

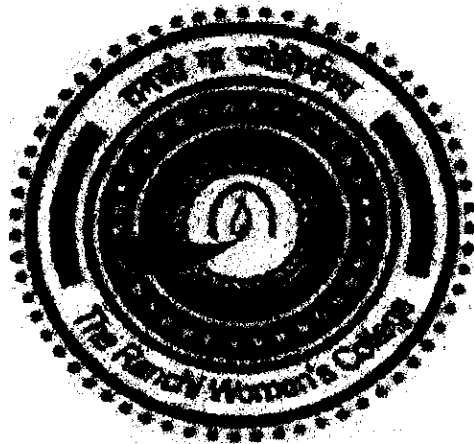
RANCHI WOMEN'S COLLEGE, RANCHI

(AUTONOMOUS COLLEGE UNDER RANCHI UNIVERSITY)

**UNDERGRADUATE
MATHEMATICS (HONS.)/GENERAL**

SYLLABUS W.E.F. 2018-19

(UNDER CHOICE BASED CREDIT SYSTEM)



DEPARTMENT OF MATHEMATICS

Ranchi Women's College, Ranchi

Department of Mathematics

Meeting for approval of Syllabus of B.Sc.(Mathematics) Hons/General Under Choice based credit system w.e.f 2018-2021.

A meeting of the Board of Studies was held on 08/04/2021 in the Department of Mathematics, Ranchi Women's College to approve the course structure of B.A./B.Sc. (Mathematics Hons) Three Year Degree course (six semesters) to be inter-fused to the session.

The following members were present in the meeting.

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| <ol style="list-style-type: none"> 1. Dr.(Mrs.) Smita Dey, Retd. Head of PG, Dept of Mathematics 2. Dr. C.S.P. Lugun, Head of PG, Dept of Mathematics 3. Dr. B.P. Verma, Principal, J.N. College Dhurwa 4. Dr. Ashalata Keshri, Associate Prof., Dept. of Mathematics, R.W.C. 5. Mrs. Nanda Banerjee, Head of Dept of Mathematics, R.W.C. 6. Mrs. Poonam Singh, Assistant Prof., Dept of Mathematics, R.W.C. 7. Dr.(Mrs.) Meena Kumari, Assistant Prof., Dept of Mathematics, R.W.C. 8. Dr.(Mrs.) Pallavika, Assistant Prof., Dept of Mathematics, R.W.C. 9. Shivani Anand 10. Arti Kumari | <p>University Nominee <i>SD</i>
8/4/21</p> <p>Expert <i>CSPL</i>
8/4/21</p> <p>Expert <i>PV</i>
8/4/21</p> <p><i>AK</i>
8/4/21</p> <p><i>Nanda Banerjee</i>
8/4/21</p> <p><i>PSingh</i>
8.4.21.</p> <p><i>Meena Kumari</i>
8/4/21</p> <p><i>Pallavika</i>
8/4/21</p> <p>Alumni Current Topper</p> |
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The board reviewed the syllabus and some minor changes were made and it was decided to implement the syllabus from the session 2021-2024.

Shivani Anand
Member Secretary
Academic Council
Ranchi Women's College

Sham
CHAIRPERSON
ACADEMIC COUNCIL
RANCHI WOMEN'S COLLEGE

Course Structure

SEMESTER I

Core Course 1	CC I	Analytic Geometry 2Dimensions, Higher Algebra & Trigonometry	Theory – 4 credits Assignment – 1 Credit Tutorial – 1 Credit
Core Course 2	CC 2	Differential Calculus & Vector Calculus	Theory – 4 credits Assignment – 1 Credit Tutorial – 1 Credit
Ability Enhancement Compulsory Course 1	AECC - 1	Environmental Science/(English/MIL / Regional Languages Communication)	Theory – 2 credits
Generic Elective 1	GE I	Differential Calculus & Coordinate Geometry 2Dimensions, Trigonometry	Theory – 4 credits Assignment – 1 Credit Tutorial – 1 Credit

SEMESTER II

Core Course 3	CC-3	Real Analysis 1	Theory – 4 credits Assignment – 1 Credit Tutorial – 1 Credit
Core Course 4	CC-4	Integral Calculus & Analytic Geometry Three Dimensions	Theory – 4 credits Assignment – 1 Credit Tutorial – 1 Credit
Ability Enhancement Compulsory Course 2	AECC - 2	Environmental Science/(English/MIL / Regional Languages Communication)	Theory – 2 credits
Generic Elective 2	GE 2	Integral Calculus, Vector Calculus & Real Analysis	Theory – 4 credits Assignment – 1 Credit Tutorial – 1 Credit

