NEW SYLLABUS FROM THE YEAR 2014-15

SUBJECT: MATHEMATICS

FIRST SEMESTER

Paper I: DIFFERENTIAL CALCULUS

1) Real numbers, Postulates and their consequences, Inequalities and Absolute values **(5 Hrs)**

2) Limits and continuity, algebra of Limits and Continuous functions, Properties of Continuous functions. Boundedness of Continuous functions, Intermediate Value Theorem. **(10 Hrs)**

3) Higher Order Derivatives, The nth derivative of 1/ (ax+b), log(ax+b), e^{ax}, $(ax+b)^m$, sin (ax+b), cos (ax+b), e^{ax}sin (bx+b), e^{ax}cos (ax+b), Leibnitz's Rule for nth derivative of a product. **(10Hrs)**

4) Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, Taylor's Theorem (with Schlomilch and Roache's form of remainder). Maclaurian's Series. **(10 Hrs)**

5) Indeterminate forms. **(5 Hrs)**

Paper II: LINEAR ALGEBRA

1) **Vector Space**: Definition, examples, Subspace. Linear independence and dependence, properties, Base for vector space, dimension and linear transformation . **(15 Hrs)**

2) Determinant of 4th order, Symmetric and Skew Symmetric determinants, Reciprocal Determinants. **(10 Hrs)**

3)Matrices. Row and column transformations, Rank of a Matrix. Reduction to normal forms. Solutions of System of Linear equations. **(15 Hrs)**

References:

1) Shanti Narayan: Mathematical Analysis
2) Shanti Narayan: Differential Calculus.
3) N Rudraiah and others: College Mathematics for B.Sc.
4) M.K.Singhal and Asha Rani: First course in Real Analysis
5) D.C.Pavate: Modern College Calculus.
6) G.K.Ranganath and others: Text Book of B.Sc. Mathematics
7) Ayres: Matrices (Schaum Publ. Co.)
8) M.L.Khanna: Modern Algebra
9) Vijay K Khanna and S K Bhambri : A Course in Abstract Algebra

SECOND SEMESTER

PAPER -I: DIFFERENTIAL CALCULUS

l) Differentiation in polar Co-ordinates, Angle between the radius vector and the tangent, Angle of intersection of curves (Polar form). Pedal equations. **(10 Hrs)**

2) Points of inflexion, concavity and convexity of curves curvature of plane curves, Formulae of radius of curvature in Cartesian, parametric and polar forms, Center of Curvature, Evolutes and involutes. Envelopes. Asymptotes. **(20 Hrs)**

3) Tracing of Standard Cartesian, polar and parametric curves (simple curves). **(10 Hrs)**

Paper-II: INTEGRAL CALCULUS AND GEOMETRY

1) Reduction Formulae, application of definite integrals to areas, volumes and surface of revolution. Length of plane curves. **(15 Hrs)**

2) Polar equation of conics. Equation of directix, Equation of Asymptotes (for hyperbola) **(5 Hrs)**

3) Geometry: Equation of a Sphere. Section of a Sphere by a plane. Equation of a Sphere through a Circle. Equation of a Sphere with two given points as the ends of diameter Tangent planes. Orthogonal Spheres.

Cone: Equation of a Cone. Quadric cone, enveloping cone of a sphere. Right circular Cone.

Cylinder: Equation of a Cylinder Enveloping cylinder of a sphere. Right circular cylinder. **(20 Hrs)**

References:

1) Shanti Narayan: Elements of Analytical solid Geometry.

2) N. Rudraiah and other: College Mathematics for B.Sc. Series I&II.

3) G.K. Ranganath and others: Text book of B.Sc. Mathematics.

THIRD SEMESTER

Paper -I: ALGEBRA AND NUMBER THEORY

1) **Elements of Set Theory**: (Recap of Union and Intersection of sets) Equivalence relations. Partition of a Set. Arbitrary unions and intersections. DeMorgan's laws. Countable and Uncountable sets. **(1 0 Hrs)**

2) **Number Theory**: Definition of divisibility, properties of divisibility, GCD, The Euclidean Algorithm, Congruence, Fundamental theorem of arithmetic. Euler's function. Number of positive divisors and their sum, Fermat's and Wilson's theorems.**(10 Hrs)**

3) **Group Theory**: Groups, Abelian group, Standard examples of groups, properties of groups, Subgroup and its properties, Permutation group. Cyclic groups, Cosets. Lagrange's theorem. Normal sub-groups. Quotient groups. Homomorphism and Isomorphism of groups. Kernel of homomorphism. Fundamental theorem of homomorphism. **(20 Hrs)**

Paper-II: ALGEBRA AND ANALYSIS

1) Rings, Integral Domain and Fields Definition, examples, Abelian Ring, Ring with Unity and without Unity, Finite and infinite Rings(Only definitions), Units in a Ring, Zero divisors in a ring, Ring without zero divisor, properties of Ring, division Ring, Integral domain, and Field definitions, Theorems (1) A finite integral domain is field (2) Every field is an integral domain. **(10 Hrs)**

