

**SYLLABUS FOR
DEGREE LEVEL COURSE
IN MATHEMATICS,
B. B. (Auto.) Mahavidyalaya,
Chandikhole**

DEPT. OF MATHEMATICS

**DEPARTMENT OF MATHEMATICS
BABA BHAIRABANANDA (AUTONOMOUS) MAHAVIDYALAYA
CHANDIKHOLE, JAJPUR, ODISHA**

MATHEMATICS (HONOURS)

SEMESTER-I

C:1-CALCULUS-I

(Total Marks-100)

Part-I(Mid-Semester: 20Marks + Semester: 50 Marks)

4 Lectures, 1 Tutorial (Per week)

Unit-I

Hyperbolic functions ,higher order derivatives, Leibnitz rule and its applications to problems of the type $e^{ax+b} \sin x, e^{ax+b} \cos x, (ax + b)^n \sin x, (ax + b)^n \cos x$ concavity and inflection points , asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves,lhospitals rule, applications in business, economics and life sciences

Unit-II

Reduction formulae , derivations and illustrations of reduction formulae of the type $\int \sin^n x dx, \int \cos^n x dx, \int \tan^n x dx, \int \sec^n x dx, \int \sin^n x \cos^n x dx, \int (\log x)^n dx$, Volumes by slicing, disks and washers methods, volumes by cylindrical, shells, parametric equations parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

UNIT-III

Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics . sphere, cone, cylinder, conicoids.

UNIT-IV

Vector triple product, introduction to vector functions, operations with vector valued functions limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration.

Mark Distributions:

- 5 Objective Questions carrying 02 marks each
- 08 long questions carrying 05 marks each

Part-II(Practical)

(Marks-30)

List of practicals(Using any software/ MATLAB)

Practical/Lab work to be performed on a computer

1. Plotting the graphs of the functions e^{ax+b} , $\log(ax + b)$, $1/(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $ax+b$ and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of the polynomial of degree 4 and 5. The derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (e.g. Cycloid, Epicycloid, Hypocycloid, Trochoid).
4. Obtaining the surface of revolution of curves.
5. Tracing of conics in Cartesian/polar coordinates.
6. Sketching Ellipsoid, Hyperboloid of one and two sheets, Elliptic cone, Elliptic, Paraboloid, Hyperbolic paraboloid using Cartesian coordinates.
7. Matrix operation (addition, multiplication, inverse and transpose)

Books Recommended:

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002. Chapters: 3(3.1, 3.2), 5(5.2-5.5), 6(6.5, 6.8), 10(10.1-10.5), 11(11.1, 11.4), 12(12.1, 12.2, 12.3, 12.6)
2. B. P. Acharya and D. C. Sahu, Analytical Geometry of Quadratic Surfaces, Kalyani publishers, New Delhi, Ludhiana, Chapters 2 and 3.
3. Santi Narayan, Text Book of Calculus (Part-II), S. Chand & Co. Pvt. Ltd., New Delhi, Chapters: 6, 7, 10(Art. 33-36).
4. Santi Narayan, Text Book of Calculus (Part-III), S. Chand & Co. Pvt. Ltd., New Delhi, Chapters: 1(Art. 1,2), 3(Art. 7, 8), 6(15 restricted).
5. B. Sc. Mathematics, Calculus-I, Kalyani Publishers.

Books for References:

1. G. B. Thomas and R. L. Finney, Calculus 9th Ed., Pearson Education, Delhi, 2005.
2. R. Courant and F. John, Introduction to calculus and analysis (Volumes I and II), Springer Verlag, New York, Inc., 1989.
3. Shanti Narayan and P. K. Mittal, Analytical solid geometry, S. Chand & Co. Pvt. Ltd., New Delhi.
4. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India), Pvt. Ltd. (Pearson Education), Delhi, 2007.
5. Practical Mathematics, Kalyani Publishers.

C:2-ALGEBRA-I

Total Marks:- 100 (Theory: 80 Marks+Mid-Semester 20 Marks)

5 Lectures, 1 Tutorial (Per week)

Unit-I

Polar representation of complex numbers, nth roots of unity, de Moivre's theorem for rational indices and its applications.

