# M.Sc. Mathematics Course Structure Under CBCS System

For the candidates admitted from the year 2016-2017 onwards

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>COURSE</th>
<th>SUBJECT TITLE</th>
<th>SUBJECT CODE</th>
<th>INSTR. HOURS</th>
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** Dissertation – 80 Marks and Viva Voce Examinations – 20 Marks
UNIT - I  A counting principle – Normal subgroups and quotient rings – Homomorphism - Another counting principle – Sylow’s theorem. (Ch. 2: § 2.5-2.7, 2.11, 2.12)

UNIT – II Ring Theory – Homomorphism – Ideals and Quotient Ring – More about ideals and Quotient Rings – Euclidean Rings. (Ch. 3: § 3.1-3.7)

UNIT – III Field Theory – Extension field – Transcendence of e. (Ch. 5: § 5.1, 5.2)

UNIT – IV Roots of polynomial- More about roots (Ch. 5: § 5.3&5.5)

UNIT – V Elements of Galois theory – Solvability of radicals. (Ch. 5: § 5.6,5.7)

TEXT BOOK:

REFERENCES:
3. “Algebra” by Thomas Hungerford,
GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M. Sc., MATHEMATICS – I SEMESTER – CORE COURSE - II
(For the candidates admitted from the year 2016 -17 onwards)

REAL ANALYSIS - I

UNIT-I  The Real and Complex Number Systems : Introduction – Ordered sets – Fields – The Real Field – Extended Real Number system – The Complex Field – Euclidean Spaces . (Ch. 1: pg no 01-17)

UNIT-II  Basic topology: Finite, countable and uncountable sets – Metric Spaces – Compact sets-Perfect sets-Connected sets. (Ch. 2: pg no 24-46)


UNIT IV  Series: The Number e – The root and ratio test – Power series – Summation by parts – Absolute Convergence- Addition and Multiplication of series - Rearrangements. (Ch. 3: pg no 63 - 82)

UNIT V  Continuity: Limits and continuous functions- continuity and compactness - continuity and connectedness - Discontinuity, Monotonic functions- Infinite Limits and Limits at Infinity. (Ch. 4: pg no 89-102)

TEXT BOOK:
“Principles of mathematical Analysis” by Walter Rudin (3rd Edn ), Tata McGraw-Hill

REFERENCES:

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M. Sc., MATHEMATICS - I SEMESTER – CORE COURSE - III
(For the candidates admitted from the year 2016 -17 onwards)

ORDINARY DIFFERENTIAL EQUATION

(Ch. 3: § 15, 16, 19 and Ch 5: § 26 -28)

UNIT -II Regular singular points – Legendre polynomials– Properties of Legendre polynomials – Bessel functions – Properties of Bessel functions.
(Ch. 5: § 29 and Ch 8: § 44 - 47)

UNIT-III Linear systems of First order equations – Homogeneous equations with constant coefficients –The method of solutions of successive approximations and Picard’s theorem. (Ch. 10: § 55,56 & Ch 13: § 68, 69)

UNIT - IV Qualitative properties of solutions – Oscilation theory and Sturm separation theorem- Sturm comparison theorem – Eigen values, Eigen functions and the Vibrating string. (Ch. 4: § 24, 25 & Ch.7:40)

UNIT - V Types of critical points: Stability – Critical points and stability for linear systems – Stability by Liapunov’s direct method. (Ch. 11: § 59- 61)

TEXT BOOK:
G.F. Simmons, “Differential Equations with Applications and Historical notes” T.M.H., New Delhi, 2003

REFERENCE BOOKS:

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M. Sc., MATHEMATICS - I SEMESTER – CORE COURSE - IV
(For the candidates admitted from the year 2016 -17 onwards)

