**Dissemination of Education for Knowledge, Science and Culture"**
**- Shikshanmaharshi Dr. Bapuji Salunkhe**

## Shri Swami Vivekanand Shikshan Sanstha's

# Vivekanand College, Kolhapur (Autonomous)

*DEPARTMENT OF MATHEMATICS*

**B.Sc. Part - III**
**Semester-V & VI**

# SYLLABUS

## Under Choice Based Credit System

**to be implemented from Academic Year 2023-24**

**B. Sc. Part-III**

| Paper No. | Course code | Title of Old Paper | Title of New Paper | Percentage of Change (%) | No. of Credits |
|---|---|---|---|---|---|
| **Semester I** | | | | | |
| V | DSC - 1003E1 | Real Analysis and Modern Algebra | Real Analysis and Modern Algebra | 0% | 4 |
| VI | DSC - 1003E2 | Matrix Algebra and Numerical Methods I | Partial Differential Equation and Numerical Methods | 70% | 4 |
| **Semester II** | | | | | |
| VII | DSC - 1003F1 | Metric Space and Linear Algebra | Metric Space and Linear Algebra | 0% | 4 |
| VIII | DSC - 1003F2 | Complex Analysis and Numerical Methods II | Complex Analysis and Optimizatio n Technique | 50% | 4 |
| | SEC | Transportation problem and itsmathematical formulation | Numerical methods and transportatio n problem and mathematica l formulation | 50% | 4 |

**Computational Mathematics Lab- DSC 1003C(PR) Total Credit 08**

| Course code | Title of the course | Instructi ons Lectures /Week | Duration of term end exam | Marks [End of academic year] | Credit |
|---|---|---|---|---|---|
| CCPM IV | Operational Research | 4 | 3 hours | 50 | 4 |
| CCPM V | Numerical Methods | 4 | 3 hours | 50 | 4 |
| CCPM VI | Mathematical Computation using python | 4 | 3 hours | 50 | 4 |
| CCPMVII | Project study and tour report | 4 | 3 hours | 50 | 4 |

**MATHEMATICS-DSC-1003E1**
**Mathematics-Paper-V**
**Real Analysis and Modern Algebra**
**Theory: 72 Hours (90 lectures of 48 minutes)- Credits-4**

**(Marks-100)Section I: Real Analysis**

**Course Outcomes: On completion of the course, the students will be able to:**
CO1: Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limitsuperior, limit inferior, and the limit of a bounded sequence.
CO2: Use the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence ofan infinite series of real numbers.
CO3: Understand some of the families and properties of Riemann integrable functions, and the applications of thefundamental theorems of integration.
CO4: Solve Riemann integral and improper integral

| UNIT | Title of unit & Contents | Hours Allotted |
|---|---|---|
| 1 | **SEQUENCES OF REAL NUMBERS:** Upper bound, Lower bound, Least upper bound, Greatest lower bound, Definitionof sequence and subsequence, Limit of a sequence, Convergent sequence, Divergent sequence, Bounded sequence, Monotone sequence, Limit superior andlimit inferior, Cauchy sequences. | 10 |
| 2 | **SERIES OF REAL NUMBERS:** Convergence and Divergence, Series with nonnegative terms, Alternating series,Conditional convergence and absolute convergence, Rearrangements of series, Tests of absolute convergence, Series whose terms form a non-increasing sequence. | 10 |
| 3 | **RIEMANN INTEGRAL:** Riemann integrability and integral of a bounded function over finite domain, Darboux's theorem (statement only), another equivalent definition of integrability and integral, Conditions for integrability, Particular classes of bounded integrablefunctions, Properties of integrable functions. | 08 |
| 4 | **IMPROPER INTEGRAL:** Definitions of Improper integral, Test for convergence at 'a'. Positive integrand f(x), not necessarily positive. General test for convergence, Convergence at $\infty$, the integrand being not necessarily positive: General test for convergence, Absoluteconvergence, Tests for conditional convergence. | 08 |

**Recommended Books:**
1. Richard R. Goldberg, Method of Real Analysis, Oxford and IBH publishing CO. PVT.LTD
2. Shanti Narayan and P. K. Mitthal, A Course of Mathematical Analysis, S. Chand Publication

**Reference Books:**
1. Tom M. Apostol, Mathematical Analysis (Second Edition) Narosa Publishing House, New Delhi
2.H.L. Royden, Real Analysis (Fourth Edition) Pearson India Education Services Pvt.Ltd.