Unit-II

Equivalence relations, basic terminology, functions, inverse and composition of functions, one to one correspondence and cardinality of a set, division algorithm, divisibility and Euclidean algorithm, prime numbers, congruence relation between integers, principles of mathematical induction, statement of fundamental theorem of arithmetic

Unit-III

System of linear equations, row reduction and echelon forms, vector equations, the matrix equation $Ax=b$, Solutions of homogeneous and non-homogeneous systems of linear equations, applications of linear systems, linear independence.

Unit-IV

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices, Subspace of \mathbb{R}^n , dimension of subspaces of \mathbb{R}^n and rank of a matrix, eigen values, eigen vectors and characteristic equation of a matrix.

Mark Distributions:

- 10 Objective Questions carrying 02 marks each
- 08 long questions carrying $7\frac{1}{2}$ marks each

Books Recommended:

1. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006, Chapter 2.
2. Edgar G. Goodaire and Michael M. Parameter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore), Pvt. Ltd., Indian Reprint, 2005, Chapters 2(2.4), 3, 4(4.1.1-4.1.6, 4.2.1-4.2.12, 4.3.1-4.3.9, 4.4.1-4.4.8), 5(5.1-5.2).
3. David C. Lay, Linear algebra and its applications, 3rd ed., Pearson Education Asia, Indian Reprint, 2007, Chapters: 1(1.1-1.9), 2(2.1-2.3, 2.8, 2.9), 5(5.1, 5.2).
4. B. Sc. Mathematics, Algebra-I, Kalyani Publishers.

SEMESTER-II

C:3-REAL ANALYSIS (ANALYSIS-I)

Total Marks:- 100 (Theory: 80 Marks+Mid-Semester 20 Marks)

5 Lectures, 1 Tutorial (Per week)

Unit-I

Review of algebraic and order properties of \mathbb{R} , upper bound and lower bound, least upper bound(LUB),greatest lower bound(GLB),LUB &GLB property of an ordered field, completeness of an ordered field, incompleteness of \mathbb{Q} , supremum and infimum, roots, Archimedean property, rational and irrational density theorems, decimal representations of real numbers.

Unit-II

Idea of countable, uncountable sets and theorems relating to these sets, sequences, convergence and divergence of sequences, limit of a sequence and limit theorems, monotonic sequences, weierstrass completeness principle, nested intervals, cantor's completeness principle, idea about higher order cardinals(restricted)

Unit-III

Subsequence, Bolzano weierstrass theorem for sequences, cluster points, Cauchy(fundamental) sequence, Cauchy convergence criterion, limit superior and limit inferior, convergence and divergence of infinite series, series of positive terms, tests of convergence.

Unit-IV

Absolute convergence, rearrangement of terms of a series, conditional convergence of a series, open sets, closed sets, limit points, closure, interior and boundary of sets. Bolzano weierstrass theorem for serie.

Mark Distributions:

- **10 Objective Questions carrying 02 marks each**
- **08 long questions carrying $7\frac{1}{2}$ marks each**

Books Recommended:

1. G.das and S Pattanayak : fundamentals of mathematics analysis, TMH pub-Lishing co. Chapters2(2.1-2.7),3(3.1-3.4),4(4.1-4.8, 4.11-4.13), 5(5.1-5.5)

Books of Reference:

1. R.G Bartle and D.R Sherbert: introduction to real analysis , 3rd ED. John Wiley and sons (A3sia) pvt. Ltd., Singapore, 2002
2. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough: an introduction to analysis, 2nd Ed., Jones and Bartlett, 2010.
3. Brian S. Thomson, Andrew .M. Bruckner and Judith B. Bruckner: elementary real analysis , prentice hall, 2001
4. S.K. Berberian: A first course in real analysis , Springer Verlag, New York, 1994.