Real Analysis: Real valued functions of more than one variable. Limits and continuity. Partial derivatives. Homogeneous functions and Euler's theorem. Differentiability Chain Rile. total differential, Jacobians. Lagrange's Mean value Theorem for functions of two variables. Taylor's and Maclaurin's theorems for two variables. Maxima and Minima of functions of two and three variables. Lagrange's method of undetermined multipliers. **(20 Hrs)**

2) Expansions of sine and cosine functions, Series of Sines and Cosines. Hyperbolic functions. Logarithm of a Complex number, summation of Trigonometric Series.**(10 Hrs)**

References:

1) Y.F. Lin and S.Y. Lin: Set Theory-intuitive approach Houghton Miffin Co USA.
2) Lipschotz: Set Theory and related topics. -Schaum Series.
3) Shanti Narayan: Introduction of Mathematical Analysis-S. Chand & Co.
4) N. Rudraiah and Others: College Mathematics for B.Sc Series I and II –SBS Publication co. Bangalore.
5) Shanti Narayan: Analytical Solid Geometry-S.Chand & Co.
6) Algebra: Golden Series (Firewal media)

FOURTH SEMESTER

Paper-I: SEQUENCES AND SERIES

1) Sequences: Sequences, bounded and unbounded sequences, Subsequences, convergent, divergent and oscillatory sequences. Limit points. Limit superior and limit inferior of sequences. Algebra of convergent sequences, Cauchy's criterion for convergence of a sequence. **(15 hrs)**

2) Infinite Series: Partial sums of a series. Idea of an infinite series as integral.

Convergence and divergence of series. Series of nonnegative terms. Necessary and sufficient condition for convergence. P-series theorem. Comparison tests. D'Alembert's ratio test, Raabe's ratio test, Cauchy's Integral test and Root test, Absolute convergence and conditional convergence of a series. Alternating series. Leibnitz's theorem. Uniform convergence . **(25 hrs)**

Paper-II: VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS

1) Vector Calculus: Dot and cross product of vectors. Ordinary derivatives of vectors. Continuity and differentiability of a vector function. Derivatives of sum, dot product. cross product and triple products of ectors. Differential of vectors. The vector differential operator del. The gradient, Divergence and curl. Solenoidal and irrational vectors.

(15 hrs)

2) Differential Equations:(Recapitulation of Differential equations of the first order and first degree). Homogeneous, Non-homogeneous, exact, linear and Bemoulli's equations. Simple equations of the first order and higher degree. Fquations solvable for P, x, y. Clairaut's equations. Singular solutions.

Linear differential equations of the nth order with constant coefficients. Particular Integral when the RHS is of the from e^{ax}, sinax, cosax, x^n, $e^{ax}V$, x.V, where V is a function of x. Reduction of homogeneous equations, exact differential equations of nth order. **(25 hrs)**

References:

1) Shanti Narayan: Vector Calculus, S. Chand & Co.
2) D.A. Murray: Differential equations.
3) H.T.H. Piaggio: Differential equations.
4) Ayres: Differential Equations-Schaum Series.
5) M.K. Singal and Asha Rani: First Course in Real Analysis.
6) S.L. Gupta and Nisha Rani: First Course in Real Analysis.
7) S.L. Gupta and N.R. Gupta: Principles of Real Analysis- Pearson Education.

MATHEMATICS

SEMESTER – V

Paper-I: Real analysis **(Teaching: 5 hrs /week)**

1. **The Reimann Integration:** The upper and lower sums. Necessary and sufficient conditions for integrability. Algebra of integrable functions. Integrability of continuous and monotonic functions. Fundamental Theorem of Integral Calculus. Change of variables. Integration by parts. The first and second mean value theorems of integral calculus. **(20 hrs)**

2. Improper integrals of the first and second kind. Comparison test. Abel's test and Dirichlet's test. **(10 hrs)**

3. Beta and Gamma functions. Differentiation under Integral Sign. Integration under integral sign. Double and triple integrals, Area and volumes. **(10 hrs)**

References:

1) Shantinarayan: A course of Mathematical Analysis – S. Chand & Co.
2) S.L. Gupta and Nisha Rani: Fundamental Real Analysis.

Paper – II: NUMERICAL METHODS **(Teaching: 5 hrs /week)**

1. **Solution of Non-linear equations:** (algebraic and transcendental) Interval halving method, secant method and Newton's method. Fixed point iteration method. **(10 Hrs)**

2. **Solution of a system of linear equations:** Gauss elimination, Gauss-Jordan, Gauss-Seidel iteration methods. **(10 Hrs)**

3. **Finite Differences:** Definition and properties of, Δ/∇ and E and relations among them. The n^{th} difference of a polynomial. Separation of operators. Newton-Gregory's forward and backward difference interpolation formulae. Lagrange's interpolation formula. **(10 Hrs)**

4. **Curve fitting by Least square method**: Numerical differentiation using forward and backward difference formulae. Computation of first and second differences. Numerical integration. Trapezoidal Rule. Simpson's rule. **(10 Hrs)**

References:

1. SS Shastry: Introductary methods of Numerical Analysis – Prentice Hall of India.
2. N.Rudraiah and others; College Mathematics – I & II.
3. M.K Jain et al: Numerical methods for Sc.& Eng –Wiley Eastern.
4. H.C. Saxena: Calculus of finite analysis – S. Chand & Co.

