

The BGE Society's
Sitabai Arts, Commerce & Science College
AFFILIATED TO SANT GADGE BABA AMRAVATI UNIVERSITY
FACULTY OF SCIENCE
Syllabus For Bachelor Of Science
1st Sem, Mathematics Paper-I
(Algebra and Trigonometry)

Unit-I : De Moivre's theorem, roots of complex number, circular functions, hyperbolic function, inverse hyperbolic function. Relation between circular functions and hyperbolic functions.

Separation of real and imaginary parts of the circular and hyperbolic functions of complex variable.

Unit-II : Trigonometric series: Gregory series, Euler's series, Machin's series, Rutherford's series, summation of series, series based upon $\sin x$, $\cos x$, $\sinh x$, $\cosh x$, exponential series, logarithmic series and series based upon Gregory series.

Unit-III: Elements of quaternion: Definition. Equality and addition, multiplication, complex conjugate of a quaternion, norm, inverse, quaternion as a rotation operator, geometric interpretation, a special quaternion product, perator algorithm, quaternion to matrices.

Unit-IV: Theory of equations: Relations between the roots and coefficients, transformation of equations, cubic equations (Cardon method), Descarte's rule of signs, biquadratic equations.

Unit-V : Matrices: Rank of a matrix, row rank, column rank, eigenvalues, eigenvectors and the characteristic equation of a matrix. Cayley- Hamilton theorem and its application.

References Books:

- 1) K.B.Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd. New Delhi, 2000.
- 2) H.S.Hall and S.R.Knight, Higher Algebra, H.M.Publications, 1994.
- 3) Chandrika Prasad, Text Book on Algebra & Theory of Equations, Pothishala Private Ltd., Allahabad.
- 4) S.L.Loney, Plane Trigonometry Part-II, MacMillan & Co., London.
- 5) R.S.Verma & K.S.Shukla, Text Book on Trigonometry, Pothishala Pvt.Ltd. Allahabad.
- 6) Ayres Jr Frank : Matrices : Schaum's outline series, McGraw Hill Book Company, Singapore, 1983.13 14
- 7) T M Karade, Maya S.Bendre, Lectures on Algebra and Trigonometry.
- 8) Hohn Franz E : Elementary Matrix Algebra, Amerind Publishing Co., Pvt.Ltd. 1964.
- 9) Spiegel M.R. :Comples Variables, Schaum's outline series, McGraw Hill, 1981.
- 10) Shanti Narayan : A Test Book of Matrices, S.Chand & Co. Delhi.
- 11) Jack B Kuipers: quaternion algebra of Quaternions and rotation sequences, Princeton University Press, Fifth printing, 2002.

Semester I
1st Sem, Mathematics Paper-II
(Differential and Integral Calculus)

Unit-I : Definition of the limit of a function, basic properties of limits, continuous functions and classification of discontinuities.

Unit-II : Differentiability, successive differentiation, Leibnitz theorem, indeterminate forms and L'Hospital rule.

Unit-III : Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Maclaurin and Taylor series expansions.

Unit-IV : Partial derivatives and differentiation of real valued function of two variables, homogeneous functions, Euler's theorem on homogeneous functions.

Unit-V: Integration of the form $\int \frac{P_n(x)}{\sqrt{Q}}$, reduction formulae for $\int \sin^n x dx$, $\int \cos^n x dx$ and Walli's formula, $\int \tan^n x dx$, $\int \cot^n x dx$, $\int \sec^n x dx$, $\int \operatorname{cosec}^n x dx$, $\int \sin^n x \cos^n x dx$, quadrature, rectification,

References :

- 1) Ayres F Jr. : Differential equations, Schaum's outline series, McGraw Hill, 1981.
- 2) Ayres F.Jr. : Calculus, Schaum's Outline series, McGraw Hill, 1981.
- 3) Karade T.M., J.N.Salunke, M.S.Bendre : Graduate level Calculus, Sonu- Nilu, 5, Bandu Soni ayout, Gayatri Road Parsodi, Nagpur.
- 4) Karade T.M., Maya S. Bendre : Integration and Differential equations, Sonu- Nilu, 5, Bandu Soni layout, Gayatri Road Parsodi, Nagpur.
- 5) Edwards J : Differential Calculus for Beginners, MacMillan and Co.Ltd.,1963.
- 6) Edwards J : Integral Calculus for Beginners, AITBS, Publishers and Distributors, 1994.
- 7) Forsynth A.R.: ATreatise on Differential Equations, (Sixth Edition) MacMillan and Co.1956.
- 8) Greenspan D. : Introduction to Calculus, Harper and Row, 1968.
- 9] Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
- 10] Gorakh Prasad : Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
- 11] Erwin, Kreyszig :Advanced Engineering Mathematics, John Wiley & Sons, 1999.
- 12] N.Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.