5. S.C. Mallik and S. Arora : mathematical analysis, new age international publications.
6. D. Somasundaram and B. Choudhury: a first course in mathematical analysis ,Narosa publishing house.
7. S.L. Gupta and Nisha Rani: real analysis, Vikas publishing house pvt. Ltd. New Delhi.

C:4-DIFFERENTIAL EQUATIONS

(Total Marks-100)

Part-I(Semester Marks: 50 + Mid-Semester: 20 Marks)

4 Lectures, 1 Tutorial (Per week)

Unit-I

Basic concepts of differential equations and mathematical models. First order and first degree ordinary differential equations(variables separable, homogeneous, exact, and linear). Applications of first order differential equations(growth, decay and chemical reactions, heat flow, oxygen debt, economics). Equations of first order but of higher degree

Unit-II

Second order linear equations (both homogeneous and non-homogeneous) with constant coefficients, second order equations with variable coefficients, variation of parameters, method of undetermined coefficients, Euler's equation, second order differential equations with variable coefficients, equations reducible to linear equations with constant coefficients,

UNIT-III

Power series solution of second order differential equations

UNIT-IV

Laplace's transform and its applications to solution of differential equations

Mark Distributions:

- **5 Objective Questions carrying 02 marks each**
- **08 long questions carrying 05 marks each**

Part-II(Practical)

(Marks-30)

List of practical (Using any software/ MATLAB)

Practical/Lab work to be performed on a computer

1. Plotting of second order solutions of family of differential equations
2. Plotting of third order solutions of family of differential equations

3. Growth model (Exponential case only)
4. Decay model (Exponential case only)
5. Oxygen debt method
6. Economic model
7. Vibration problems.

Book recommended

1. J. Sinha roy and S. Padhy: a course of ordinary and partial differential equations, kalyani publishers, New Delhi. Chapter: 1, 2, 3, 4(4.1-4.8), 5, 7, 9(9.1-9.5, 9.10, 9,11, 9.13).
2. Practical Mathematics, Kalyani Publishers.

Books for reference

1. Martin Braun: differential equations and their applications, Springer international.
2. M.D. Raisinghania: advanced differential equations, S. Chand and company Ltd., New Delhi.
3. G. Dennis Zill: a first course in differential equations with modelling applications, Cengage learning India Pvt. Ltd.
4. S.L. Ross: differential equations, John Wiley and sons, India, 2004.

GENERIC ELECTIVES (Interdisciplinary)

[Total: 04 papers, 02 papers each from two allied disciplines(For Physics & Chemistry Hons.)]

(Students may opt. Either in odd or in even semesters)

(Credit: 06 each in Paper, Marks: 100)

Generic Elective:-1

GE-1: CALULUS AND ORDINARY DIFFERENTIAL EQUATIONS

Total marks: 100-(Semester: 80 marks + Mid-Semester: 20 marks)

Unit-I

Curvature, asymptotes, tracing of curves(cartenary, cycloid, folium of Descartes), rectification, quadrature.

Unit-II

Limit and continuity of functions of several variables, partial derivatives of higher orders, homogeneous functions, change of variables, mean value theorem, taylors theorem, and maclaurins theorem for functions of two variables(statements and applications).

Unit-III

Maxima and minima of functions of two and three variables, implicit functions, lagranges multipliers(formula and its applications).

Unit-IV

Ordinary differential equations of order one and degree one (variables separable, homogeneous, exact and linear). Equations of order one but higher degree. Second order linear equations with constant coefficients, homogeneous forms, second order equations with variable coefficients, variation of parameters.

Mark Distributions:

- **10 Objective Questions carrying 02 marks each**
- **08 long questions carrying $7\frac{1}{2}$ marks each**

Books Recommended

1. S. K. Sengar And S. P. Singh: Advanced Calculus, Cengage Learning India Pvt. Ltd. (6th Indian Reprint), Chapters: 1(1.11-1.14 Restricted), 2(2.1-2.13 Restricted), 4(4.1-4.11), 5, 7(7.1-7.3 Restricted), 11(Restricted).
2. Shantinarayan : Text Book Of Calculus, Part-II, S. Chand Ands Co. , Chapter 8(Art. 24, 25, 26).
3. Shantinarayana: Text Book Of Calculus, Part-III, S.Chan And Co. , Chapter-1(Art. 1,2), 3, 4(Art.10 To 12 Ommiting Simpsons Rule), 5(Art.13) And 6(Art-15).
4. G. Samal , S. C. Jena, T. Biswal, D. K. Dalai: Advanced Higher Calculus , Vidyapuri, Chp-6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.
5. J. Sinharoy And S. Padhy: A Course Of Ordinary And Partial Equations, Kalyani Publishers, Chapter:2(2.1-2.7), 3, 4(4.1-4.7), 5.