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SEMESTER III

Core Course 5	CC - 5	Theory of Real Functions	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Core Course 6	CC - 6	Group Theory & Matrices	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Core Course 7	CC - 7	Differential Equations & Statics	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Skill Enhancement Course 1	SEC - I	Computer application	Theory - 1 Credit Assignment / Tutorial - 1 Credit
Generic Elective 3	GE - 3	Matrices, Group theory & Differential Equations	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit

SEMESTER IV

Core Course 8	CC - 8	Analysis II & Partial Differential Equations	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Core Course 9	CC - 9	Dynamics & Set Theory	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Core Course 10	CC - 10	Ring Theory & Vector Integration	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Skill Enhancement Course 2	SEC - 2	Graph Theory	Theory - 1 Credit Assignment / Tutorial - 1 Credit
Generic Elective 3	GE - 4	Real Analysis, Set Theory & Mechanics	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit

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SEMESTER V

Core Course 11	CC - 11	Metric Space & Complex Analysis	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Core Course 12	CC - 12	Linear Algebra	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Discipline Specific Elective 1	DSE - I	Number Theory	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Discipline Specific Elective 2	DSE - 2	Special Functions	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit

SEMESTER VI

Core Course 13	CC - 13	Mechanics II	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Core Course 14	CC - 14	Numerical Analysis	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Discipline Specific Elective 3	DSE - 3	Linear Programming	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit
Discipline Specific Elective 4	DSE - 4	Fluid Mechanics	Theory - 4 Credits Assignment - 1 Credit Tutorial - 1 Credit

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Semester wise distribution of credits and marks.

SEMESTER I

Paper Code	Credits	Max. Marks	
		UNIV. EXAM.	MID SEM
CC I	6	75	25
CC-2	6	75	25
AECC-1	6	100	-
GE-I	6	100	-

SEMESTER II

Paper Code	Credits	Max. Marks	
		UNIV. EXAM.	MID SEM
CC-3	6	75	25
CC-4	6	75	25
AECC 2	6	100	-
GE-2	6	100	-

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SEMESTER III

Paper Code	Credits	Max. Marks	
		UNIV. EXAM.	MID SEM
CC-5	6	75	25
CC-6	6	75	25
CC-7	6	75	25
SEC-I	6	100	-
GE-3	6	100	-

SEMESTER IV

Paper Code	Credits	Max. Marks	
		UNIV. EXAM.	MID SEM
CC-8	6	75	25
CC-9	6	75	25
CC-10	6	75	25
SEC-2	6	100	-
GE-4	6	100	-

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SEMESTER V

Paper Code	Credits	Max. Marks	
		UNIV. EXAM.	MID SEM
CC-11	6	75	25
CC-12	6	75	25
DSE-I	6	75	25
DSE-2	6	75	25
GE-5 (For General Students)	6	100	

SEMESTER VI

Paper Code	Credits	Max. Marks	
		UNIV. EXAM.	MID SEM
CC-13	6	75	25
CC-14	6	75	25
DSE-3	6	75	25
DSE-4	6	75	25
GE-6 (For General Students)	6	100	

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B.SC (Honours)

Question paper will contain two groups.

Group A: 2 Questions

Q1- Containing 10 questions carrying 1 mark each.

Q2- Containing 1 question of 5 marks

Group B: 2 Questions

Containing 6 questions carrying 15 marks each [May be in two parts (a) and (b)]

Candidates will be required to answer 4 questions.

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Sulman
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Pallavi
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Ashmi
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Aana Kum
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Paper Code: CC - I

Sem - I

Credits:6, Full Marks:75, Time:

UNIT I-ANALYTICAL GEOMETRY OF TWO DIMENSION

Change of rectangular axes. Conditions for the general equation of second degree to represent parabola, ellipse, hyperbola and reduction into standard forms, Equations of tangent and normal (Using Calculus). (2 Questions)

Equations of Chord of contact, Pole and Polar, Pair of tangents, in reference to general equation of conic. Axes, centre, director circle, in reference to general equation of conics.

Polar equation of conics.