MATHEMATICS

2nd Sem, Mathematics Paper-III

(Differential Equations: Ordinary and Partial)

Unit-I : Degree and order of a ordinary differential equation, linear differential equations and differential equations reducible to the linear form. Exact differential equations. Differential equations of first order and higherdegree, differential equations solvable for p and y, differential equations in Clairaut's form. Orthogonal trajectories.

Unit-II: Second order linear differential equations with constant coefficients, homogeneous linear ordinary differential equations, equations reducible to homogeneous differential equations.

Unit-III: Reduction of order, transformation of the equation by changing the dependent variable and independent variable, normal form, method of variation of parameters. Ordinary simultaneous differential equations.

Unit-IV: Formation of partial differential equations, partial differential equations of the first order, total differential equation (Pfaffian). Lagrange's method, some special types of equations which can be solved easily by methods other than the general method.

Unit-V : Compatible differential equations. Charpit's general method of solution, partial differential equations of second and higher orders. Homogeneous and non-homogeneous equations with constant coefficients.

References :

- 1) Ayres F Jr. : Differential equations, Schaum's outline series, McGraw Hill, 1981.
- 2) Ayres F.Jr. : Calculus, Schaum's Outline series, McGraw Hill, 1981.
- 3) Birkhoff G : Ordinary Differential equations, John Wiley and Sons, and Rota G.C.1978.
- 4) Coddington : An Introduction to Ordinary Differential Equations, E.A.Prentice Hall of India, 1998.
- 5) Karade T.M., Bendre M.S.: Lectures on Calculus and Differential and Equations, Sonu-Nilu, 5, Bandu Soni layout, Gayatri Road Parsodi, Nagpur.
- 6) Murray D.A.: Introductory course in Differential Equations, Orient Longman(India), 1967. 7) Erwin, Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 1999.
- 8) Piaggio HTS: Differential Equations, CBS Publishers & Distributors, Delhi, 1985.
- 9) Siminons G.F. : Differential Equations, Tata McGraw Hill, 1972.
- 10) Karade T.M., Maya S. Bendre : Integration and Differential equations, Sonu- Nilu, 5, Bandu Soni layout, Gayatri Road Parsodi, Nagpur.
- 11) T.M.Karade, Lectures on Differential Equations, Sonu Nilu Publication, Nagpur.
- 12) A.R.Forsyth. A Treatise on Differential Equations. Macmillan and Co.Ltd.London.
- 13) Ian N., Sneddon, Elements of Partial Differential Equations. McGraw- Hill Book Company, 1988.
- 14) Jane Cronin. Differential equations, Marcel Dekkar, 1994.
- 15) Frnak Ayres. Theory and Problems of Differential Equations. McGraw Hill Book Company, 972.
- 16) Richard Bronson, Theory and Problems of Differential Equations. McGraw Hill Inc, 1973.

Semester II
2nd Sem, Mathematics Paper-IV

(Vector Analysis and Solid Geometry)

Unit-I : Scalar and vector product of three vectors, product of four vectors, vector differentiation and vector integration.

Unit-II : Space curve t , n , b vectors, fundamental planes, curvature, torsion, Frenet-Serret formulae.

Unit-III : Gradient, divergence and Curl, directional derivative, line integral (existence and valuation), work done, Greens theorem.

Unit-IV : Sphere: Different forms of sphere, section of a sphere by a plane, sphere through a given circle, intersection of sphere and a line, orthogonal sphere and condition of orthogonality.

Unit-V : Cone : The equation of a cone with a guiding curve, cone with vertex and origin, right circular cone. Cylinder: equation of right circular cylinder.