## Section II: Modern Algebra

**Course Outcomes: On completion of the course, the students will be able to:**

CO1: Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutationgroups, etc;
CO2: Explain the significance of the notion of cosets, normal subgroups, and factor groups
CO3: The fundamental concept of Rings, Fields, subrings, integral domains and the corresponding Homorphisms
CO4: Apply fundamental theorem, Isomorphism theorems of groups to prove these theorems for Ring.

| UNIT | Title of unit & Contents | Hours Allotted |
|---|---|---|
| 1 | **GROUPS:** Binary Compositions, Permutations (Definition and examples), Cyclic Permutations,Cycles of a Permutation, Disjoint Permutations Even permutation, odd permutation, Some Results from Number Theory (statement only), The Greatest Common Divisor(definition only), Some properties without proof, Groups - Abelian groups (definition and examples), Subgroups, Centre of group, Normaliser of subgroup, Cosets, Cyclic Groups, Euler's theorem and Fermat's theorem | 10 |
| 2 | **NORMAL SUBGROUPS, HOMOMORPHISM:** Normal Subgroups, Quotient Groups, Homomorphisms, Isomorphisms, Kernel,Fundamental theorems of homomorphism, conjugate elements | 07 |
| 3 | **RINGS:** Rings, zero divisors, Integral domains, Field, Subrings, Characteristic of a Ring, Idempotent element, nilpotent element, Product of Rings, Ideals, Sum of Ideals,Product of Ideals, Simple rings | 10 |
| 4 | **HOMOMORPHISM S IN RINGS:** Quotient Rings, Homomorphisms, kernel, fundamental theorems of ring homomorphism, Embedding of Rings(statements), Maximal Ideal, Prime ideals | 09 |

**Recommended Book:**

1 V. K. Khanna and S. K. Bhambri, A course in abstract algebra, 5th edition, Vikas publishing house pvt.ltd

**Reference book:**

1. J.B. Fraleigh and N.E. Brand, A course in abstract algebra, 8th edition pearson

2.Joseph A. Gallian, Contemporary Abstract Algebra (Fourth Edition) Narosa Publishing House.

**MATHEMATICS-DSC-1003E2**
**Mathematics-Paper-VI**
**Partial Differential Equation and Numerical Methods Theory: 72 Hours (90 lectures of 48 minutes)- Credits-4 (Marks-100)**

**Section I: Partial Differential Equation**

**Course Outcomes: On completion of the course, the students will be able to:**

CO1: Understand the concept of formation of partial differential equation.
CO2: Understand the classification of partial differential equations.
CO3: Understand the Geometrical meaning of partial differential equation and method of solutions.
CO4: Understand transformation equations and its applications.

| Units | Title of unit & Contents | Hours Allotted |
|---|---|---|
| 1 | **UNIT:I PARTIAL DIFFERENTIAL EQUATIONS** Definitions, Derivation of a partial order differential equation by the elimination of constants, Derivation of partial differential equation by the elimination of arbitrary functions. | 06 |
| 2. | **UNIT:II NON-LINEAR PARTIAL DIFFERENTIAL EQUATIONS** The integrals of the non-linear equation, the complete and particular integrals, The singular integral, The general integral, The integral of the linear equation, Equation equivalent to the linear equation, Lagrange's solution of the linear equation, Verificationof Lagrange's solution. | 10 |
| 3 | **GENERAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS** The linear equation involving more than two independent variables, Geometrical meaning of the linear partial differential equation, Special methods of solution applicableto certain standard forms, General method of solution. | 10 |
| 4 | **UNIT:IV HIGHER ORSER PARTIAL DIFFERENTIAL EQUATIONS** Partial equations of the second order, Examples readily solvable, General method of solving Rr+Ss+Tt=V, The general linear partial equation of an order higher than the first,The homogeneous equation with constant coefficients: The complementary function, Solution when the auxiliary equation has repeated or imaginary roots, The non- homogeneous equation with constant coefficients: the complementary function, The particular integral, Transformation of equations, Laplace's equation, Poisson's equation. | 10 |

**Recommended books:**

1. Daniel A. Murray Introductory Course in Differential Equations Khosla Publishing House.

**Reference book: -**

1. IAN N. SNEDDON, Elements of partial differential equation, Dover publication.
2.Dr. M.D. Raisinghania, Ordinary and Partial Differential Equation, Eighteenth revised edition 2016; S. Chand andcompany pvt.ltd. New Delhi.