(2 Questions)

UNIT II-HIGHER ALGEBRA & TRIGONOMETRY

Statement and proof of Binomial theorem for any index, exponential and logarithmic series. (1 Questions)

De Moivre's theorem and its applications. Trigonometric and Exponential functions of complex argument and hyperbolic functions. (2 Questions)

Summation of Trigonometrical series. Factorisation of $\sin\theta, \cos\theta$. (1 Questions)

Books Recommended:

1. Analytical Geometry & Vector Analysis - B.K. Kar, Books & Allied Co., Kolkata
2. Analytical Geometry of Two Dimension - Askwith
3. Coordinate Geometry - S.L. Loney. A. Das Gupta / Laljee Prasad
4. Trigonometry - Das and Mukherjee
5. Trigonometry - A. Dasgupta / Laljee Prasad

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Paper Code: CC-2 Sem - I

Credits:6, Full Marks:75

UNIT I- DIFFERENTIAL CALCULUS

Successive Differentiation, Leibnitz's theorem. Maclaurin and Taylor series expansions. Partial differentiation, Euler's theorem for functions of two variables, Total differential . (2Questions)

Tangent and Normal, Curvature, Asymptotes, Curve Tracing, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers. (2Questions)

UNIT II -VECTOR CALCULUS

Product of three and four vectors, Work done, Moment of a vector about a point and a line. (2Questions)

Scalar and vector point functions, Differentiation of a vector function of scalar variables.

Gradient, Divergence and Curl, Second order operators in Cartesian coordinate system. (2Questions)

Books Recommended:

1. Calculus-GB Thomas & RLF Finney.
2. Differential Calculus-Das & Mukherjee. J. Edward / Laljee Prasad / A. Dasgupta
3. Vector Calculus-A Dasgupta / Shanti Narayan / Dr. K.K. Jha

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Paper Code: cc-3 - Sem - 2.

Credits: 6, Full Marks: 75

UNIT I - TOPOLOGY OF THE REAL LINE \mathbb{R}

Axioms of least upper bound and greatest lower bound in \mathbb{R} . The completeness property of \mathbb{R} , Archimedean property, Density theorem. Neighbourhoods and limit point of a set, open and closed sets, isolated points, Bolzano-Weierstrass theorem. (2 Questions)

Compact sets and their properties. Heine borel theorem. (1 Questions)

UNIT II ANALYSIS - I

Sequences, Bounded sequence, Convergent sequence, Monotonic sequence, Sub sequence, Cauchy sequence and Cauchy's general principle of convergence. (2 Questions)

Infinite series, Convergence and Divergence of infinite series of real numbers, Pringsheim's theorem, Comparison test, Cauchy's root test, D'Alembert's ratio test, Raabe's test, De-Morgan's and Bertrand's test, Gauss's ratio test, Cauchy's condensation test, Integral test, Alternating Series Leibnitz test, Absolute and conditional convergence. (3 Questions)

Books Recommended:

1. Elements of Real Analysis- Shanti Narayan & M D Raisinghania / Dr. K.K. Jha
2. Higher Algebra-S Bernard & J M Child / Tom M. Apostol.

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Paper Code: CC-4 - Sem - 2.

Credits:6, Full Marks:75

UNIT-I- INTEGRAL CALCULUS

Evaluation of definite integrals, Reduction Formulae, Differentiation and Integration under the sign of integration.

(1 Question)

Length of plane curve, Area bounded by plane curves, Volume and surface area of solid of revolution. Double and triple integrals. (3 Questions)

UNIT II -ANALYTICAL GEOMETRY OF 3 DIMENSIONS

Rectangular, spherical, polar and cylindrical co-ordinates, Direction cosines. Angle between two straight lines, Equation of planes and straight lines, Shortest distance between two lines. (2 Questions)

Sphere, cone and cylinder.

(2 Question)

Books Recommended:

1. Calculus- G B Thomas & R L Finney.
2. Integral Calculus- Das & Mukherjee.
3. Integral Calculus- Lalji Prasad.
4. Coordinate Geometry of 3 D- J T Bell
5. Analytical Geometry of 3 D- Lalji Prasad / Dasgupta and Prasad.

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Paper Code : CC-5Sem - 3.

Credits: 6, Full Marks: 75

THEORY OF REAL FUNCTIONS**UNIT I**

Limit of functions: Limit, Algebra of limit of functions. Continuity and Discontinuities, Algebra of continuous functions. Intermediate value theorem, Location of roots theorem, Preservation of intervals theorem. Uniform continuity, Functions of bounded variations. (2 Questions)

Derivability: Derivability, relationship with continuity, Rolle's theorem, Lagrange's and Cauchy Mean value theorem, Taylor's theorem, Maclaurin's theorem, Remainder after n terms, Power series expansion of $(1+x)^n$, $\sin x$, $\cos x$, e^x , $\log x$. using suitable remainder after n terms. (2 Questions)

UNIT II

Riemann Integration: Definition, Darboux theorem I and II, Integrability conditions. Particular classes of bounded integrable functions, Primitive, Fundamental theorem, First and Second Mean value theorems.