Books for reference:

1. David V. Weider: Advanced Calculus , Dover Publications.
2. Martin Braun: Differential Equations, And Their Applications Martin Barun, Springer International.
3. M. D. Raisinghania: Advanced Differential Equations, S. Chand And Company Ltd., New Delhi.
4. G. Dennis Zill: A First Course In Differential Equations With Modelling Applications, Cengage Learning India Pvt. Ltd.

Generic Elective:-2

GE-1: LINEAR ALGEBRA, ABSTRACT ALGEBRA & NUMERICAL ANALYSIS

Total marks: 100-(Semester: 80 marks + Mid-Semester: 20 marks)

Unit-I

Vector space, Subspaces, Span of a set, Linear dependence and independence, Dimensions and Basis, Linear transformations, Range, Kernel, Rank, Nullity, Rank-nullity theorem.

Unit-II

Matrices and linear maps, Rank, nullity and transpose of a matrix, types of matrices, elementary row operations, system of linear equations, matrix inversion using row operations, Determinant and rank of matrices, Eigen value and eigen vectors.

Unit-III

Convergence, Errors: Relative, absolute, round off, truncation, Transcendental and polynomial equations by Bisection, Newtons, Secant methods, Rate of convergence of these methods System of linear algebraic equations(Gaussian elimination and Gauss-Jordan methods).

Unit-IV

Interpolation: Lagrange's and Newton's methods, Error bounds, Finite difference operators, Gregory forward and backward difference interpolatory methods (Statements, definitions and uses, examples only), Numerical integration: Introduction, Newton-Cotes Quadrature formula, Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ rule and composite forms.

Mark Distributions:

- **10 Objective Questions carrying 02 marks each**
- **08 long questions carrying $7\frac{1}{2}$ marks each**

Book recommended

1. V Krishnamurthy V.P.Mainar, J. L. ARORA: An Introduction To Linear Algebra , Affiliated East-West Press Pvt.Ltd.New Delhi, Chapters:3,4(4.1 To 4.7),5(Expect 5.3),6(6.1,6.2,6.5,6,6,6.8),7(7.4 Only)
2. .N.Herstein :Topics In Algebra Wiley Eastern Pvt.Ltd. Chapter :2(2.1-2.7),3(3.1,3.2).
3. B.P. Acharya And R.N. DAS :A Course On Numerical Analysis,Kalyani Publishers,New Delhi,Ludhianan .Chapter :1,2 (2.1 To 2.4,2.6,2.8,2.9),3(3.1 To 3.4) ,4(4.1 To 4.2), 5(5.1-5.3), 6(6.1-6.3 except Simpson's $3/8^{\text{th}}$ rule, 6.5).

Books For References:

1. I. H. Seth: Abstract Algebra, Prentice Hall Of India Pvt. Ltd. , New Delhi.
2. S. Kumaresan: Linear Algebra, A Geometric Approach , Prentice Hall Of India.
3. Rao And Bhimasankaran: Linear Algebra, Hindustan Publishing House.
4. S. Singh: Linear Algebra , Vikas Publishing House Pvt. Ltd., New Delhi.
5. Gilbert Strang: Linear Algebra And Its Applications, Cengage Learning India Pvt. Ltd.
6. Galian: Contemporary Abstract Algebra, Narosa Publishing House.
7. Artin: Algebra, Prentice Hall Of India.
8. V. K. Khanna And S. K. Bhambri: A Course In Abstract Algebra, Vikas Publishing House Pvt. Ltd. , New Delhi.