CLASSICAL MECHANICS

UNIT - I  Mechanics of a particle, Mechanics of a system of particles, Constraints.  (Ch. 1: § 1.1-1.3)
UNIT - II  D’Alembert’s principle and Lagrange’s equations, Velocity-dependent potentials and the dissipation function, Hamilton’s principle, Some techniques of the calculus of variations – Simple applications of Lagrangian formulation.  (Ch. 1: § 1.4-1.6 & Ch 2: § 2.1-2.2)
UNIT - III  Derivation of Lagrange’s equations from Hamilton’s principle, Extension of Hamilton’s principle to non holonomic systems, Advantage of a variational principle formulation, conservation theorems and symmetry properties.  (Ch. 2: § 2.3-2.6)
UNIT - IV  Reduction to the equivalent one-body problem, The equations of motion and first integrals, The equivalent one-dimensional problem and classification of orbits, The Virial theorem.  (Ch. 3: § 3.1-3.4)
UNIT - V  The differential equation for the orbit and integrable power-law potentials, Conditions for closed orbits (Bertrand’s theorem), The Kepler problem: Inverse square law of force, The motion in time in the Kepler problem, The Laplace-Runge-Lenz vector.  (Ch. 3: § 3.5-3.9)

TEXT BOOK:

REFERENCE:

CHAIRMAN – BOS  COE
M. Sc., MATHEMATICS – I SEMESTER – ELECTIVE COURSE – I
(For the candidates admitted from the year 2016-17 onwards)

GRAPH THEORY

(Ch. 1: § 1.1-1.7, and Ch. 2: § 2.1-2.3)

UNIT- II  Connectivity, Euler tours and Hamilton cycles: Connectivity – Block – Euler tours – Hamilton cycles.  
(Ch. 3: § 3.1 and Ch. 4: § 4.1-4.2)

(Ch. 5: § 5.1-5.2, and Ch. 6: § 6.1-6.2)

UNIT- IV  Independent sets and cliques, vertex colouring: Independent sets – Ramsey’s theorem – Chromatic number – Brook’s theorem.  
(Ch. 7: § 7.1-7.2 and Ch. 8: § 8.1-8.2, 8.4)

UNIT- V  Planer Graphs: Plane and planar graphs – Dual graphs – Euler’s formula – Five colour theorem and the four colour conjecture.  
(Ch. 9: § 9.1-9.3, 9.6)

TEXT BOOK:
GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M. Sc., MATHEMATICS - II SEMESTER – CORE COURSE -V
(For the candidates admitted from the year 2016-17 onwards)

ALGEBRA - II

UNIT 1: Linear transformation – Characteristic roots – Matrices.

UNIT 2: Canonical form – Triangular form – Nilpotent linear transformation –
Decomposition of V – Jordan form.


UNIT 4: Hermitian, Unitary and Normal Transformation – Real Quadratic forms.

UNIT 5: Finite field – Wedderburn theorem on finite division ring.

TEXT BOOK:

REFERENCE BOOKS:
3. Thomas Hungerford, “Algebra”.

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M. Sc., MATHEMATICS - II SEMESTER – CORE COURSE - VI
(For the candidates admitted from the year 2016-17 onwards)

REAL ANALYSIS – II

UNIT-I  **Differentiation:** Derivative of Real Function- Mean value Theorems - The continuity of Derivatives – L’ Hospital’s Rule - Taylor’s Theorem - Differentiation of Vector valued functions.  (Ch. 5: pg no 103-119)

UNIT-II  **The Riemann Steltjes Integral:** Definition and Existence of Integral Properties of Integral – Integration and Differentiation – Rectifiable Curves.  (Ch. 6: pg no 120-142)

UNIT-III  **Sequence and series of functions:** Sequence of functions – Discussion of main problem – Uniform Convergence and Continuity – Uniform convergence and Integration – Uniform Convergence and Differentiation.  (Ch. 7: pg no 143-152)

UNIT IV  Equicontinuous families of functions – The Stone – Weierstrass theorem – Some special Functions - Power Series – The Exponential and Logarithmic Functions.  (Ch. 7: pg no 154-165& Ch.8: 172 - 181)

