



MAHARAJA KRISHNAKUMARSINHJI BHAVNAGAR UNIVERSITY
NAAC Accreditation Grade ``B``
(With effect from Academic Year 2014-2015)

Academic Council: 23 / 11 / 2013, R.No. (2)

**Second Year B.Sc.
MATHEMATICS**

| | | |
|-----------------|--------------------|------------------|
| Paper No-M-201: | Advanced Calculus | Total Marks: 100 |
| Paper No-M-202: | Linear Algebra | Total Marks: 100 |
| Paper No-M-203: | Numerical Analysis | Total Marks: 100 |



S.Y. B.Sc.
MATHEMATICS

Paper No-M-201: **Advanced Calculus**

Total Marks: 100

| UNIT | DETAILED SYLLABUS | TEACHING HOURS | MARKS |
|--------|--|----------------|-------|
| Unit-1 | Increasing and decreasing functions, Concave upwards and concave downwards functions, Points of inflexion, Asymptotes parallel to co-ordinate axes, oblique type and algebraic methods, Rules for finding asymptotes. Multiple points, Types of double points. Real functions of several variables, Their limit and continuity, (Repeated limits and limits in R^2 to be explained), Partial derivatives of functions of n variable (For special case $n = 2$ notation, D_{12} and D_{21} to be explained) Partial differentiation of implicit function, Young's and Schwartz's theorem (without proof). | 18 | 20 |
| Unit-2 | Differentiability, Chain rule, Partial derivatives of higher order, Condition for commutative property of variables in higher order partial derivatives, Derivatives of implicit functions. Euler's theorem on partial derivatives of homogenous functions. Extrema of functions of several variables, Lagrange's method of undetermined multipliers, Taylor's and Maclaurin's expansions for functions of several variables (Proof for cases of two variables only) Errors and approximate values, Jacobians, | 18 | 20 |
| Unit-3 | Curves, Surfaces, First order partial differential equation, Classification of integrals, Linear equations of first order Differentiation along a curve, Applications to geometry: 1. Curvature in Cartesian and polar co-ordinates 2. Singular points for plane curves especially points of inflexion and double points. | 18 | 20 |
| Unit-4 | Beta and Gamma functions, relation between Beta and Gamma functions, Duplication formula, Properties of Beta and Gamma functions. Equation of Tangent plane and normal to surfaces, Equation of Tangent and normal plane to curve, Gradient, Divergence and Curl of vectors, Their properties. Vector point functions and Scalar point functions, Vector Differentiation, Laplace operator, Laplace equation. | 18 | 20 |
| Unit-5 | Double integral, Repeated integral, integral on a non-rectangular region, Jacobian, Triple integrals : Definition and Examples ; only introduction and use for transformation from Cartesian to polar, spherical and cylindrical coordinates and vice-versa. Line integral, Change of order of integration in Cartesian and Polar form, Line integral independent of path. Surface integral, Green's theorem and Stoke's theorem (Only statements), Examples based on Green's theorem and Stoke's theorem. | 18 | 20 |

Reference books:

1. David Widder: Advanced Calculus (Prentice hall, New Delhi)
2. T.M. Apostol: Advanced Calculus Volume-II (Blaisdell)
3. Shanti Narayan: Differential Calculus (S.Chand)
4. Shanti Narayan: Integral Calculus (S.Chand)
5. T. Amarnath: Partial Differential Equation (Narosa) (Articles 1 to 4)
6. James Stewart: Calculus Brooks/Cole publishing company