SEMESTER-III

C:5 THEORY OF REAL FUNCTIONS(ANALYSIS-II)

(Total Marks-100)

Total Marks:- 100 (Theory: 80 Marks+Mid-Semester 20 Marks)

5 Lectures, 1 Tutorial (Per week)

Unit-I

Limits of functions($\epsilon - \delta$ approach), sequential criterion for limits, divergence criteria, limit theorems, one sided limits. Infinite limits and limit at infinite limits and limit at infinity. Continuous functions, sequential criterion for continuity, algebra of continuous functions and theorems related to continuity of functions.

Unit-II

Discontinuity and kinds of discontinuity, further properties of continuity, uniform continuity, differentiable functions, left hand and right hand derivatives, algebra of differentiable functions, caratheodory's theorem.

Unit-III

Mean value conditions, global and local maximum and minimum, Rolle's theorem, generalized mean value theorem, Cauchy mean value theorem, Lagrange's mean value theorem and their applications, Darboux's theorem, indeterminate forms, higher order derivatives (Leibnitz theorem), Taylor's theorem and its applications to approximating functions by means of polynomials.

Unit-IV

Maxima and minima, Taylor's theorem with different forms of remainder, Maclaurin's theorem, deduction of Taylor's theorem from mean value theorem, Taylor's and Maclaurin's infinite series, Taylor's series and Maclaurin's series of exponential and trigonometric functions, $(1+x)^n$, $\frac{1}{(ax+b)}$ and $\ln(ax+b)$.

Books recommended:

1. G.Das And S. Pattanayak: Fundamentals Of Mathematics Analysis, TMH Publishing Co. Chapters:6(6.6-6.7), 7(7.1-7.7), 9(9.7only).
2. S. C Mallik And S. Arora: Mathematical Analysis, New Age International Publications, Chapter:6(8.1-8.6).

Books For Reference:

1. R. Bartel And D.R. Sherbert, Introduction To Real Analysis, John Wiley And Sons, 2003.
2. K. A. Ross, Elementary Analysis: The Theory Of Calculus, Springer, 2004.
3. A. Mattuck, Introduction To Analysis, Prentice Hall, 1999.
4. S. R. Ghorpade And B. V. Limaye, A Course In Calculus And Real Analysis, Springer, 2006.

C-6:GROUP THEORY(ALGEBRA-II)

Total Marks:- 100 (Theory: 80 Marks+Mid-Semester 20 Marks)

5 Lectures, 1 Tutorial (Per week)

Unit-I

Symmetries of a square, Dihedral groups, definition and examples of groups including Permutation groups and Quaterion groups(illustration through matrices), Elementary properties of groups. Subgroups and examples of subgroups, centralizer, normalizer, center of group, product of two subgroups.

Unit-II

Properties of cyclic groups, classification of subgroups of cyclic groups, cyclic notation for permutations, properties of permutations, Even and odd permutations, alternating group, properties of cosets, Langranges theorem and consequence including Fermat's-Little theorem.

Unit-III

External direct product of a finite number of groups, normal subgroups, factor groups, cauchys theorem for finite abelian groups.

Unit-IV

Group homomorphism, properties of homomorphism, cayleys theorem, properties of isomorphisms, first isomorphism theorem, second and third isomorphism theorems(statement only).

Book Recommended:

1. Joseph A. Gallian: Contemporary Abstract Algebra(4th Edn.), Narosa 6.2 Only), VII, VIII, IX, X, XI.

Books For Reference:

1. D.S.Malik, J.M. Mordeson, And M.K. Sen: Fundamentals Of Abstract Algebra, Mcgraw-Hill, 1997.
2. John B. Fraleigh: A Course In Abstract Algebra, 7th Ed. , Pearson,2002.
3. M. Artin: Abstract Algebra, 2nd Ed., Pearson, 2011.
4. Joseph J. Rotman: An Introduction To The Theory Of Groups, 4th Ed. , Springer Verlag, 1995.
2. publishing house, new delhi, chapters: I, II, III, IV, V, VI,(up to theorem I.N. Herstein: Topics In Algebra, Wiley Eastern Limited, India, 1975.