UNIT-V  Special Functions – The Trigonometric Functions - The Algebraic Completeness of the Complex Field - Fourier Series – The Gamma Function.  (Ch. 8: pg no 182 - 196)

TEXT BOOK:  
“**Principles of mathematical Analysis**” by Walter Rudin (3rd Edn ), Tata McGraw-Hill

REFERENCES:

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M. Sc., MATHEMATICS - II SEMESTER – CORE COURSE – VII
(For the candidates admitted from the year 2016 -17 onwards)

COMPLEX ANALYSIS

UNIT - I  Analytical Functions: Cauchy-Riemann Equation, Analyticity, Harmonic functions, Bilateral transformations and Mappings: Basic Mappings, Linear Fractional transformations. (Ch. 5:§5.1-5.3, Ch. 3: §3.1,3.2)

UNIT- II  Power Series: Sequences revisited, Uniform Convergence, Maclaurin and Taylor Series, Operations on Power Series, Conformal Mappings. (Ch. 6: §6.1-6.4, Ch. 11: §11.1)

UNIT - III Complex Integration and Cauchy’s Theorem: Curves, Parameterizations, Line Integrals, Cauchy’s Theorem. (Ch. 7: §7.1-7.4)

UNIT- IV Applications of Cauchy’s Theorem: Cauchy’s Integral Formula, Cauchy’s Inequality and Applications, Maximum Modules Theorem. (Ch. 8: §8.1-8.3)

UNIT - V Laurent’s Series and The Residue Theorem: Laurent’s Series, Classification of Singularities, Evaluation of Real Integrals, Argument Principle. (Ch. 9: §9.1-9.4)

TEXT BOOK: S.Ponnusamy and Herb Silverman, “Complex Variables with Applications”, Birkhauser, Boston, 2006

REFERENCE BOOKS:

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M. Sc., MATHEMATICS - II SEMESTER – CORE COURSE - VIII
(For the candidates admitted from the year 2016-17 onwards)

PARTIAL DIFFERENTIAL EQUATIONS

UNIT - I
First order PDE – Curves and Surfaces – Genesis of First order PDE – Classification of Integrals - Linear Equations of the First order.
(Ch. 1: § 1.1-1.4)

UNIT - II
(Ch. 1: § 1.5-1.8)

UNIT - III
Second order PDE: Classification of second order PDE: One-dimensional Wave equation – Vibrations of an Infinite string – Vibrations of a string of finite Length (Method of separation of variables).
(Ch. 2: § 2.2,2.3 & 2.3.1,2.3.3)

UNIT - IV
(Ch. 2: § 2.4,2.4.1-2.4.5)

UNIT - V
(Ch. 2: § 2.5,2.5.1,2.5.2,2.6,2.6.1,2.6.2)

TEXT BOOK:

REFERENCE BOOKS:

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GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M. Sc., MATHEMATICS - II SEMESTER – ELECTIVE COURSE- II
(For the candidates admitted from the year 2016-17 onwards)

NUMERICAL METHODS

UNIT – I: Empirical relations and curve fitting: Equations reducible to linear form-Methods of moments-METHOD OF LEAST SQUARES-Fitting a straight line--METHOD OF LEAST SQUARES –Fitting a second degree parabola-VALUE OF THE SUM OF SQUARES OF RESIDUALS - Conclusions. (Ch.2: § 2.1-2.6)


UNIT - IV: Numerical Differentiation and Integration - Numerical Integration - Newton-cote’s Quadrature Formula – Romberg’s Method- Gauss’s Quadrature Formula - Gauss – Legendre Integration Method . (Ch:8 § 8.8,8.9,8.10,8.11,8.12)


TEXT BOOK:
“Numerical Methods with programming in C” Prof.T.Veerarajan and Dr.T.Ramachandran.

