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 2020-21

B.Sc.Part-III [Semester V]

Course code	Title o the course	Instructions Lectures /Week	Duration of term end exam	Marks Term end exam	Marks (Internal) Continuous Assessment	Credit
DSC - 1003E1	Real Analysis and Abstract Algebra	6	3 hours	80	20	4
DSC - 1003E2	Matrix Algebra/ Optimization Techniques and Numerical Methods-I	6	3hours	80	20	4
SEC-SE	Programming in C++	3	2.4	50	--	2

B. Sc. Part-III [Semester VI]

Course code	Title o the course	Instructions Lectures /Week	Duration of term end exam	Marks Term end exam	Marks (Internal) Continuous Assessment	Credit
DSE 1003F1	Metric Spaces and Linear Algebra	6	3 hours	80	20	4
DSE 1003F2	Complex Analysis and Numerical Methods-II	6	3 hours	80	20	4
SEC-SF	Transportation problem and its mathematical formulation	3	2 .4	50	--	2

Core Course Practical in Mathematics [CCPM IV to VII] Total Credit 08

Course code	Title o the course	Instructions Lectures /Week	Duration of term end exam	Marks [End of academic year]	Credit
CCPM IV	Operations Research	5	6 hours	50	2
CCPM V	Numerical Methods	5	6 hours	50	2
CCPM VI	Python Programming	5	6 hours	50	2
CCPM VII	Project, sturdy tour, viva.	5	6 hours	50	2

Semester: V

MATHEMATICS-DSC -1003 E1

Real analysis and Modern Algebra

Theory: 72 Hours (96 lectures of 48 minutes) - Credits -4 (Marks-100)

Section I: Real Analysis

Course Outcomes:

After studying this course student will able to

CO1: Understand The characteristics of set of real number..

CO2: Learn Sequence and series of real numbers and their properties.

CO3: Use the ratio, root, alternating series and limit comparison test for convergence and absolute convergence of infinite series of real numbers

CO4: Learn Riemann Integral and Improper Integral.

Unit	Contents	Hours Allotted
1	The algebraic and ordered properties of R, Absolute value and real line, The completeness property of R, Application of supremum property, Intervals. Sequence: Definition and examples, Limit of Sequence, Limit Theorems, Monotone Sequences, Subsequences and The Bolzano-Weierstrass Theorem, The Cauchy Criterion, Property of Divergent Sequences, Introduction to Series: Definition and examples, n^{nt} term Test, Cauchy Criterion for the series, Comparison Tests, Cauchy Condensation Test.	20
2	The Riemann integral: Definition, examples and properties, Riemann integrable functions, The squeeze Theorem, Classes of Riemann integrable functions, The fundamental Theorem. Improper integral, Definition of improper integral of first kind, Comparison test,μ – test for Convergence, Absolute and conditional convergence, Integral test for convergence of series, Definition of improper integral of second kind and some tests for their convergence, Cauchy principle value.	16

Recommended Book:

1. R. G. Bartle, D. R Sherbert,, Introduction to Real Analysis, John Wiley and Sons(Asia) P. Ltd., 2000.
2. D. Somasundaram , B Choudhary, First Course in Mathematical Analysis, NarosaPublishing House , New Delhi, Eighth Reprint 2013.

Reference Books:

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2 . K. A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts inMathematics, Springer Verlag, 2003.
3. R. R. Goldberg, Methods of Real Analysis, *Oxford* & IBH Publishing Co. Pvt. Ltd., New Delhi.

Section II: Modern Algebra

Course Outcomes:

After studying this course student will able to

CO1: Understand an algebraic structures Group and ring.

CO2: Understand Properties and terminologies related to Group and Ring.

CO3: Apply fundamental theorem, Isomorphism theorems of groups to prove these theorems for Ring.

CO4: Recognize the mathematical objects that are group and classify them as abelian, cyclic and permutation group

Unit	Contents	Hours Allotted
1	Binary operations – Definitions and properties, Groups – Definition and elementary properties, Finite groups and composition tables, Subgroups and its properties, Generators and cyclic groups, Permutations – Functions and permutations cycles and cyclic notation, even, odd, permutations, Symmetric group, Alternating groups. Cyclic groups-elementary properties, The classification of cyclic groups, Isomorphisms –Definition and elementary properties, Cayley's theorem, Groups of cosets, Applications, Normal subgroups – Factor groups, Criteria for existing of a coset group ,Inner automorphism and normal subgroups ,Simple groups, The fundamental theorems of isomorphisms, applications	20
2	Definition and basic properties, Fields, Integral domains, divisors of zero andcancellation laws, The characteristic of a ring, some non commutative rings ,Examples, matrices over a field, The real quaternions, Homomorphism of ringsDefinition and elementary properties, Maximal and Prime ideals, Prime fields	16

Recommended Book:

John B Fraleigh , The first course in Abstract Algebra , Narosa publishing house.