(4 Questions)

Books Recommended:

1. Introduction to Real Analysis – R Bartle & D R Sherbert/Dr. K.K. Jha/
Dr A R Vasishtha
2. Elements of Real Analysis – Shanti Narayan & M. D. Raisinghania.

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Paper Code : cc - 6

Sem - 3

Credits: 6, Full Marks: 75

UNIT I – GROUP THEORY

Groups: Definitions, Preliminary results, equivalent definitions, Subgroups.

(1 Question)

Cyclic Group and its subgroups, Cosets of a subgroup in a group, Lagrange's Theorem and its applications.

(1 Question)

Normal subgroups, Quotient group, Homomorphism, Isomorphism, Automorphism of groups. Fundamental theorem of homomorphism of Groups.

(1 Question)

Permutations, Permutation groups, Symmetric and Alternating groups. Cayley's Theorem.

(1 Question)

UNIT II – MATRICES

Matrices : Introduction, Different types of Matrices, Algebra of Matrices, Transpose, Adjoint and Inverse of a Matrix. Different ways of finding inverse.

(1 Question)

Rank of a Matrix, Elementary transformations, Elementary matrices. Invariance of Rank through elementary transformations. Reduction to Normal form. Rank of Sum and Product of matrices and related theorems.

(2 Questions)

Solution of a system of linear equations by matrix method. Consistency conditions.

(1 Question)

Books Recommended:

1. Modern Algebra – Quazi Zameeruddin, Surjeet Singh
2. Modern Algebra – A.R. Vasishtha
3. Matrices – Shanti Narayan
4. Matrices – A.R. Vashishtha.

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Paper Code : CC - 7 - Sem - 3.

Credits: 6, Full Marks: 75

UNIT I – DIFFERENTIAL EQUATIONS

Differential equation of first order higher degree, Clairaut's form, Singular solution
Orthogonal trajectories. (1 Question)

Linear equations with constant co-efficients. Homogeneous linear equations with
variable co-efficient. (1 Question)

Second order linear equations : Solution by changing independent variable and by
variation of parameters. (1 Question)

Simultaneous equation $dx/P = dy/Q = dz/R$ and total differential equation
 $Pdx+Qdy+Rdz = 0$ together with their geometrical significance. (2 Questions)

UNIT II – STATICS

Reduction of system of coplanar forces, Equation of resultant, Condition for
equilibrium. Astatic equilibrium and center. (2 Question)

Laws, Angles and cone of friction, Equilibrium on a rough inclined plane, particle
constrained to move on a rough curve under any given forces. (1 Question)

Books Recommended:

1. Differential equations : M.D. Raisinghanian / J.N. Sharma
2. Differential equation: Piaggio / Murrey / Das Gupta
3. Mechanics : Singh and Sen.

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Paper Code : CC-7 - Sem-3.

Credits: 6, Full Marks: 75

UNIT I – DIFFERENTIAL EQUATIONS

Differential equation of first order higher degree, Clairaut's form, Singular solution
Orthogonal trajectories. (1 Question)

Linear equations with constant co-efficients. Homogeneous linear equations with
variable co-efficient. (1 Question)

Second order linear equations : Solution by changing independent variable and by
variation of parameters. (1 Question)

Simultaneous equation $dx/P = dy/Q = dz/R$ and total differential equation
 $Pdx+Qdy+Rdz = 0$ together with their geometrical significance. (2 Questions)

UNIT II – STATICS

Reduction of system of coplanar forces, Equation of resultant, Condition for
equilibrium. Astatic equilibrium and center. (2 Question)

Laws, Angles and cone of friction, Equilibrium on a rough inclined plane, particle
constrained to move on a rough curve under any given forces. (1 Question)

Books Recommended:

1. Differential equations : M.D. Raisinghania / J.N. Sharma
2. Differential equation: Piaggio / Murrey / Das Gupta
3. Mechanics : Singh and Sen.

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Paper Code : cc - 8 - Sem - IV.