REFERENCE BOOK
1. Elementary Numerical Analysis – Samuel D.Conte Cal De Boor.
2. Numerical Methods-Dr.P.Kandasamy, Dr.K.Thilagavathy, Dr.K.Gunavathi.
(Note:Scientific calculator is allowed).

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M. Sc., MATHEMATICS - III SEMESTER – CORE COURSE - IX

(For the candidates admitted from the year 2016-17 onwards)

FUNCTIONAL ANALYSIS

UNIT – I  Banach Space: Definition and some Examples – continuous linear transformations – The Hahn Banach theorem – The natural imbedding of N in N* - The open mapping theorem – The conjugate of an operator. (Ch. 9: § 46-51)

UNIT – II  Hilbert Space: Definition and some properties – Orthogonal complements – orthonormal sets – the conjugate space H* - the adjoint of an operator – self adjoint operators – normal and unitary operators.  (Ch. 10: § 52-58)

UNIT – III  Finite Dimensional Spectral Theory: Matrices – Determinants and the spectrum of an operator – the spectral theorem – A survey of the situation.  (Ch. 11: § 60-63)

UNIT – IV  General preliminaries of Banach Algebras: Definition and some Examples – Regular and singular elements – Topological divisors of zero – the spectrum – the formula for spectral radius – the radical and semi-simplicity.  (Ch. 12: § 64-69)

UNIT – V  The structure of Commutative Banach Algebra: The Gel’fand mapping – the application of the formula r(x) = lim ||x^n||^1 / n – involution in Banach algebras – The Gel’fand Neumark theorem.  (Ch. 13: § 70-73)

TEXT BOOK:

REFERENCE BOOKS:
GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M. Sc., MATHEMATICS – III SEMESTER – CORE COURSE - X
(For the candidates admitted from the year 2016-17 onwards)

INTEGRAL EQUATIONS, CALCULUS OF VARIATION
AND FOURIER TRANSFORMS


(Ch. 2: § 2.1-2.9[2])


Ch. 7[3])

UNIT-III  Hankel Transforms(finite case only) – Definition – Inverse formula – Some important results for Bessel functions - Linearity Property – Hankel transform of differential operators – Parseval’s Theorem.

(Ch. 9[3])

UNIT : IV  Linear Integral equations – Definition - Regularity conditions – Special kind of Kernels – Eigen values and Eigen functions – Convolution Integral – The inner (or) Scalar product of two functions.

(Ch. 1)

UNIT-V  Reduction to a Algebraic Equations – Examples – Fredholm alternative – Examples – An Approximate method.

(Ch 2[1])

Text Book:

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M. Sc., MATHEMATICS – III SEMESTER – CORE COURSE - XI  
(For the candidates admitted from the year 2016-17 onwards)

**TOPOLOGY**

<table>
<thead>
<tr>
<th>UNIT- I</th>
<th>Topological spaces : Topological spaces - Basis for a topology - The orderTopology-The Product Topology and ( \times ). (Ch. 2: § 12-15)</th>
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<td>UNIT II</td>
<td>The subspace Topology – Closed set and limit Points continuous functions - The Product Topology. (Ch. 2: § 16-19)</td>
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| UNIT- III | The metric topology – Connected spaces – Connected subspaces of the real line – Components and Local connectedness.  
(Ch. 2: § 20, 21 and Ch. 3: § 23-25) |
| UNIT- IV | Compact spaces – Compact subspaces of the real line – Limit point compactness – Local compactness. (Ch. 3: § 26-29) |
| UNIT- V  | Countability axioms – The separation axioms – Normal spaces – (The Urysohn lemma,The Urysohn metrization theorem,Tietze Extension Theorem) Statement only. (Ch. 4: § 30-35) |

**TEXT BOOK:**

**REFERENCE BOOKS:**
GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M. Sc., MATHEMATICS - III SEMESTER – ELECTIVE COURSE - III
(For the candidates admitted from the year 2016-17 onwards)