References :

- 1) Murray R. Spiegel, Theory and problems on Advanced Calculus, Schaum Publishing Company, New York.
- 2) Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
- 3) N.Saran and S.N.Nigam , Introduction to vector Analysis Pothishala Pvt.Ltd.Allahabad.
- 4) Erwin Kreyszig Advanced Engineering Mathematics, John Wiley & sons, 1999.
- 5) Shanti Narayan, A Text Book of Vector Calculus, S.Chand & Co. New Delhi.
- 6) S.L.Loney, The elements of Co-ordinate Geometry Macmillan and Company, London.
- 7) Gorakh Prasad and H.C.Gupta, Text Book on Co-ordinate Geometry, Pothishala Pvt.Ltd.Allahabad.
- 8) T.M.Karade, Maya S. Bendre, Lectures on Vector analysis and geometry, Sonu Neelu Publication, Nagpur.
- 9) R.J.T.Bell, Elementary Treatise on Co-ordinate Geometry of Three Dimensions, Macmillan India Ltd., 1994.
- 10) P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Two Dimensions, Wiley Eastern Ltd., 1994.
- 11) P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd, 1999.
- 12) N.Saran and R.S.Gupta, Analytical Geometry of three dimensions, Pothishala Pvt.Ltd.Allahabad.

1. MATHEMATICS
3rd Sem, Mathematics – Paper-V
(Advanced Calculus)

Unit. I : Sequence : Theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion.

Unit II : Series : Series of non negative terms, convergence of geometric series and the series $\sum \frac{1}{n^p}$
Comparison tests, Cauchy's integral test, Ratio test, Root test.

Unit III : Limit and continuity of functions of two variables, Algebra of limits and continuity, Taylor's theorem for function of two variables. Maxima and minima, Lagrange's multipliers method. Jacobians.

Unit IV : Properties of Beta and Gamma functions. Double integral : Definition and Evaluations of double integral.

Unit V : Change of order of integration in double integral, triple integral (evaluation technique only). Double integral by transforming it into polar coordinates.

Reference Books :

- 1) T. M. Karade, M. S. Bendre :Lectures on Vector Analysis and Geometry, Sonu-Nilu Publication, Nagpur.
- 2) T. M. Karade, J. N. Salunke, A. G. Deshmukh, M. S. Bendre: Lectures on Advanced Calculus, Sonu-Nilu Publication, Nagpur.
- 3) Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd. Allahabad.
- 4) Gorakh Prasad : Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
- 5) Murray R. Spiegel :Theory and Problems of Advanced Calculus, Schaum Outline Series.
- 6) S. C. Malik and Arora : Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
- 7) O. E. Stanaitis : An Introduction to Sequences, Series and improper Integrals, Holden-Dey , Inc. San Francisco, California.
- 8) Earl D. Rainville : Infinite series, The Macmillan Co., New York.
- 9) N. Piskunov : Differential and Integral Calculus, Peace publishers, Moscow.
- 10) Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
- 11) D. Somasundaram and B. Choudhary: A First course in Mathematical Analysis, Narosa Publ. House.

**3rd Sem - Mathematics – Paper-VI
(Partial Differential Equations)**

Unit I : Partial differential equations of first order. Lagrange's solutions. Some special types of equations which can be solved easily by methods other than general method. Charpit's general method of solutions. Jacobi's Method.

Unit II : Partial differential equations of second and higher orders. Homogeneous and non-Homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients.

Unit III : Classifications of linear partial differential equations of second order. Monge's methods.

Unit IV : Calculus of Variation : Functional, continuity of functional, variational problems with fixed boundaries, Extremum of a functional.

Unit V : Method of separation of variables, method of separation of variable for wave equations and heat equation in one dimension.

Reference Books :

- 1) T. M. Karade : Lectures on Differential Equations, Sonu-Nilu Publication, Nagpur.
- 2) J. N. Sharma : Differential Equations, Krishna Prakashan Mandir, Meerut.
- 3) Ian N. Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
- 4) D. A. Murray : Introductory course on Differential Equations. Orient Longman (India), 1967.
- 5) Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, Inc. New York, 1999.
- 6) A. R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd. , London.
- 7) Frank Ayres : Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 8) B. Courant and D. Hilbert : Methods of Mathematical Physics, Vol. I & II, Wiley-interscience, 1953.
- 9) A. S. Gupta : Calculus of Variations with Applications, Prentice-Hall of India, 1997.
- 10) I. M. Gelfand and S. V. Fomin : Calculus of Variations, Prentice-Hill Englewood Cliffs (New Jersey), 1963.
- 11) J. I. Oden and J. N. Reddy : Variational Methods in Theoretical mechanics, Springer Verlag, 1976.
- 12) Jane Cronin : Differential Equations, Marcel Dekkar, 1994.
- 13) G.S.Sharma, I.J.S. Saran, Engineering Mathematics, P.B.H. Publishing, New Delhi.
- 14) Rajsinghaniya M.D. : Ordinary and Partial Differential Equations, S.Chand and Co., New Delhi.
- 15) K.Shaukatrao Rao, Partial Differential Equations.