Credits: 6, Full Marks: 75

UNIT I – ANALYSIS II

Convergence of improper integrals, Comparison tests, Absolute convergence, Abel's and Dirichlet's tests. (1 Question)

Frullani's Integrals, Definition and convergence of Beta & Gamma functions and their properties, duplication formula, inter-relation. (1 Question)

Evaluation of double and triple integrals, Multiple integrals of Dirichlet's form, Liouville's extension. (2 Question)

Change of order of integration and change of variables. (1 Question)

UNIT II – PARTIAL DIFFERENTIAL EQUATION

Partial Differential Equations: Formation, Linear partial differential equation of order one, Lagrange's Method. (1 Question)

Non Linear equation of order one. Four forms and Charpit's method. (1 Question)

Homogeneous Linear Equation with constant co-efficients, rules, C.F. and P.I. (1 Question)

Books Recommended:

1. Mathematical Analysis – Sharma & Vasistha / Shanti Narayan.
2. Elements of Real Analysis – Shanti Narayan & M.D. Raisinghania
3. Differential equation – Piaggio
4. Advanced Differential equation – M.D. Raisinghania.

[Handwritten signatures and dates:]
 8/4/21, 8/4, 8/4, 8/4, P Singh 8.4.21, Arti kumari 8/4/21, 8/4, Pallanika 8/4, Aashni 8.4.21, 8/4/21

Paper Code : CC-9

Sem - IV

Credits: 6, Full Marks: 75

UNIT I - DYNAMICS

Rectilinear motion with variable acceleration, Simple Harmonic Motion. Motion in a straight line under inverse square Law, Hooke's Law, Extension of elastic strings horizontal and vertical. (1 Question)

Kinematics in two dimensions: Angular, Radial, transverse, tangential and normal velocities and accelerations, simple pendulum. (2 Questions)

Rectilinear Motion(Kinetics): Newton's law, work, power, energy principle. Impulse, Torque and angular momentum, conservation of energy, momentum.

(1 Question)

UNIT II – SET THEORY

Indexed family of sets, Generalised set operations and De Morgan's laws, Set Mappings. (1 Question)

Equivalence relations and related fundamental theorem on partitions. (1 Question)

Bijections: Countable and uncountable sets. (1 Question)

Partial ordering relations and related concepts of upper bounds, inf, sup, Maximal and Minimal elements & Lattice (Definition and examples only) statement of Zorn's Lemma(only) (1 Question)

Book Recommended:

1. Dynamics – S. L. Loney / M.D. Raisinghania / Dr. Shaligram Singh.
2. Mechanics – Singh & Sen.
3. Set Theory – K. K. Jha.

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Paper Code : CC-10

Sem - IV

Credits: 6, Full Marks: 75

UNIT I – RING THEORY

Rings, Field and Integral domain, Preliminary results, special kinds, subrings and Ideals, kinds of Ideals. (3 Question)

Quotient rings, Fields and Homomorphism. (1 Question)

Fundamental Theorem of homomorphism, First and second theorem of Isomorphism. (1 Question)

Field of quotients and embedding theorem, Polynomial rings, Euclidean ring and unique factorization in it. (1 Question)

UNIT II – VECTOR INTEGRATION

vector integration : Line integral, Surface integral, Green's theorem in R^2 , Stoke's theorem, Gauss's divergence theorem. (2 Question)

Books Recommended:

1. Modern Algebra – Surjeet Singh and Quazi Zameerudin.
2. Modern Algebra – A.R. Vasishtha
3. Vector Analysis – Shanti Narayan.

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Paper Code : SEC-2

Credits: Full Marks: 100

Mid Sem Examination

There will be two groups of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type six questions of five marks each. out of which any four are to answer.

End Semester Examination (ESE):

There will be two groups of questions. Group A is compulsory and will contain two questions Question No. 1 will be very short answer type consisting of ten questions of 1 mark each. Question No. 2 will be short answer type of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

Graph Theory

Unit – I

Introduction to graph theory: Basic terminology of graphs, travelling salesman problem, Simple graph, multigraph and pseudograph, degree of vertex, Handshaking theorem (degree sum theorem), types of graph, subgraph, isomorphic graphs, complement.

(2 Questions)

Paths, circuits, cycles and connectivity, weighted graphs, Eulerian and Hamiltonian graphs, Fleury's algorithm, Dirac theorem, Ore's theorem, shortest path problem, Dijkstra's algorithm, Matrices associated with graphs.

(2 Questions)

Unit – II

Trees, characterisation of trees, Rooted and binary Trees, BFS algorithm, DFS algorithm, Prim's algorithm, Kruskal algorithm.

(2 Questions)

Graph colouring, Chromatic number, vertex colouring algorithm, upper and lower bound of chromatic numbers, chromatic partitioning, Brook's theorem, five colour problem,.