ADVANCED OPERATIONS RESEARCH

UNIT : I
Integer Programming Problems Pure and Mixed I.P.P – Construction of
Gomory’s constraints, Fractional cut method – All I.P.P – Fractional cut
method – Mixed L.P.P Branch and bound method, Application of integer
programming. (Ch.11: § 11.1-11.4)

UNIT : II
Dynamic programming – Bellman’s Principle of Optimality - Characteristics
of a dynamic programming – Solutions of discrete D.P.P - Solution of L.P.P
using Dynamic Programming approach. (Ch.12: § 12.1,12.3,12.5,12.6)

UNIT : III
Queueing system – Elements and Characteristic of queueing system – Pure birth
process and pure death process – Classification of queueing models – Single
server models ( M/M/1: ∞ - FIFO), ( M/M/1: N/EIEO) birth and death process
. (Ch.17: § 17.1-17.8)

UNIT : IV
Inventory control – Types of Inventories – Objectives of Inventory control –
Costs associated with inventories – Factors affecting inventory control –
Concept of EOQ – Deterministic models with no shortage – Deterministic
models with shortage – Problems of EOQ with price break.
(Ch.18: § 18.1-18.7)

UNIT : V
Network Scheduling by CPM/PERT – Network basic components – Rules of
Network construction – CPM – Types of Floats – Critical path – Cost slop–
Probability consideration in PERT – Distinction between PERT and CPM.
(Ch.21: § 21.1-21.8)

Text Book:
Kanti Swarup, P.K. Gupta & Man Mohan – Operations Research, Sultan

Reference Books:
Macmillan.

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M. Sc., MATHEMATICS - III SEMESTER – ELECTIVE COURSE - IV

(For the candidates admitted from the year 2016-17 onwards)

PROBABILITY AND STOCHASTIC PROCESSES

UNIT : I

(Ch. 1: §1.3 to 1.10[1])

UNIT: II

(Ch. 2: § 2.1 to 2.5, Ch. 4: § 4.1 to 4.4[1])

UNIT: III

(Ch. 1: § 1.5, Ch. 2: § 2.1 to 2.3[2])

UNIT : IV
Markov Chains: Classification of States and Chains – Determination of Higher Transition probabilities – Stability of a Markov Chains - Markov Chain with Denumerable number of states - Reducible Chains - Markov Chain with Continuous state space. (Ch. 2: § 2.4 to 2.6, § 2.8, 2.9, 2.11[2])

UNIT : V

(Ch. 3: §3.1 to 3.5[2])

TEXT BOOKS:

REFERENCES:

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GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05

M. Sc., MATHEMATICS – IV SEMESTER – CORE COURSE - XII

(For the candidates admitted from the year 2016-17 onwards)

THEORY OF NUMBERS

UNIT-I
Introduction – Divisibility- Primes-The Binomial theorem- Congruences-Euler’s totient- Fermat’s, Euler’s and Wilson’s theorems- Solution of Congruences- The Chinese Remainder theorem. (Ch.1& Ch.2: § 2.1-2.3)

UNIT-II
Techniques of Numerical calculations- Public key cryptography- Prime power moduli- primitive roots and power residues- Congruences of degree two. (Ch.2: § 2.4-2.6,2.8,2.9)

UNIT-III
Number theory from an algebraic view point- Groups, Rings and Fields- Quadratic Residues- The Legendre symbol ( a/r) where r is an odd prime- Quadratic reciprocity. (Ch.2: § 2.10,2.11& Ch.3: §3.1-3.2)

UNIT-IV
The Jacobi symbol (p/q) where q is an odd positive integer. Binary Quadratic forms- Equivalence and reduction of Binary Quadratic forms- Sums of two squares – Positive definite binary quadratic forms. (Ch.3: § 3.3-3.7)