Reference Books:

1. Joseph A Gallian, Contemporary Abstract Algebra , Narosa publishing house.

   PearsonEducation, Seventh Edition(2014).

2 I. N. Herstein, Topics in Algebra, *Wiley Eastern. 1979*.

3. V. K. Khanna, S. K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House,PVT. LTD.,New Delhi.

MATHEMATICS-DSC -1003E2
Semester: V
Matrix Algebra and Numerical Methods-I
Theory: 72 Hours (96 lectures of 48 minutes) - Credits -4 (Marks-100)
Section I: Matrix Algebra

Course Outcomes:

After studying this course student will able to

CO1: Learn Terminologies related with matrices.

CO2: To solve system of homogeneous and non-homogeneous equations

CO3: Calculate eigen values and corresponding eigen vectors of square matrix

CO4: Calculate the translation, dilation, rotation of point, line and plane by using matrices

Unit	Contents	Hours Allotted
1	Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces. Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations.	18
2	Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four. Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics	18

Recommended Books:

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.

2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt.Ltd.,New Delhi, 2004.

3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

Section II: Numerical Methods-I

Course Outcomes:

After studying this course student will able to

CO1: Use approximate numerical methods and determine the solutions to give non-linear equations

CO2: Use appropriate numerical methods and determine approximate solutions to systems of linear equations and ordinary differential equations.

CO3: Learn numerical methods to calculate eigen value

CO4: Learn numerical method to find solution of system of equations

Unit	Contents	Hours Allotted
1	Introduction: Polynomial equations, algebraic equation and their roots, iterative methods, Bisection method, algorithm, examples, Secant method: iterative sequence of secant method, examples, Regula-Falsi method: algorithm, graphical representation, examples. Newton's method: algorithm, examples. Introduction: System of linear equations as a vector equation Ax = b, Augmented matrix. Direct methods: Gauss elimination method: Procedure, examples, Gauss-Jordan method: Procedure, examples. Iterative methods: General iterative rule	18
2	Jacobi iteration scheme, examples. Gauss-Seidel method: Formula, examples. Eigen values and eigenvectors of a real matrix, Power method for finding aneigen value of greatest modulus, the case of matrix whose dominant eigenvalue is not repeated, examples. Method of exhaustion, examples, Method ofreduction, examples. Shifting of the eigen value, examples	18

Recommended Book:

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

Reference Books:

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

2. J. H. Mathews, Numerical Methods for Mathematics, Science and Engineering, Prentice Hallof India.

3. K. SankaraRao,Numerical Methods for Scientists and Engineers, , Prentice Hall of India.

4. Bhupendra Singh, Numerical Analysis, Pragati Prakashan.

Semester: VI

MATHEMATICS-DSC -1003 F1

Metric Spaces and Linear Algebra

Theory: 72 Hours (96 lectures of 48 minutes) - Credits -4 (Marks-100)

Section I: Metric Spaces

CourseOutcome:

After studying this course student will able to

CO1: Learn Metric spaces and its different types.

CO2: Apply the notion of metric space to continuous functions on metric spaces

CO3: Demonstrate the properties of continuous function on metric space

CO4: Understand the basic concepts of connectedness, completeness and compactness of metric space

Unit	Contents	Hours Allotted
1	Definition and examples of metric spaces. Open ball. Open set. Closed setas complement of open set. Interior point and interior of a set. Limit point and closure of a set. Boundary point and boundary of a set. Properties of interior, closure and boundary. Bounded set and diameter of a set. Distance between two sets. Subspace of a metric space. Convergent sequence. Cauchy sequence. Every convergent sequence is Cauchy and bounded, but the converse is not true. Completeness. Cantor's intersection theorem. R is a complete metric space. Q is not complete	18
2	Continuous mappings, sequential criterion of continuity. Uniform continuity. Compactness, Sequential compactness, Heine-Borel theorem in R. Finite intersection property, continuous functions on compact sets. Concept of connectedness and some examples of connected metric space, connected subsets of R, C. Contraction mappings, Banach Fixed point Theorem and its application to ordinary differential equations.	18

Recommended Book: Satish Shirali and Harikishan L. Vasudeva, Metric Spaces, SpringerVerlag, London, 2006.

Reference Books:

[1] S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.

[2] P. K. Jain and K. Ahmad, Metric Spaces, Narosa Publishing House.

[3] G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004. T. M.Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.

Section II: Linear Algebra

CourseOutcome:

After studying this course student will able to

CO1: Understand the concept of Vector spaces and operators on them.

CO2: Learn properties of Inner product spaces

CO3: Learn basic concept of linear transformation, dimension theorem

CO4: Familiarize characteristic roots and characteristic vectors.