## Section II: Numerical Methods

**Course Outcomes: On completion of the course, the students will be able to:**
CO1: Learn about various interpolating methods to find numerical solutions.
CO2: Demonstrate the use of interpolation methods to find intermediate values in given graphical and/or tabulated data.
CO3: Use of numerical differentiation and integration
CO4: Learn to find the solution of ordinary differential equation by Euler, Taylor and Runge-Kutta methods

| UNIT | Title of unit & Contents | Hours Allotted |
|---|---|---|
| 1 | **NUMERICAL INTERPOLATION: (for unequal interval)** Introduction, Lagrangian interpolating polynomial (formula only), examples, Divided difference interpolation: Newton's divided differences,divided difference table, examples finding divided (differences of given data), Newton's divided difference form of interpolating polynomial, examples | 08 |
| 2 | **NUMERICAL INTERPOLATION: (for equal interval)** Forward interpolation: Newton's forward differences, forward difference table. Newton's forward form of interpolating polynomial (formula only),examples. Backward interpolation: Newton's backward differences, backward difference table, Newton's backward form of interpolating polynomial (formula only), examples | 10 |
| 3 | **NUMERICAL DIFFERENTIATION AND INTGRATION:** Numerical differentiation based on interpolation polynomial. Numerical integration: Newton-Cotes formula, Basic Trapezoidal rule (excluding thecomputation of error term), composite Trapezoidal rule, examples, Basic Simpson's 1/3rd rule (excluding the computation of error term), compositeSimpson's 1/3rd rule, examples, Basic Simpson's 3/8th rule (excluding thecomputation of error term), composite Simpson's 3/8th rule, examples. | 10 |
| 4 | **SOLUTION OF FIRST ORDER ORDINARY DIFFERENTIALEQUATION:** Euler's Methods, Modified Euler's Methods, Examples, Second order Runge-Kutta method (formula only), examples, Fourth order Runge-Kuttamethod (formula only), examples | 08 |

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**Recommended Books:**

1. S.S. Sastry, Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India, 1999

**Reference books:**

1. Bhupendra Singh, Numerical Analysis, Pragati Prakashan.

2.Dr.P. Kandasamy & Others, Numerical Methods, S. Chand Publishing Ltd, New Delhi.

**Semester: VI**

**MATHEMATICS-DSC-1003F1**
**Mathematics-Paper-VII**
**Metric Spaces and Linear Algebra**
**Theory: 72 Hours (90 lectures of 48 minutes)- Credits-4 (Marks-100)**
**Section I: Metric Space**

**Course Outcomes: On completion of the course, the students will be able to:**

CO1. Acquire the knowledge of notion of metric space, open sets and closed sets.
CO2. Demonstrate the properties of continuous functions on metric spaces,
CO3. Apply the notion of metric space to continuous functions on metric spaces.
CO4. Understand the basic concepts of connectedness, completeness and compactness of metric spaces

| UNIT | Title of unit & Contents | Hours Allotted |
|---|---|---|
| 1 | **LIMIT AND METRIC SPACE:** Limit of a function on the real line, Metric spaces, Limits in metricspaces. | 10 |
| 2 | **CONTINUOUS FUNCTION ON METRIC SPACE:** Functions continuous at a point on the real line, Reformulation, Functionscontinuous on a metric space, Open sets, Closed sets, Discontinuous functions on $R^1$ | 10 |
| 3 | **CONNECTEDNESS AND COMPLETENESS:** More about open sets, connected sets, bounded sets and totally boundedsets, Complete metric spaces | 08 |
| 4 | **COMPACTNESS:** Compact metric spaces, Continuous functions on compact metric spaces,Continuity of the inverse function, Uniform continuity | 08 |

**Recommended Books:**
1. Richard R. Goldberg, Method of Real Analysis, Oxford and IBH publishing CO. PVT.LTD.

**Reference Book:**
1. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House.

## Section II: Linear Algebra

**Course Outcomes: On completion of the course, the students will be able to:**

CO1: Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.