UNIT-V
Greatest integer function- Arithmetic functions- The Mobius inversion formula- Recurrences functions- Combinatorial number theory. (Ch.4:4.1 – 4.5)

TEXT BOOK:

REFERENCE BOOKS:
GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05

M. Sc., MATHEMATICS – IV SEMESTER – CORE COURSE - XIII
(For the candidates admitted from the year 2016-17 onwards)

DIFFERENTIAL GEOMETRY

UNIT – I
(Ch. 1: § 1-9)

UNIT – II
(Ch. 2: § 1-9)

UNIT – III
(Ch. 2: §10-18)

UNIT – IV
(Ch. 3: § 1-8)

UNIT – V
Differential Geometry of surfaces: Introduction- Compact surfaces whose points are umblics – Hilbert’s lemma - Compact surface of constant Guassian or Mean curvature – complete surface –characterization of Complete Surfaces - Hilbert’s theorem – Conjugate points on geodesics.
(Ch. 4: § 1-8)

TEXT BOOK:

REFERENCE BOOK:

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(For the candidates admitted from the year 2016-17 onwards)

MEASURE THEORY AND INTEGRATION


UNIT – III Abstract measure spaces: Measures and outer measures – Completion of Measures – Measure spaces – Integration with respect to measure.


TEXT BOOKS:

REFERENCE BOOKS:
GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M. Sc., MATHEMATICS – IV SEMESTER – ELECTIVE COURSE - V
(For the candidates admitted from the year 2016-17 onwards)

FLUID DYNAMICS

UNIT I Kinematics of fluids in motion: Real fluids and ideal fluids-Velocity of a fluid at a point, streamlines-path lines-steady and unsteady flows, velocity potential-the vorticity vector-local and particle rates of changes-equations of continuity-examples. (Ch 2: 2.1-2.8)

UNIT II Equations of motion of a fluid: Pressure at a point in a fluid at rest-Pressure at a point in a moving fluid-Condition at a boundary of two inviscid immiscible fluids, Euler’s equation of motion-Discussion of the case of steady motion under conservative body forces. (Ch 3: 3.1-3.4 & 3.7)

UNIT III Some three & Two dimensional flows:Introduction-Sources-Sinks and doublets-Images in a rigid infinite plane-Axis symmetric flows-Stoke’s stream function - Two-dimensional flows-Meaning of two-dimensional flow-Use of cylindrical polar co-ordinates-The stream function. (Ch 4: 4.1-4.3,4.5& Ch:5 5.1 – 5.3)

UNIT IV Viscous flows: Viscous flows-Stress components in a real fluid-Relation between Cartesian components of stress-Translation motion of fluid elements - The rate of strain quadric and principle stresses- Further properties of the rate of strain quadric. (Ch 8: 8.1-8.5)

UNIT V Stress analysis in fluid motion-Relation between stress and rate of strain-The coefficients of viscosity and laminar flow-The Navier-Stoke’s equations of motion of a viscous fluid. (Ch 8: 8.6-8.9)


REFERENCE BOOKS:
2.S.W.Yuan, Foundation of fluid mechanics, Prentice Hall of India Pvt.Ltd

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M. Sc., MATHEMATICS – IV- SEMESTER – PROJECT WORK

(For the candidates admitted from 2016-17 onwards)

# PROJECT WORK

<table>
<thead>
<tr>
<th>SL.</th>
<th>Area of Work</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PROJECT WORK:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) Plan of the Project</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>(ii) Execution of the plan / Collection of data / Organization of materials/ Fabrication Experimental study / Hypothesis, Testing etc., and Presentation of the report.</td>
<td>45</td>
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<tr>
<td></td>
<td>(iii) Individual Initiative</td>
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<tr>
<td>2.</td>
<td>VIVA VOCE EXAMINATION</td>
<td>20</td>
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</table>

**TOTAL** | **100** |

PASSING MINIMUM – 50 MARKS

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