C:7 PARTIAL DIFFERENTIAL EQUATIONS & SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

(Total Marks-100)

Part-I(Mid-Semester: 20Marks + Semester: 50 Marks)

4 Lectures, 1 Tutorial (Per week)

Unit-I

Systems of linear differential equations, basic theory of linear systems, trial solutions method for linear system with constant coefficients, simultaneously linear first order equations in three variables, methods of

solutions, pfaffian differential equations, method of solutions of pfaffian differential equations in three variables.

Unit-II

Formation of first order partial differential equations, linear and non-linear partial differential equations of first order, special types of first order equations, solutions of partial differential equations of first order satisfying given conditions.

Unit-III

Linear partial differential equations with constant coefficient, equations reducible to linear partial differential equations with constant coefficients, partial differential equations with variable coefficients, some standard forms of variable coefficients.

Unit-IV

Laplace equation, solution of laplace equations by separation of variables, one-dimensional wave equation, solution of the wave equations(method of separation of variables), diffusion equation, solution of one-dimensional diffusion equation, method of separation if variables.

Part-II(Practical)

(Marks-30)

List of practicals(Using any software/ MATLAB)

Practical/Lab work to be performed on a computer

1. To find the general solution of the non-homogeneous system of the form:

$$\frac{dx}{dt} = a_1x + b_1y + f_1(t), \frac{dy}{dt} = a_2x + b_2y + f_2(t) \text{ with given conditions.}$$

2. Plotting the integral surfaces of a given first order PDE with initial data.

3. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions.

(a) $u(x, 0) = \phi(x), u_t(x, 0) = \varphi(x), x \in R, t > 0,$

(b) $u(x, 0) = \phi(x), u_t(x, 0) = \varphi(x), u_x(0, t) = 0, x \in (0, \infty), t > 0$

(c) $u(x, 0) = \phi(x), u_t(x, 0) = \varphi(x), u(0, t) = 0, x \in (0, \infty), t > 0$

(d) $u(x, 0) = \phi(x), u_t(x, 0) = \varphi(x), u(0, t) = 0, u(1, t) = 0, 0 < x < 1, t > 0$

4. Solution of diffusion equation $\frac{\partial u}{\partial t} - k^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions:

(a) $u(x, 0) = \phi(x), u(0, t) = a, u(1, t) = b, 0 < x < 1, t > 0$

(b) $u(x, 0) = \phi(x), x \in R, 0 < t < T.$

(c) $u(x, 0) = \phi(x), u(0, t) = a, x \in (0, \infty), t \geq 0.$

Book Recommended:

1. J. Shina Roy And S. Padhy: A Course On Ordinary And Partial Differential Equations, Kalyani Publishers, New Delhi, Ludhiana, 2012.

Chapters: 8(8.1-8.3),11, 12, 13(13.1-13.5), 15(15.1 And 15.5 Only), 16.1 And 16.1.1only), 17(17.1-17.3).

Books For References:

1. Tyn Myint-U And Lokenath Debnath: Linear Partial Differential Equations For Scientists And Engineers, 4th Edition, Springer, Indian Reprint, 2006.
2. S.L. Ross: Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

SEMESTER-IV

C-8:NUMERICAL METHODS

(Total Marks-100)

Part-I(Mid-Semester: 20 Marks + Semester: 50 Marks)

4 Lectures, 1 Tutorial (Per week)

Unit-I

Rate of convergence, algorithms, errors: relative, absolute, round off, truncation. Numerical solution of non linear equations : bisection method, regular-falsi method, secant method, Newton-Raphson method, fixed-point iteration method, Newton-Raphson method for multiple roots, Aitken's Δ^2 process, Muller's method. Rate of convergence of these methods.

Unit-II

System of liner equations: Gaussian elimination method, Gauss-Jordan method, Gauss-Jacobi method, Gauss-Sidel method and their convergence analysis.