CO2: Learn properties of inner product spaces and determine orthogonality in inner product spaces.

CO3: Learn basic concepts of linear transformation, dimension theorem, matrix representation of a lineartransformation, and the change of coordinate matrix.

CO4: Familiarize characteristic roots and characteristic vectors.

| UNIT | Title of unit & Contents | HOURS ALLOTED |
|---|---|---|
| 1 | **VECTOR SPACES:** Vector Spaces, Subspaces, Sum of Subspaces, Quotient Spaces, Homomorphisms orLinear Transformations, Linear Span, Linear Dependence and Independence | 12 |
| 2 | **INNER PRODUCT SPACES:** Norm of a Vector, Inner product spaces, Orthogonality, Orthonormal Set | 06 |
| 3 | **LINEAR TRANSFORMATIONS:** Algebra of Linear Transformations, Invertible Linear Transformations, Matrix of a LinearTransformation, Dual Spaces, Transpose of a Linear Transformation. | 10 |
| 4 | **EIGEN VALUES AND EIGEN VECTORS:** Eigen Values and Eigen Vectors, Characteristic Polynomials, Characteristic Polynomialof a Linear Operator | 08 |

**Recommended Book:**

1. V. K. Khanna and S. K. Bhambri, A course in abstract algebra, 5th edition, Vikas publishing house pvt ltd

**Reference book:**

1. Vivek Sahai & Vikas Bist, Linear Algebra (Second Edition) Narosa Publishing House.

2.Seymour Lipschutz & Mark Lipson, Linear Algebra (Third Edition) Schaum's Outlines TATA McGraw-Hilledition.

**MATHEMATICS-DSC-1003F2**
**Mathematics-Paper-VIII**
**Complex Analysis and Optimization Techniques**
**Theory: 72 Hours (90 lectures of 48 minutes)- Credits-4 (Marks-100)**

**Section I: Complex Analysis**

**Course Outcomes: On completion of the course, the students will be able to:**

CO1: Understand the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.

CO2: Understand the exponential function, Logarithmic function, Trigonometric function.

CO3: apply Cauchy integral formula to evaluate integrals.

CO4: Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues andevaluate complex integrals using the residue theorem.

| UNIT | Title of unit & Contents | Hours Allotted |
|---|---|---|
| 1 | **ANALYTIC FUNCTIONS:-** Functions of a Complex Variables, Limits. Theorems on limits (Without Proof), Limits involving the point at infinity. Continuity. Derivatives, Differentiation formulas (Without Proof), Cauchy-Riemann Equations, necessary and Sufficient Conditions for differentiability (Only Statement and Examples), Polar coordinates,Analytic functions, Harmonic functions. | 09 |
| 2 | **ELEMENTARY FUNCTIONS:-** The Exponential functions, The Logarithmic function, Branches and derivatives oflogarithms, Some identities involving logarithms, Complex exponents, Trigonometric functions | 07 |
| 3 | **INTEGRALS:-** Derivatives of functions, Definite integrals of functions, Contours, Contour integral, Examples, Upper bounds for Moduli of contour integrals, Anti- derivatives (Only Examples), Cauchy-Goursat Theorem. Simply and multiply Connected domains. Cauchy integral formula, Derivatives of analytic functions.Liouville's Theorem and Fundamental Theorem of Algebra (Without Proof). | 11 |
| 4 | **SERIES:-** Convergence of sequences and series (Theorems without proof), Taylor's series (without proof), Laurent series (without proof), examples only, Isolated singularpoints, Residues, Zeros of analytic functions, zeros and poles. | 09 |

**Recommended Books:**

1.James Ward Brown, Ruel V. Churchill, Complex Variables and Application, Mc Graw Hill Education – EighthEdition

**Reference Books:**

1.S. Ponnusamy, Foundation of complex analysis, Narosa Publishing House, - second Edition
2. H.S KASANA, Complex Variables Theory & Applications PHI Learning Private Ltd. New Delhi.

## Section I: Optimization Techniques

**Course Outcomes: On completion of the course, the students will be able to:**

CO1: Analyse and solve linear programming models of real-life situations.

