VIVEKANAND COLLEGE (AUTONOMOUS), KOLHAPUR

Department of Mathematics

B.Sc.-III

Semester-V & VI

CBCS Syllabus to be implemented from June 2020 Onwards.

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 understand and learn about

> CO1:   The characteristics of set of real number.
> CO2:   Sequence and series of real numbers and their properties.
> CO3:   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, Narosa Publishing 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 in Mathematics, 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 understand and learn about

CO1: An algebraic structures Group and Ring

CO2: Properties and terminologies related to Group and Ring.

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 and cancellation laws, The characteristic of a ring, some non commutative rings ,Examples, matrices over a field, The real quaternions, Homomorphism of rings Definition 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. Pearson Education, 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 completing this course, students will understand and learn about

CO1: Terminologies related with matrices

CO2:   able to solve system of homogeneous and non-homogenous equations.

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.

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

Course Outcomes:

After studying this course student will understand and learn about

      CO1: Formulate and apply suitable methods to solve problems

      CO2: Identify and select procedures for various sequencing, assignment, transportation problems

Unit	Contents	Hours Allotted
1	Introduction, Formulation of Linear Programming Problems. General formulation of Linear Programming Problems, Slack and Surplus variables, Canonical forms and Standard form of Linear Programming Problems. Methods to solve Linear Programming Problems. Simplex method-Formulation, Optimal Solution (Minimization and Maximization).	12
2	Transportation Problem: Introduction, Mathematical formulation, Matrix form of Transportation Problem. Feasible solution, Basic feasible solution and optimal solution, Balanced and Unbalanced transportation problems. Methods of Initial Basic Feasible Solution: North-West corner rule (Stepping stone method), Lowest cost entry method (Matrix minima method), Vogel's Approximation Method (Unit Cost Penalty Method), The optimality test (MODI method). Assignment Models: Introduction, Mathematical formulation of assignment problem, Hungarian Method for assignment problem. Unbalanced assignment problem. Maximization Problem. Traveling salesman problem. Assignment problem with restrictions.	24

Recommended Books:

      J. K. Sharma : Operation Research: Theory and Applications, Laxmi Publications, 2017

Reference Books:

1. Sharma S. D., Operation Research-Theory Methods and Applications Kedarnath, Ramnath Meerut, Delhi Reprint 2015.
2. Mohan C. and Deep, Kusum, Optimization Techniques, New Age, 2009.
3. Mittal K. V. and Mohan C., Optimization methods in Operations Research and Systems Analysis, New Age, 2003
4. Taha H. A.: Operations Research – An introduction, Prentice Hall, (7th Edition), 2002.
5. Ravindran A., Phillips D. T. and Solberg J. J., operations Research: Principles and Practice, John Wiley and Sons, 2nd Edition, 2009.
6. Kanti Swarup, P. K. Gupta and Manmohan, Operation Research, S. Chand and Co.

Section II: Numerical Methods-I

Course Outcomes:

After studying this course student will understand and learn about

> CO1: Use appropriate numerical methods and determine the solutions to given non-linear equations.
>
> CO2: Use appropriate numerical methods and determine approximate solutions to systems of linear equations and ordinary differential equations.
>
> CO3: Demonstrate the use of interpolation methods to find intermediate values in given graphical and/or tabulated data.

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 an eigen value of greatest modulus, the case of matrix whose "dominant eigen value is not repeated", examples. Method of exhaustion, examples, Method of reduction, 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 Hall of 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

Course Outcomes:

After studying this course student will understand and learn about

CO1: Metric spaces and its different types.

CO2: solution of ordinary differential equations using fixed point

Unit	Contents	Hours Allotted
1	Definition and examples of metric spaces. Open ball. Open set. Closed set as 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, Springer Verlag, 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

Course Outcomes:

After studying this course student will understand and learn about

CO1: Vector spaces and operators on them.

CO2: Inner product spaces

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. 4th 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:

Upon successful completion of this course, Students will understand and learn about

1. basic concepts of functions of theory of function of complex variable.
2. differentation and integration of complex valued functions.

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 series and 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 and poles, Application of residue theorem to evaluate real integrals	18

Recommended Books:

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

Reference Books:

1. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, Second Edition , 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 understand and learn about

CO1: Use appropriate numerical methods and determine the solutions to given non-linear equations.

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

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

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 Hall of India.

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

4. Bhupendra Singh, Numerical Analysis, Pragati Prakashan.

<div align="center">
Skill Enhancement Course
SEC-SE
Programming in C++
</div>

List of hands on examples (using C++)
      1. Calculate the sum $1+2+3+\ldots+n$
      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., Pearson Education, 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.

<div align="center">
SEC-SF

Transportation problem and its mathematical formulation
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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 Network Flows, 2nd Ed., John Wiley 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.

MATHEMATICS LAB: DSC -1003C (Practical) Credits: 08 Marks: 100

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 intepolation	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 intepolation	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 measurment	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 visiting students will be inspired to go for higher studies in Mathematics

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

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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)

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

     A)

    B)

    C)

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

     a)

    b)

    c)

    d)

    e)

    f)