Unit-III

Polynomial interpolation: Existence uniqueness of interpolating polynomials, Lagrange and Newtons divided difference interpolation, error in interpolation, central difference and averaging operators, Gauss-forward and backward difference interpolation, simple numerical methods for derivatives, interpolatory formulas.

Unit-Iv

Numerical integration: some simple quadrature rules, newton cotes rules, Trapezoidal rule, Simpsons rule, Simpsons $3/8^{\text{th}}$ rule, compound quadrature rules, compound mid-point rule, compound trapezoidal rule, compound Simpsons rule, Gauss-legender 2-point and 3-point rules. Numerical solutions of differential equations: eulers method. Runge-kutta methods of orders two, three and four.

Part-II(Practical)

(Marks-30)

List of practicals(Using any software/ MATLAB)

Practical/Lab work to be performed on a computer

1. Calculate the sum $1/1+1/2+1/3+1/4+\dots+1/N$.

2. To find the absolute value of an integer.
3. Enter 100 integer into an array and sort them in an ascending order.
4. Bisection method.
5. Newton-Raphson method.
6. Secant method.
7. Regular falsi method.
8. LU decomposition method.
9. Gauss Jacobi method.
10. SOR method or gauss siedel method.
11. Langrange interpolation or newton interpolation.
12. Simpsons rule.

Note : for any of the CAS (computer aided software) data types simple data types, floating data types, chapter data types, arithmetic operator precedence, variable and constant declarations, expressions, input/output, relational operators, logical operator and logical expressions, control statements and loop statements, array should be introduced to the students.

Book Recommended:

1. B. P. Acharya And R. N. Das: A Course On Numerical Analysis , Kalyani Publishers, New Delhi, Ludhiana.Chapters:0(0.2,0.8),1(1.8, 1.9), 2(2.1-2.4, 2.6-2.9), 3(3.1-3.4, 3.6-3.11),5(5.1-5.3), 6(6.1-6.3, 6.5 ,6.10, 6.11), 7(7.1-7.5 And 7.7).
2. Brian Bradie, A Friendly Introduction To Numerical Analysis, Pearson Education, India,2007.

Books For Reference:

1. M. K. Jain, S. R. K. Lyenger And R.K. Jain: Numerical Methods For Scientific And Engineering Computation, 6th Ed., New Age International Publisdher, India, 2007.
2. C.F. Geraldand P.O. Wheatley: Applied Numerical Analysis, Pearson Education, India,2008.
3. Uri M. Ascher And Chen Greif: A First Course In Numerical Methods, 7th Ed., Phi Learning Private Limited,2013
4. John H. Mathews And Kurtis D. Fink: Numerical Methods Using Matlab, 4th Ed., Phi Learning Private Limited,2012.
5. P. Khandasamy, K. Thilagavathy And K. Gunavathi: Numerical Methods, S. Chand & Company Ltd., 2012.
6. E. Balagurusamy: Numerical Methods, Tata Mcgraw-Hill Pub. Co. Ltd., 1999.

C-9:REIMANN INTEGRATION AND SERIES OF FUNTIONS(ANALYSIS-III)

Total Marks:- 100 (Theory: 80 Marks + Mid-Semester 20 Marks)

5 Lectures, 1 Tutorial (Per week)

Unit-I

Riemann integration, inequalities of upper and lower sums, Riemann conditions of integrability . Riemann sum and definition of Riemann integral through Riemann sums, equivalence of two definitions, Riemann integrability of monotone and continuous functions, properties of the Riemann integral, definition and integrability of piecewise continuous and monotone functions, fundamental theorems of calculus.

Unit-II

Improper integrals, series and integral, absolute convergence of integrals, convergence of Beta and Gamma functions.

Unit-III

Pointwise and uniform convergence of sequence of functions, Cauchy's criterion and Weierstrass M-test for uniform convergence, Dedekind test, uniform convergence and continuity, term by term integration of series, term by term differentiation of series.

Unit-IV

Power series (Cauchy's Hadamard theorem), radius of convergence, differentiation and integration of power series, Abels limit theorem, Stirling's formula, more about Taylor's series, Weierstrass approximation theorem.