CO2: Formulate and apply suitable methods to solve problems.

CO3: Identify and select procedures for various sequencing, assignment, transportation problems.

CO4: Model competitive real-world phenomena using concepts from game theory and analyse pure and mixedstrategy games.

| UNIT | Title of unit & Contents | Hours Allotted |
|---|---|---|
| 1 | **LINEAR PROGRAMMING PROBLEM:** Revision of L.P.P., canonical form, standard form of L.P.P. Solution of L.P.P bySimplex method and examples, Solution of L.P.P by Big – M method and examples | 08 |
| 2 | **TRANSPORTATION PROBLEM:** Basics of Transportation problem, Basic Definitions, Initial Solution: North – West corner method and examples, Matrix minima method and examples, Vogel's approximation method and examples. MODI method and examples, Unbalanced transportation problem and examples | 10 |
| 3 | **ASSIGNMENT PROBLEM:** Introduction to Assignment problem, Hungarian method and examples, Unbalanced Assignment problem and examples, Assignment problems with restrictions and examples. | 10 |
| 4 | **THEORY OF GAMES:** Basics definitions, Saddle point and examples, Algebraic method for $\mathbf{2 \times 2}$ size game and examples, Arithmetic method for $\mathbf{2 \times 2}$ size game and examples, Principal of dominance, Dominance method and examples, Sub-game method for $\mathbf{2 \times n}$ & $\mathbf{m \times 2}$ size game and examples, Graphical method for $\mathbf{2 \times n}$ & $\mathbf{m \times 2}$ size game and examples | 08 |

**Recommended Books:**

1. S. D. Sharma: Operations Research, KedarNath RamNath Meerut, Delhi Reprint 2015.

**Reference Books:**

1. Kanti Swarup, P.K.Gupta, Man Mohan, Operations Research, Sultan Chand and Sons.

**Skill Enhancement Course**

**SEC-SE**

**Numerical Methods Credits:2 (60 Hours)**

1. Bisection Method
2. Regula – Falsi Method
3. Secant Method
4. Newton – Raphson Method
5. Gauss – Elimination Method
6. Gauss – Jordan Method
7. Jacobi's Method
8. Gauss – Seidal Method

**Reference books:**


1. Introductory Methods of Numerical Analysis, S.S. Sastry, 3rd edition, Prentice Hall of India, 1999
2. Bhupendra Singh, Numerical Analysis, Pragati Prakashann


**Transportation problem and its mathematical formulation**

Credits: 2(60 Hours)

Northwest-corner method, least cost method and Vogel approximation method for determination of starting basicsolution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem. Game theory: formulation of two-person zero sum games, solving two-person zero sum games, games with mixed strategies, graphical solution procedure.

**Reference:**


1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., JohnWiley and Sons, India, 2004.
2. F. S. Hillier and G. J.Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore,2009.
3. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.


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**MATHEMATICS LAB: DSC-1003 (Practical) Marks: 100**

**Core Course Practical In Mathematics**

**(CCPM-IV)Operational Research (Marks 50)**

**credits 04**

| SR. No. | Title of the experiment | Sessions |
|---|---|---|
| 1 | Graphical method for linear programming problems. | 1 |
| 2 | Solution of LPP using Simplex method. | 1 |
| 3 | Solution of LPP using Big – M method | 1 |
| 4 | Transportation Problems [ North west corner rule] | 1 |
| 5 | Transportation Problems [ Lowest Cost Entry Method] | 1 |
| 6 | Transportation Problems [ Vogel Approximation Method] | 1 |
| 7 | Transportation Problems [ Test for Optimality MODI method] | 1 |
| 8 | Assignment Problems [Hungarian Method] | 1 |
| 9 | Assignment Problems [ Travelling Salesman Problem] | 1 |
| 10 | Assignment Problems [ Unbalanced Problem] | 1 |
| 11 | Two by two (2 X 2) games with saddle point. | 1 |
| 12 | Algebraic method of Two by two (2 X 2) games. | 1 |
| 13 | Arithmetic method of Two by two (2 X 2) games. | 1 |
| 14 | Dominance Method for games. | 1 |
| 15 | Sub Game Method for 2 X n, m X 2 games. | 1 |
| 16 | Graphical method for 2 x n games and m x 2 games | 1 |
| | Total | 16 |

**Recommended Books:**

1. S. D. Sharma: Operations Research, KedarNath RamNath Meerut, Delhi Reprint 2015.
2. Kanti Swarup, P.K.Gupta, Man Mohan, Operations Research, Sultan Chand and Sons.