Paper-III: STATICS AND LAPLACE TRANSFORMS (Teaching: 5 hours/week)

1. **Statics**: Couples, moment of a couple, Varignon's Theorem. Resultant of coplanar couples. Resultant of a force and a couple. Resultant of a system of coplanar forces acting at different points of a rigid body. Conditions of equilibrium. Finding the equation of the line of action the resultant. Catenary and common catenary. **(20 Hrs)**

2. **Laplace Transforms**: Basic Properties. Laplace transforms of some common functions. Periodic functions, derivative and integral of a function. Heaviside function and Dirac-delta function. Convolution theorem. Inverse Laplace Transforms. Laplace Transform method of solving differential equation of first and second order with constant co-efficients. **(20 Hrs)**

References:

1. M.Ray and P.T Chandi – Statistics.
2. N. Rudraiah and others – College Mathematics for B.Sc. Series- III – SBS Publication Co., Bangalore.
3. M.G. Smith: Laplace Transform Theory – Van Nostrand.

SEMESTER - VI

(Teaching: 5 Hrs / Week)

Paper – I: DIFFERENTIAL EQUATIONS AND FOURIER TRANSFORMS

1. **Differential Equations:** Simultaneous differential equations with two and more than two variables. Condition of integrability of Pdx+Qdy+Rdz=0. Partial differential equations of the first order. Integral of the linear equation Pp+Qq=R. Special methods of solution applicable to standard forms. Charpit's method. Partial differential equations of the second order. **(30 Hrs)**

2. **Fourier Transforms:** Fourier series of functions with period 2π and Period 2L. half range Cosine and Sine series. Finite Fourier Cosine and Sine transforms of some common functions. Transforms of derivatives. **(10 Hrs)**

References:

1. D.A. Murray: Differential Equations.
2. J.N. Sharma and R.K. Gupta: Differential Equations.
3. P.N. Chatterjee: Differential Equations.
4. I.N. Sneddon: Fourier Transforms – Mc-Graw Hill.

(Teaching: 5 Hrs / Week)

Paper –II: DYNAMICS AND MATHEMATICAL MODELING

1. **Dynamics:** Velocity and acceleration of a particle along a plane curve. Radial and transverse components of velocity and acceleration. Tangential and Normal components of velocity and acceleration.

   Motion of a projectile in a non-resisting medium under gravity. Motion of a particle under a central force. Use of polar co-ordinates and pedal co-ordinates.

   Elastic impact-Direct and oblique impact of elastic bodies. **(30 Hrs)**

2. **Mathematical Modeling:** Need for Mathematical modeling. Brachistochrone Problem with historical developments. Techniques and classification of mathematical models. Mathematical modeling through Geometry, Algebra (Compound Interest Model), Trigonometry and Calculus.

Mathematical modeling through differential equations of first order. Growth and Decay models (linear and non-linear). Prey and predator model.

Miscellaneous mathematical models.

1. Population dynamics model.
2. Modeling in Economics and Finance.
3. Modeling in Medicine (A Model of Diabetes Mellitus)
4. Richardson's model for Arms Race. **(10 Hrs)**

References:

1. M. Ray – A text Book of Dynamics.
2. F. Chorlton – Text Book of Dynamics – Van Nostrand
3. T. P. Dreyer. Modeling with Ordinary Differential Equations – CRC Press, Inc.
4. J.N. Kapur: Mathematical Modeling, John Wiley & Sons.

(Teaching: 5 Hours / Week)

Paper – III: TOPOLOGY AND COMPLEX ANALYSIS

1. **Topology:** Basic concepts. Closure, Neighbourhood, Limit points and Derived sets. Interior, Exterior and Boundary. Bases and sub-bases. Sub-spaces, T_1 and T_2 spaces. **(15 Hrs)**

2. **Complex Analysis:** Analytical Functions. Cauchy-Riemann Equations. Complex Integration. Cauchy Theorem. Taylor's and Laurent's series. Residue Theorem and Contour Integration. **(25 Hrs)**

References:

1. J.N. Sharma: Topology – Krishna Prakashan, Meerut.
2. S. Lipschutz: General Topology – Schaum's Series.
3. Sampathkumar & K.S. Amur : Elements of Modern Algebra and Topology.
4. J.N. Sharma: Complex Variables – Krishna Prakashan.
5. Spiegal: Complex Variables – Schaum's Series.