4th Sem - Mathematics – Paper-VII
(Laplace Transforms and Fourier Series)

Unit I : Laplace transform. Linearity of Laplace transform. Existence theorem for Laplace transform, Shifting Theorem, Change of scale property, Laplace transform of derivatives. Multiplication by power of t .

Unit II : Inverse Laplace transform, Shifting Theorem, Change of scale property, Inverse Laplace transform of derivative, division by s . Convolution theorem.

Unit III : Solution of integral equations and system of ordinary and partial differential equations using the Laplace transform. Solutions of simultaneous ordinary differential Equations using Laplace transform

Unit IV : Fourier Series, Fourier expansion of piecewise monotonic functions, Fourier series of Even and odd function. Half range series..

Unit V : Bessel and Legendre functions and their Properties, recurrence relations and generating functions. Sturm- Liouville problem. Eigen Function, Orthogonality of eigen functions.

Reference Books :

- 1) T. M. Karade : Lectures on Differential Equations, Sonu-Nilu Publication, Nagpur.
- 2) Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, Inc. New York, 1999.
- 3) A. R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd. , London.
- 4) Frank Ayres : Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 5) B. Courant and D. Hilbert : Methods of Mathematical Physics, Vol. I & II, Wiley-interscience, 1953.
- 6) I. N. Sneddon : Fourier Transforms, McGraw Hill Book Co.
- 7) Goel and Gupta : Integral Transforms, Pragati Prakashan , Meerut.
- 8) Raisinghaniya, M.D., Integral Transform, S.Chand & Co., N.D.

4th Sem - Mathematics – Paper-VIII
(Mechanics)

Statics :

Unit I : Coplanar forces : Forces acting at a point, Triangle law of forces. Parallel forces. Equilibrium of forces, Lami's theorem. Analytical conditions of equilibrium of coplanar forces.

Unit II : Virtual work. Uniform Catenary .

Dynamics :

Unit III : Velocities and accelerations along the coordinate axes, radial and transverse directions, tangential and normal directions. Projectile.

Unit IV : Constraints. Generalised Coordinates D'Alembert's principle and Lagrange's equations of motion.

Unit V : Central force motion : Areal velocity. Equivalent one body problem. Central Orbit . Virial theorem. Kepler's laws of motions (Statement Only).

Reference Books :

- 1) T. M. Karade, M. S. Bendre : Lectures on Mechanics, Sonu-Nilu Publication, Nagpur.
- 2) H. Goldstein : Classical Mechanics (2nd edition), Narosa Publishing House, New Delhi.
- 3) S. L. Loney : Statics, Mc-Millan and co., London.
- 4) R. S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd. , Allahabad.
- 5) S. L. Loney : An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.
- 6) D. K. Daftari, V. N. Indurkar : Elements of Statics, Published by Dattsons, J. Nehru Marg, Nagpur.
- 7) M. A. Pathan : A modern Text Book of Statics, Pragati Prakashan, Nagpur.

5th Sem, Mathematics - Paper – IX (Analysis)

Unit I : Riemann Integral. Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence. Comparison and limit tests **Unit II :** Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic and Conjugate functions. Milne Thompson method

Unit III : Elementary functions Mapping by elementary functions. Mobius transformations. Fixed points. Cross ratio. Inverse points and critical points. Conformal mappings.

Unit IV : Metric Spaces :Countable and uncountable sets. Definition & examples of metric spaces. Neighbourhoods. Limit points. Interior points. Open and closed sets. Closure, Interior & boundary points. Sub-space of a metric space. Cauchy sequences. Completeness. Cantor's intersection theorem. Baire category theorem.

