Printice-Hall of India Pvt. Ltd.
3. F. M. Stewart, Introduction to Linear Algebra, Dover Publications.
4. S. Kumaresan, Linear Algebra, Prentice Hall India Learning Private Limited.
5. Kenneth Hoffman & Ray Kunze (2015), Linear Algebra, (2^{nd} Edition), Prentice Hall India Leaning Private Limited.
6. Gilbert. Strang (2015), Linear Algebra and its applications, (2^{nd} Edition), Elsevier.
7. Vivek Sahai & Vikas Bist (2013), Linear Algebra (2^{nd} Edition) Narosa Publishing.
8. Serge Lang (2005), Introduction to Linear Algebra (2^{nd} Edition), Springer India.
9. T. K. Manicavasagam Pillai and K S Narayanan, Modern Algebra Volume 2.
10. R D Sharma, Theory and Problems of Linear Algebra, I.K.International Publishing House Pvt Ltd.
11. A.S. Gupta (2004). Calculus of Variations with Applications. PHI Learning.
12. L. E. Elsgolc Calculus of Variations, Pergamon Press Ltd 1962.
13. R. Weinstock (1974), Calculus of Variations with applications to Physics and Engineering, Dover.

Semester – VI Syllabus for Paper 7 (Practical)

Subject Title (Practical)	**Linear Algebra, Beta and Gamma Functions and Calculus of Variation Lab**
Subject Code	**MAT-601P**
Teaching Hours	**4 Hours/Week**
Credits	**2**
Total Teaching Hours	**60 Hours**
Max. Marks	**50 (S.A.- 25 + I.A. - 25)**

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open-Source Software (FOSS) tools for computer programming.
- Solve problem on Linear Algebra studied in **MAT-601T** by using FOSS software's.
- Acquire knowledge of applications of Linear Algebra through.

FOSS tools: Scilab/Maxima/Python/ R Programming

1. Program on linear combination of vectors.
2. Program to verify linear dependence and independence.
3. Program to find basis and dimension of the subspaces.
4. Program to verify if a function is linear transformation or not.
5. Program to find the matrix of linear transformation.
6. Program to find the Eigenvalues and Eigenvectors of a given linear transformation.
7. Program on Rank – nullity theorem.
8. Program to verify if the given linear transformation is singular/non-singular.
9. Program to find the algebraic multiplicity of the Eigenvalues of the given linear transformation.
10. Program on diagonalization
11. Program on beta functions.
12. Program on gamma functions
13. Example of Euler's equation in full form.
14. Particular Forms of Euler's equation.
15. Examples on isoperimetric problems.

Web Resources

- Web Math
- Wolfram Math work

Semester – VI (Paper 8)

Subject Title	**Numerical Analysis**
Subject Code	**MAT-602T**
Teaching Hours	**4 Hours/Week**
Credits	**4**
Total Teaching Hours	**60 Hours**
Max. Marks	**100 (S.A.- 60 + I.A. - 40)**

CO ID	Course Outcomes
CO1	Explain the concepts and use equations, formulae and mathematical expressions and relationships in a variety of contexts
CO2	Apply the knowledge in solving problems
CO3	Ability to solve problems and evaluate them.
CO4	Analyze and demonstrate mathematical skill

Semester – VI Syllabus for Paper 8 (Theory)

Sl. No.	Module Title	Module content	No. of Hours	Skills Developed
1	Algebraic and Transcendental Equations	Errors - Significant digits, absolute, relative, percentage errors, rounding off and truncation errors (meanings and related problems), general error formula (derivation of formula and problems based on it), error in series approximation: Taylor series approximations (problems only), Solutions to algebraic and transcendental equations - Bisection method, Regula-Falsi method, iterative method Newton-Raphson method and secant method (Plain discussion of the rationale behind techniques and problems on their applications).	15	Interpretation and evaluation

2	System of Linear Algebraic Equations	Direct Methods – Gauss elimination method, Gauss-Jordan elimination method and Triangularization method; Iterative methods – Jacobi method, Gauss-Jacobi method, Gauss-Seidal method, Successive-Over Relaxation method (SOR) method**.**	15	Problem solving skills
3	Polynomial Interpolations	Finite differences**.** Forward, backward and central differences and shift operators: definitions, properties and problems; Polynomial interpolation - Newton-Gregory forward and backward interpolation formulas, Gauss's Forward and backward interpolation formulas, Lagrange interpolation polynomial, Newton's divided differences and Newton's general interpolation formula (Discussion on setting up the polynomials, differences between them and problems on their applications).	15	Computational skills
4	Numerical Differentia tion an Integration	Formula for derivatives (till second order) based on Newton-Gregory forward and backward interpolations (Derivations and problems based on them). Numerical Integration - General quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule and Weddell's rule (derivations for only general quadrature formula, trapezoidal rule and Simpson's 1/3rd rule and problems on the applications of all formulas).	15	Analytic and Problem-solving skills

Reference Books:

1. E. Isaacson and H. B. Keller, Analysis of Numerical methods, Dover Publications.
2. S. S. Sastry, Introductory methods of Numerical Analysis, 5th Edition, PHI Learning Private Limited.
3. E Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Limited
4. B. S. Grewal, Numerical Methods for Scientists and Engineers, Khanna Publishers.
5. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering computation, 4th Edition, New Age International
6. H. C. Saxena, Finite Difference and Numerical Analysis, S. Chand Publishers
7. B. D. Gupta, Numerical Analysis, Konark Publishers Pvt. Ltd.
8. Gupta-Malik, Calculus of finite differences and Numerical Analysis.

Semester – VI Syllabus for Paper 8 (Practical)

Subject Title (Practical)	**Numerical Analysis Lab**
Subject Code	**MAT-602P**
Teaching Hours	**4 Hours/Week**
Credits	**2**
Total Teaching Hours	**60 Hours**
Max. Marks	**50 (S.A.- 25 + I.A. - 25)**

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open-Source Software (FOSS) tools for computer programming.
- Solve problem on numerical Analysis studied in **MAT-602T** by using FOSS software's.
- Acquire knowledge of applications of Numerical Analysis through FOSS.

FOSS tools: Scilab/ Maxima/ Python/ R programming

1. Program to find root of an equation using bisection and Regula-Falsi methods.
2. Program to find root of an equation using Newton-Raphson and Secant methods.
3. Program to solve system of algebraic equations using Gauss-elimination method.
4. Program to solve system of algebraic equations using Gauss-Jordan method.
5. Program to solve system of algebraic equation using Gauss-Jacobi method.
6. Program to solve system of algebraic equation using Gauss-Seidel method.
7. Program to solve the system of algebraic equations using SOR method.
8. Program to evaluate integral using Simpson's 1/3 and 3/8 rules.
9. Program to evaluate integral using Trapezoidal and Weddle rules.
10. Program to find the sums of powers of successive natural numbers using Newton – Gregory technique.
11. Program to find differentiation at specified point using Newton-Gregory interpolation method.
12. Program to find the missing value of table using Lagrange method

Web Resources

- Web Math
- Wolfram Math work.