Unit	Contents	Hours Allotted
1	Vector spaces, General properties of vector spaces, Vector subspaces, Algebra of subspaces, linear combination of vectors, Linear span, linear sum of two subspaces .Linear dependence and independence of vectors, Basis of vector space Finite dimensional vector space, Dimension of a vector space, Dimension of subspace, Linear transformations, linear operators, Range and null space of linear transformation, Rank and nullity of linear transformation, Linear transformations as vectors ,product of linear transformations, Invertible linear transformation.	18
2	The adjoint or transpose of a linear transformation ,Sylvester's law of nullity, characteristic values and vectors of linear transformation, Cayley -Hamilton theorem, Diagonalisable operators, Inner product spaces, Euclidean and unitary, Norm or length of vector, Schwartz inequality, Orthogonality, Orthonormal set,complete orthonormal set Gram – Schmidt ortogonalisation process.	18

Recommended Book:

J. N.Sharma and A .R. Vasistha , Linear Algebra, Krishna Prakashan mandir Meerut – 250002

Refference Books:

1. Kenneth Hoffman and Ray Kunze, Linear Algebra, Pearson Education, New Delhi.
2. Stephen H. Friedberg , Linear Algebra , Prentice Hall of India Pvt. Ltd. 4^{th} edition 2007.

MATHEMATICS-DSC -1003F2
Semester: V
Complex Analysis and Numerical Methods-II
Theory: 72 Hours (96 lectures of 48 minutes) - Credits -4 (Marks-100)
Section I: Complex Analysis

Course Outcomes:

After studying this course student will able to

CO1: Familiarize with Basic concepts of functions of theory of functions of complex variable.

CO2: Learn Differentiation and Integration of complex valued functions

CO3: Apply Cauchy integral formula to calculate integrals

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

Unit	Contents	Hours Allotted
1	Basic algebraic and geometric properties of complex numbers, Function of complex variable, Limits, continuity and differentiation, Cauchy Riemann equations, Analytic functions and examples of analytic functions, Exponential function, Logarithmic function, Trigonometric function, Definite integrals of functions, Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals, Cauchy integral formula and examples.	**18**
2	Convergence of sequences and series of complex variables, Taylor seriesand its examples, Laurent series and its examples, absolute and uniform convergence of power series, Isolated singular points, Residues, Cauchy's residue theorem, Residue at infinity, The three types of isolated singularities, Residues at poles and examples, Zeros of analytic functions, Zeros andpoles, Application of residue theorem to evaluate real integrals	**18**

Recommended Books:

James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8thEd.,McGraw – Hill Education (India) Edition, 2014. Eleventh reprint 2018.

Reference Books:

1. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, SecondEdition , 2005, Ninth reprint 2013.
2. Lars V Ahlfors, Complex Analysis, McGraw-Hill Education; 3 edition (January 1,1979).
3. S.B.Joshi, T.Bulboaca and P.Goswamy, Complex Analysis, Theory and Applications,DeGruyter, Germany(2019).

Section II: Numerical Methods-II

Course Outcomes:

After studying this course student will able to

CO1: Use appropriate numerical methods to evaluate the integration

CO2: Demonstrate the use of interpolation methods to find intermediate values in given graphical and/or tabulated data for unequally spaced data

CO3: Demonstrate the use of interpolation methods to find intermediate values in given graphical and/or tabulated data for equally spaced data

CO4: Learn to find the solutions of ordinary differential equations by Euler, Taylor and Runga Kutta Method

Unit	Contents	Hours Allotted
1	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 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	18
2	Numerical differentiation based on interpolation polynomial.Numerical integration:Newton-Cotes formula (statement only), Basic Trapezoidal rule (excluding the computation of error term), composite Trapezoidal rule, examples, Basic Simpson's 1/3rd rule (excluding the computation of error term), composite Simpson's 1/3rd rule, examples, Basic Simpson's 3/8th rule (excluding the computation of error term), composite Simpson's 3/8th rule, examples. Euler's Method, Examples, Second order Runge-Kutta method (formula only), examplesFourth order Runge-Kutta method (formula only), examples	18

Recommended Book:

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

Reference Books:

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

2. J.H. Mathews, Numerical Methods for Mathematics, Science and Engineering, Prentice Hallof India.

3. K. SankaraRao,Numerical Methods for Scientists and Engineers, , Prentice Hall of India.

Skill Enhancement
CourseSEC-SE
Programming in C++

List of hands on examples (using C++)

1. Calculate the sum 1+2+3+…+n
2. Enter 100 integers into an array and sort them in an ascending order.
3. HCF and LCM of three positive integers.
4. Separate even and odd numbers from first N natural numbers.
5. Find all the prime numbers between 1 and N (N being a positive integer).
6. Find the binary representation of a decimal number (up to 3 digits).
7. Addition , subtraction, multiplication of two matrices (order up to 4 × 4).
8. Compute the value of the determinant of a square matrix (order up to 4 × 4).