Unit V : Compactness. Connectedness. Limit of functions. Uniform continuous functions. Continuity and compactness. Continuity and connectedness.

Reference Books :

1. R. R. Goldberg: Methods of Real Analysis, Oxford IBH publishing Co. New Delhi, 1970.
2. T. M. Karade, J. N. Salunke, K. S. Adhav, M. S. Bendre : Lectures on analysis, Sonu Nilu Publication, Nagpur.
3. Walter Rudin: Principles of Mathematical Analysis, International students edition (Third edition)
4. T. M. Apostol :Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.,
5. S. Lang : Undergraduate Analysis, Springer-Verlag New York, 1983.
6. D. Somasundaram & B. Choudhari : A First Course in Mathematical Analysis, New Delhi. 1997.
7. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
8. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
9. R. V. Churchill and J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw Hill, New York, 1990
10. Mark J Ablowitz and : A.S. Fokas, Complex Variable Introduction and Application ,Cambridge University Press ,South Asian Edition ,1998.
11. Shanti Narayan : Theory of functions of Complex Variable,,S.Chand and Co. New Delhi.
12. E.T.Coption,:Metric Spaces, Cambridge University Press ,1968.
13. P.K.Jain and K.Ahmed ,:Metric Spaces ,Narosa Publishing House, New Delhi 1996.
14. G.F.Simmons :Introduction to Topology and Modern Analysis, McGraw Hill, New York, 1963

Semester V

5th Sem, Paper – X (Modern Algebra)

Unit I : Normal Subgroups: Definition, examples. Different characterizations of normal subgroups, Algebra of normal subgroups, Quotient group.

Unit II : Homomorphism and Isomorphism: Homomorphism, Homomorphic image, Kernel of homomorphism, Isomorphism of groups, Fundamental theorem of homomorphism, Natural homomorphism.

Unit III : Ring: Definition, Examples , Properties of ring, Commutative ring, Ring with unity, Zero divisor, Without zero divisor, Boolean ring, Cancellation laws in rings, Subring.

Unit IV : Integral domain and field: Definition, examples, field, Subfield, Prime field, The field of quotients of an integral domain, Characteristics of a ring.

Unit V : Polynomial rings: Division Algorithm theorem, Unique factorization theorem for polynomials over a field, Polynomials over rational field, Gauss Lemma, The Eisenstein Criterion. Unique factorization domain (UFD) (only Definition).

Reference Books:

1. I.N.Herstein:Topics in Algebra, Wiley Eastern Ltd., New Delhi,1975.
2. N.Jacobson: Basic Algebra ,Vol. I and II W.H.Freeman,1980(Hindustan Publishing Co.
3. Shanti Narayan :A Text Book Of Modern Abstract Algebra, S. Chand and Co. ,New Delhi
4. K.B.Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd.New Delhi,2000
5. P.B.Bhattacharya, S.K.Jain and S.R.Nagpal : Basic Abstract Algebra (IInd Edition)Cambridge University Press Indian Edition, 1997
6. K.Hoffman and R.Kunze :Linear Algebra ,II nd Edition Prentice Hall,Englewood Cliffs, New Jersey,1971.
7. S.K.Jain, A Gunawardhana and P.B.Bhattacharya : Basic Linear algebra with MATLAB, Key College Publishing (Springer- Verlag)2001
8. S. Kumaresan : Linear Algebra, A Geometric Approach,P Prentice Hall of India Pvt.Ltd.New Delhi,2000
9. Vivek Sahai and Vikas Bisht :Algebra, Narosa Publishing House ,1997.
10. D.s.Malik,J.N.Mordeson and M.K.Sen :Fundamentals of Abstract Algebra ,McGraw Hill International Edition 1997
11. T.M.Karade, J.N.Salunke, K.S.Adhav, M.S.Bendre :Lectures on Abstract Algebra.Sonu Nilu Publication.Nagpur(IInd Publication)

Semester VI

6th Sem - Paper XI (Linear Algebra)

Unit I : Vector Space :Definition and example of vector spaces. Subspaces. Sum and direct sum of subspaces. Linear span. Linear dependence, independence and their basic properties.Basis , Finite dimensional vector spaces . Existence theorem for bases. Invariance of the number of elements of a basis set. Dimension.

Unit II : Linear Transformations: Linear transformation and their representation as matrices. The algebra of linear transformations. The rank nullity theorem. Change of basis.