**Core Course Practical In Mathematics**

**(CCPM- V)**

**Numerical Methods. (Marks 50) credits 04**

| Sr. No. | Title of the experiment | Sessions |
|---|---|---|
| 1 | Newton's forward interpolation | 1 |
| 2 | Newton's backward interpolation | 1 |
| 3 | Lagrange's interpolation | 1 |
| 4 | Newton's Divided difference interpolation | 1 |
| 5 | Newton's forward differentiation for Tabular Value | 1 |
| 6 | Newton's forward differentiation for Non-Tabular Value | 1 |
| 7 | Newton's backward differentiation for Tabular Value | 1 |
| 8 | Newton's backward differentiation for Non-Tabular Value | 1 |
| 9 | Trapezoidal rule | 1 |
| 10 | Simpson's 1/3rd rule | 1 |
| 11 | Simpson's 3/8th rule | 1 |
| 12 | Euler's Methos | 1 |
| 13 | Euler's Modified Method | 1 |
| 14 | Second order Runge-Kutta method | 1 |
| 15 | Fourth order Runge-Kutta method | 1 |
| 16 | Power method (Maximum Eigen Value) | 1 |
| | Total | 16 |

**Recommended Books:**


1 Devi Prasad. An Introduction to Numerical Analysis (Third Edition), Narosa Publishing

2. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India.

3. J. H. Mathews, Numerical Methods for Mathematics, Science and Engineering, Prentice Hall of India

4. K. Sankara Rao, Numerical Methods for Scientists and Engineers, Prentice Hall of India. India.

5. Bhupendra Singh, Numerical Analysis, Pragati Prakashan.

**Core Course Practical In Mathematics (CCPM-VI)**

**Mathematical Computation Using Python**

**(Marks 50) credits 04**

| Sr. No. | Title of the experiment | Sessions |
|---|---|---|
| 1 | Introduction to Python | 1 |
| 2 | Expression and operators | 1 |
| 3 | Conditional statements | 1 |
| 4 | Looping and control statements | 1 |
| 5 | Functions | 1 |
| 6 | Modules and packages in Python | 1 |
| 7 | Operation on sets | 1 |
| 8 | Numerical Integration (Trapezoidal, Simpson's $1/3^{rd}$ & $3/8^{th}$) | 3 |
| 9 | Roots of equations (Bisection, Newton-Raphson Method) | 2 |
| 10 | Initial value problem (Euler, Euler Modified, RK2, RK4) | 4 |
| | Total | 16 |

**Recommended Books:**


1. Jaan Kiusalaas, Numerical Methods in Engineering with Python3, Cambridge University Press

2. Amit Saha, Doing Math with Python, No Starch Press, 2015.

3. Yashwant Kanetkar and Aditya Kanetkar, Let Us Python, BPB Publication, 2019

**Core Course Practical in Mathematics (CCPM-VII)**

**Project, Study Tour Report and**

**Viva(Marks 50) credits 04**

**A. PROJECT [30 Marks]**

Project should be based on Mathematical modelling, Concepts and History of Mathematics,Mathematicians or any other relevant subjects.

**B. STUDY TOUR [05 Marks]**

It is expected that the tour should contain at least renown academic institution so that the visiting studentswill be inspired to go for higher studies in Mathematics.

**C. VIVA-VOCE (on the project report) [15 Marks]**

## SCHEME OF MARKING (THEROY)

| Sem. | DSC | Marks | Evaluation | Sections | Answer Books | Standard of passing |
|---|---|---|---|---|---|---|
| V | 1003E1 | 80 | Semester wise | Two sections each of 40 marks | As per Instruction | 35% (28 marks) |
| | 1003E2 | 80 | Semester wise | Two sections each of 40 marks | As per Instruction | 35% (28 marks) |
| VI | 1003F1 | 80 | Semester wise | Two sections each of 40 marks | As per Instruction | 35% (28marks) |
| | 1003F2 | 80 | Semester wise | Two sections each of 40 marks | As per Instruction | 35% (28marks) |