References

[1] Arnold Robbins, Linux Programming by Examples The Fundamentals, 2nd Ed., PearsonEducation, 2008.
[2] Cox K, Red Hat Linux Administrator's Guide, PHI, 2009.
[3] R. Stevens, UNIX Network Programming, 3rd Ed., PHI, 2008.
[4] Sumitabha Das, UNIX Concepts and Applications, 4th Ed., TMH, 2009.

SEC-SF

Transportation problem and its mathematical formulation

Northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, 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.

Books Recommended:

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

Core Course Practical In Mathematics (CCPM-VI)
Operational
Research (Marks 50)
credits 04

Sr. No.	Title of the experiment	Sessions
1	Graphical method for linear programming problems	1
2	Transportation Problems[North west corner rule]	1
3	Transportation Problems[Lowest Cost Entry Method]	1
4	Transportation Problems[Vogel Approximation Method]	1
5	Transportation Problems[Test for Optimality MODI method]	1
6	Assignment Problems [Hungarian Method]	1
7	Assignment Problems [Maximization Case]	1
8	Assignment Problems[Travelling Salesman Problem]	1
9	Assignment Problems[Unbalanced Problem]	1
10	Two by two (2 X 2) games without saddle point.	1
11	Algebraic method of Two by two (2 X 2) games.	1
12	Arithmetic method of Two by two (2 X 2) games.	1
13	Graphical method for 2 x n games and m x 2 games.	1
14	Processing n jobs through 2 machines.	1
15	Processing n jobs through 3 machines.	1
16.	Processing 2 jobs through m machines. Processing n jobs through m machines.	1
	Total	**16**

Core Course Practical In Mathematics (CCPM-III)
Numerical Methods
(Marks 50) credits 04

Sr. No.	Title of the experiment	Sessions
1	Bisection Method	1
2	Secant Method	1
3	Newton's method	1
4	Gauss elimination method	1
5	Gauss-Jordan method	1
6	Jacobi iteration scheme	1
7	Gauss-Seidel method	1
8	Power method	1
9	Newton's forward interpolation	1
10	Newton's backward interpolation	1
11	Lagrangian interpolation	1
12	Divided difference interpolation	1
13	Trapezoidal rule	1
14	Simpson's 1/3rd rule	1
15	Second order Runge-Kutta method	1
16.	Fourth order Runge-Kutta method	1
		16

RECOMMENDED BOOKS:

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

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

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

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

5. Numerical Analysis, Bhupendra Singh, Pragati Prakashan.

Core Course Practical In Mathematics (CCPM-V)
Numerical Methods
(Marks 50) credits 04

Sr. No.	Title of the experiment	Sessions
1	Bisection Method	1
2	Secant Method	1
3	Newton's method	1
4	Gauss elimination method	1
5	Gauss-Jordan method	1
6	Jacobi iteration scheme	1
7	Gauss-Seidel method	1
8	Power method	1
9	Newton's forward interpolation	1
10	Newton's backward interpolation	1
11	Lagrangian interpolation	1
12	Divided difference interpolation	1
13	Trapezoidal rule	1
14	Simpson's 1/3rd rule	1
15	Second order Runge-Kutta method	1
16.	Fourth order Runge-Kutta method	1
		16

RECOMMENDED BOOKS:

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

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

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

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

5. Numerical Analysis, Bhupendra Singh, 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	Python Data Structure	1
8	Operation on sets and array	1
9	System of linear algebraic equations	1
10	Roots of equations	1
11	Initial value problem	1
12	Magic square and Area calculation without measurement	1
13	Graph Theory: Network	1
14	Collaz conjucture and Monte Hall problem	1
15	Data compressing using Numpy	1
16.	Data visualization in Python	1
		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. YashwantKanetkar and Aditya Kanetkar,Let Us Python, BPB Publication, 2019.

Core Course Practical In Mathematics (CCPM-VII)
Project, Study-Tour, Seminar, Viva-Voce(Marks 50) credits 04

A :PROJECT [30 Marks]

Project should be based on Mathematical modeling, 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 visitingstudents will 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**

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Nature of Theory Question Paper

***Instructions*: 1) All the questions are *compulsory*.**

*2) Answers to the two sections should be written in **same** answer book.*

*3) Figures to the right indicate **full** marks.*

*4) Draw neat labeled diagrams **wherever** necessary.*

5) Use of log table/calculator is allowed.

SECTION-I

Time : 2 hours **Total Marks: 40**

Q.1. Choose correct alternative. **8**

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)

vi)

A) B) C) D)

vii)

A) B) C) D)

viii)

A) B) C) D)

A) B) C) D)

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

A)

B)

C)

Q.3. Attempt any four. **16**

a)

b)

c)

d)

e)

f)