Books Recommended:

1. G. Das And S. Pattanayak: Fundamentals Of Mathematics Analysis, Tmh Publishing Co. , Chapter: 4(4.14 Only), 8(8.1-8.6), 9(9.1-9.6,9.8).
2. S.C. Mallik And S. Arora : Mathematical Analysis , New Age International Ltd. ,New Delhi, Chapters: 11(3.3, 4.3 Only), 12(Restricted)

Books For Reference:

1. K.A. Ross, Elementary Analysis: The Theory Of Calculus, Undergraduate Texts In Mathematics, Springer(Sie), Indian Reprint,2004.
2. R.G. Bartle D.R. Sherbert: Introduction To Real Analysis,3rd Ed., John Wiley And Sons(Asia)Pvt. Ltd. , Singapore, 2002.
3. Charles G. Denlinger : Elements Of Real Analysis, Jones And Bartlett(Student Edition),2011.
4. Shanty Narayana And M.D. Raisinghania : Elements Of Real Analysis, S. Cahnd And Co. Pvt.Ltd.

C-10:RING THEORY AND LINEAR ALGEBRA(ALGEBRA-III)

Total Marks:- 100 (Theory: 80 Marks + Mid-Semester 20 Marks)

5 Lectures, 1 Tutorial (Per week)

Unit-I

Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring, ideal, ideal generated by a subset of a rings, operations on ideals prime and maximal ideals.

Unit-II

Ring homomorphisms, properties of ring homomorphisms, isomorphism theorem I,II and III, field of quotients.

Unit-III

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit-IV

Linear transformations, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphism, isomorphism theorems, invertibility and isomorphisms, change of co-ordinate matrix.

Book recommended:

1. Joseph A. Galian : Contemporary Abstract Algebra(8th Edn.), Narosa Publishing House, New Delhi, Chapter: 12, 13, 14, 15.
2. Stephen H. Friedberg, Arnold J. Insel, And Lawrence E. Spence: Linear Algebra, 4th Ed., Prentice-Hall Of India Pvt. Ltd., New Delhi, 2004. Chapter: 1(1.2-1.6), 2(2.1-2.5).

Books for reference:

1. John B. Fraleigh : A First Course In Abstract Algebra, 7th Ed. , Pearson, 2002.
2. M. Artin: Abstract Algebra, 2nd Ed. , Pearson, 2011.
3. S. Lang: Introduction To Linear Algebra, 2nd Ed. , Springer, 2005.
4. Gilbert Strang : Linear Algebra And Its Applications, Cengage Learning India Pvt. Ltd.
5. S. Kumaresan : Linear Algebra A Geometrical Approach, Prentice Hall Of India, 1999.
6. Kenneth Hoffman , And Ray Alden Kunze: Linear Algebra, 2nd Ed., Prentice Hall Of India Pvt. Ltd., 1971.
7. I.N. Herstein : Topics In Algebra, Wiley Eastern Pvt. Ltd.

Skill Enhancement Courses(SEC)
(Credit: 02 each, Marks: 100)
Theory: 80 Marks + Mid-Sem.: 20 Marks

SEC-I (Semester-III)

COMMUNICATIVE ENGLISH & WRITING SKILL (Compulsory)

SEC-II (Semester-IV)

LOGIC & SETS

Introduction, propositions, truth table, negation, conjunction and disjunction, implication, biconditional, converse, contrapositive and inverse propositions, precedence of logical operators, propositional equivalence, logic equivalences, predicates and quantifiers: Introduction, Quantifiers, Binding variable and negations.

Sets, subsets, set operations, laws of set theory and Venn-diagrams, examples of finite and infinite sets, Finite sets and counting principle, Empty set and its properties, Standard set operations, Classes of sets, power of a set.

Difference and symmetric difference of two sets, set identities, generalized of union and intersections, relation: product set, composition of relations, types of relations, partitions, equivalence relations with example of congruence modulo relation.

Books Recommended:

1. Logic and sets, D. K. Dalei, Kalyani Publishers.