## SCHEME OF MARKING (CIE) Continuous Internal Evaluation

| Sem. | DSC | Marks | Evaluation | Sections | Answer Books | Standard of passing |
|---|---|---|---|---|---|---|
| V | 1003E1 | 20 | Concurrent | - | As per Instruction | 35% (7 marks) |
| V | 1003E2 | 20 | Concurrent | - | As per Instruction | 35% (7 marks) |
| VI | 1003F1 | 20 | Concurrent | - | As per Instruction | 35% (7 marks) |
| VI | 1003F2 | 20 | Concurrent | - | As per Instruction | 35% (7 marks) |

## SCHEME OF MARKING (PRACTICAL)

| Sem. | DSC | Marks | Evaluation | Sections | Standard of passing |
|---|---|---|---|---|---|
| V AND VI | CCPM IV | 50 | Annual | As per Instruction | 35% (18 marks) |
| | CCPM V | 50 | Annual | As per Instruction | 35% (18 marks) |
| | CCPM VI | 50 | Annual | As per Instruction | 35% (18 marks) |
| | CCPM VII | 50 | Annual | As per Instruction | 35% (18 marks) |

***A separate passing is mandatory**

**Nature of Question Paper:**

**Instruction:**

- *All the questions are **compulsory**.*
- *Figures to the right indicate **full** marks.*
- *Draw neat labelled diagrams **wherever** necessary.*
- *Use of log table/calculator is allowed.*

**SECTION-I**

**Time: 2 hours** **Total Marks: 35**

**Q. 1) A) Choose correct alternative.** 05

**i)**

**a)** **b)** **c)** **d)**

**ii)**

**a)** **b)** **c)** **d)**

**iii)**

**a)** **b)** **c)** **d)**

**iv)**

**a)** **b)** **c)** **d)**

**v)**

**a)** **b)** **c)** **d)**

**B. Fill in the Blanks.** **02**

**i)**

**ii)**

**Q.2 Attempt any two.** **16**

**i)**

**ii)**

**iii)**

**Q.3Attempt any Three.** **12**

**i)**

**ii)**

**iii)**

**iv)**

**v)**

## SCHEME OF MARKING

| Paper No. | Internal Evaluation | End semester theory Examination | Total |
|---|---|---|---|
| **DSC-1003 E1(Section I)** | 15 | 35 | 50 |
| **DSC-1003 E1(section II)** | 15 | 35 | 50 |
| **DSC-1003 E2(section I)** | 15 | 35 | 50 |
| **DSC-1003 E2(section II)** | 15 | 35 | 50 |
| **DSC-1003 F1(section I)** | 15 | 35 | 50 |
| **DSC-1003 F1(section II)** | 15 | 35 | 50 |
| **DSC-1003 F2(section I)** | 15 | 35 | 50 |
| **DSC-1003 F2(section II)** | 15 | 35 | 50 |

## Structure of B.Sc. III (Semester V & VI) (Mathematics)

| B.Sc. III | Subject (Core Course) | No. Of Lect. | Hours | Credits |
|---|---|---|---|---|
| **Semester – V** | Mathematics: -<br>Real Analysis and Modern Algebra | 6 | 4 | 4 |
| **Semester –V** | Mathematics: -<br>Partial Differential Equations and NumericalMethod | 6 | 4 | 4 |
| **Semester –VI** | Mathematics: -<br>Metric spaces and Linear Algebra | 6 | 4 | 4 |
| **Semester –VI** | Mathematics: -<br>Complex Analysis and Optimization Techniques | 6 | 4 | 4 |
| **Annual Practical** | CCPM(IV)<br>Operations Research | 4 | 3.2 | 4 |
| | CCPM(V)<br>Numerical Methods | 4 | 3.2 | 4 |
| | CCPM(VI)<br>Python Programming | 4 | 3.2 | 4 |
| | CCPM(VII)<br>Project, Study tour , Viva | 4 | 3.2 | 4 |
| **Annual SEC** | Skill Enhancement course (SE) | 2 | 1.6 | 2 |
| | Skill Enhancement course (SF)<br>Transportation problem and its mathematicalformulation | 2 | 1.6 | 2 |