S.Y. B.Sc.
MATHEMATICS

Paper No -M-202: **Linear Algebra**

Total Marks: 100

| UNIT | DETAILED SYLLABUS | TEACHING HOURS | MARKS |
|--------|---|----------------|-------|
| Unit-1 | Vector space: Definition and examples, Linear dependence, independence and their properties, Linear span, Subspace, Sum and direct sum of subspaces, Basis and finite dimension of vector space, Existence theorem for basis, Invariance of the number of the elements of a basis set, Existence of complementary subspace of subspace of finite dimensional vector space, Dimension of sum of subspaces W_1 and W_2 of vector space. | 18 | 20 |
| Unit-2 | Linear transformations ,properties of Linear transformations ,The algebra of linear transformations, Rank and Nullity theorem, Ad joint of a linear transformation, Eigen values and eigen vectors of linear transformations, Singular and non-singular transformations, Diagonalization, Inverse linear transformations. | 18 | 20 |
| Unit-3 | Matrix associated with a Linear Map, Linear Map associated with a Matrix. Linear operations in $\mu_{m,n}$, Only introduction of $L(U,V)$ and Isomorphism between $L(U,V)$ and $\mu_{m,n}$, Dimension Theorems for $\mu_{m,n}$ and $L(U,V)$. Rank – Nullity of Matrices and verification of the Rank-Nullity Theorem for Matrices. | 18 | 20 |
| Unit-4 | Inner product spaces, the Euclidean plane and the dot product,general inner product spaces, Orthogonality, Geometrical application, orthogonal projection onto a line, orthonormal basis, orthogonal complements and projections. | 18 | 20 |
| Unit-5 | orthogonal Linear transformations, Determinants and its properties, Value of a determinant, Basic results-Laplace expansion. Cramer's rule, Application to geometry, orientation and vector product Diagonalization of symmetric matrices.Conics and quadrics, classification of Quadrics, computational examples. | 18 | 20 |

Reference books:

1. Linear Algebra – A Geometric Approach by S.Kumaresan (Prentice Hall, New Delhi).
2. Finite Dimensional Vector spaces P.Halmos
3. Matrix and Linear algebra K.B. Dutta (Prntice Hill, New Delhi)
4. Linear Algebra-A problem book P.R.Halmoose(Cambrige university Press)
5. Linear Algebra G.Paria (New central book agency-Calcutta)
6. Linear algebra and applications Gilbert Strang Thomson Brooks/cole (The course is roughly covered by the book by S. Kumaresan)



S.Y. B.Sc.
MATHEMATICS

Paper No -M-203: Numerical Analysis

Total Marks: 100

| UNIT | DETAILED SYLLABUS | TEACHING HOURS | MARKS |
|--------|--|----------------|-------|
| Unit-1 | Forward differences, Backward differences, central differences, Shift operator and other difference operators , Reciprocal factorial, Polynomial in factorial notation. Significant error, Relative error, Estimation of error, Application of error formula. | 18 | 20 |
| Unit-2 | Gregory – Newton forward difference formula and Gregory – Newton backward difference formula , Gauss’s forward difference formula. and Gauss’s backward difference formula. Derivatives using Newton forward difference formula and Derivatives using Newton backward difference formula . | 18 | 20 |
| Unit-3 | Stirling’s interpolation formula, Derivatives using Stirling’s interpolation formula, Bessel’s and Everett’s formulae, Lagrange’s formula. Divided difference, Newton’s divided difference formula, inverse interpolation, its application. | 18 | 20 |
| Unit-4 | General quadrature formula, Trapezoidal rule, Simpson’s rule, Weddel’s rule. Quadrature formula based on Lagrange’s formula, Newton-Cotes formula, Numerical integration formula based on central difference formulae, Euler-Maclaurin sum formula. | 18 | 20 |
| Unit-5 | Algebraic and transcendental equations, Numerical solution of differential equations of first order, method of bisection, method of iteration, Newton-Raphson formula, Newton’s iterative formula, convergence of Newton-Raphson method, Rate of convergence of Newton-Raphson method, method of false position. Euler’s method, Euler’s modified method, Picard’s method. Taylor’s series method, Runge-Kutta method, Milne’s method. | 18 | 20 |

Reference books:

1. Numerical Analysis and Computational Procedures by S.A. Moolah, New Central Book Agency (P) Ltd., Calcutta.
2. Elementary Numerical analysis S.S. Sastry (Prentice Hall, New Delhi)
3. Numerical mathematical analysis Scarborough 6th edition. (Oxford & IBH)
4. Numerical analysis S.Kunz Mcgraw Hill Book New York
5. Numerical Analysis Richard Burden and J. Douglas Thomson (The course is roughly covered by the book by S.A. Moolah)