Unit III : Dual Spaces : Dual space. Bidual space and natural isomorphism. Adjoint of a linear transformation. Eigen values and eigenvectors of a linear transformation.

Unit IV : Inner Product Spaces :Inner product spaces. Cauchy- Schwarz inequality. Orthogonal vectors. Orthogonal complements. Orthonormal sets and bases. Bessel's inequality for finite dimensional spaces. Gram Schmidt Orthogonalisation process.

Unit V : Modules : Modules, Submodules, Quotient modules. Homomorphism and Isomorphism theorems.

Reference Books:

1. I.N.Herstein:Topics in Algebra, Wiley Eastern Ltd., New Delhi,1975.
2. N.Jacobson: Basic Algebra ,Vol. I and II W.H.Freeman,1980 (Hindustan Publishing Co.)
3. Shanti Narayan :A Text Book Of Modern Abstract Algebra, S. Chand and Co. ,New Delhi
4. K.B.Datta:Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd.New Delhi,2000
5. P.B.Bhattacharya, S.K.Jain and S.R.Nagpal :Basic Abstract Algebra (IInd Edition) Cambridge University Press Indian Edition,1997
6. K.Hoffman and R.Kunze,:Linear Algebra ,IInd Edition Prentice Hall,Englewood Cliffs, New Jersey,1971.
7. S.K.Jain, A Gunawardhana and P.B.Bhattacharya:Basic Linear algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001
8. S. Kumaresan :Linear Algebra, A Geometric Approach,P Prentice Hall of India Pvt. Ltd. New Delhi,2000
9. Vivek Sahai and Vikas Bisht :Algebra, Narosa Publishing House, 1997.
10. D.S.Malik,J.N.Mordeson and M.K.Sen :Fundamentals of Abstract Algebra ,McGraw Hill International Edition 1997
11. T.M.Karade, J.N.Salunke, K.S.Adhav, M.S.Bendre :Lectures on Abstract Algebra.Sonu Nilu Publication. Nagpur (IInd Publication)

6th Sem - Paper-XII (Optional)
(Graph Theory)

Unit I : Graph. Application of graphs, finite and infinite graphs, incidence and degree, isolated vertex, pendent vertex and null graph, isomorphism, subgraphs, walks, path and circuits, connected graphs and components, Euler graph, operation on graphs, Hamiltonian paths and circuits, travelling salesman problem.

Unit II : Trees, some properties of trees, pendent vertices in a tree, distance and centres in a tree, Rooted and binary trees, On counting trees, spanning trees.

Unit III : Fundamental circuits, Cutsets, Some properties of cutsets, all cutset in a graph, fundamental circuits and cutsets, connectivity and separability, planer graphs, Kuratowski's two graphs, different representation of planer graph, detection of planarity.

Unit IV : Vector space associated with a graph, circuit and cutset subspaces, Orthogonal vectors and spaces, Intersection and joint of W_F and W_S

Unit V : Incidence matrix, Submatrix of $A(G)$, Circuit matrix, Fundamental circuit matrix B , Rank of B , an application to a switching network, cutset matrix, path matrix, adjacency matrix, the relationship among A_f , A_r and C_f .

Reference Books:

1. Narsingh Deo: Graph Theory with Application to Engineering and Computer Science, Prentice Hall Of India, New Delhi.,
2. Richard Johnson- Baugh : Discrete Mathematics, Macmillan Publishing Company 886, Third Avenue New York 10022
3. Olympia Nicodemi : Discrete Mathematics, C.B.S. Publ. and Distributors 485, Jain Bhavan Bholanath Nagar Shahadara New Delhi- 32 India
4. Frank Harare : Graph Theory , Narosa Publishing House , 307 , Shiv Centre D.B.C. Sector Ku Bazar New Bombay 400704,
5. S.A. Choudum: A first Course In Graph Theory, McMillan India Ltd. ercatile House Magazine Street Bombay 10 5 6
6. E.L. LIU : Elements of Discrete Mathematics, McGraw Hill Book company, New York
7. Seymour Lipschultz and Marc Lipson : Discrete Mathematics , TMH New Delhi (Schaum Outline series) IInd Edition.
8. J.N. Salunke : Boolean Algebra and Graph Theory Laxmi Publication Akot.