(2 Questions)

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Paper Code : CC-11 - Sem - V

Credits: 6, Full Marks: 75

UNIT I – METRIC SPACE

Definition and Examples of metric space. open and closed spheres. open sets, neighbourhoods, interior of a set, closed sets, accumulation points and closure of a set. (1 Question)

Sequence in a metric space, Cauchy sequence and Convergence, complete and incomplete metric spaces. (1 Question)

Diameter of a set, Cantor's intersection theorem, Dense sets, Perfect sets, Baire's category theorem. (1 Question)

Continuous mappings, Sequential criterion, Characterization of continuity by open sets and closed sets. (1 Question)

UNIT II – COMPLEX ANALYSIS

Functions of complex variables: Limit, Continuity, Derivative. Cauchy-Riemann equation, Analytic functions, Harmonic function, Construction of Analytic functions, Milne Thompson's method. (2 Questions)

Geometric import of some standard transformations e.g. on method $w=z+c$, $w=cz$, $w=1/z$, $w=(az+b)/(cz+d)$ (bilinear) (1 Question)

Conformal transformation as transformation effected by analytic function. Special conformal transformations $w=z^2$, $w=e^z$, $w=\sin z$. (1 Question)

Books Recommended:

1. Introduction to topology – G. F. Simmons / Dr. K. K. Jha
2. Metric space – P. K. Jain & Khalil Ahmad
3. Complex Variable – Churchill and Brown / J. N. Sharma / A. R. Vashishtha

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Paper Code : ec-12Sem V

Credits: 6, Full Marks: 75

LINEAR ALGEBRA**UNIT I**

Vector Space: Definition, Examples and Elementary Properties, subspaces, Linear Dependence and Independence of vectors, Basis and dimension of a vector space and related theorems. (1 Question)

Quotient space, Direct Sum and Complements. Matrices and change of Basis. (1 Question)

Inner product spaces: Definition, Examples, Schwarz Inequality, Norm of a vector, Idea of distance. (1 Question)

Orthogonal Vectors, Orthogonal and Orthonormal sets. Gram-Schmidt orthogonalization process, Bessel's Inequality. (1 Question)

UNIT II

Linear Transformations: Definition, Examples, Rank and Nullity of a linear transformation, Sylvester's Law of Nullity. (1 Question)

Algebra of linear transformations. $\text{Hom}(U, V)$ as a vector space and related theorems. (1 Question)

Dual spaces: Dual space of a vector space, Bidual of a vector space, Principle of Duality. (1 Question)

Matrices and Linear Transformations. (1 Question)

Books Recommended:

1. Modern Algebra – Quazi Zameeruddin, Surjeet Singh.
2. Linear Algebra – A.R. Vashishtha.

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Paper Code : DSE II Sem V

Credits: 6, Full Marks: 75

NUMBER THEORY

UNIT I

Divisibility and primes, H.C.F., Euclid's Algorithm, unique factorization, perfect numbers. (1 Question)

Residue class, complete and reduced residue system, congruences and their properties, Fermat's theorem, Wilson's theorem. (1 Question)

Arithmetical functions, Euler's and Mobius function, Mobius inversion formula. (2 Questions)

Algebraic Congruence, solution by inspection, Solution of $ax \equiv b \pmod{c}$, system of linear congruences, Chinese remainder theorem. (1 Question)

UNIT II

The Diophantine equations : $ax + by = c$, $x^2 + y^2 = z^2$. (1 Question)

Farey sequence, continued fractions, Pell's equation. (2 Questions)

Books Recommended:

1. Number Theory – G H Hardy & E M Wright.
2. Number Theory – S G Telang/ Ivan Niven & Zuckermann.
3. Number Theory – Harikisan.

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Paper Code : DSE 2 Sem - V

Credits: 6, Full Marks: 75

SPECIAL FUNCTIONS

UNIT I

Series Solution : Ordinary point, singular point (regular), general methods and forms of series solution (Indicial equation – Frobenius method) [N.B.: Results of analysis regarding validity of series solution are taken for granted].

(2 Questions)

Bessel's equation: Solution, recurrence formula for $J_n(x)$, Generating function for $J_n(x)$, equations reducible to Bessel's equation, Orthogonality of Bessel's function.

(2 Questions)

UNIT II

Legendre's equation: Solution, Rodrigue's formula, Legendre's polynomials, generating function for $P_n(x)$, orthogonality of Legendre's polynomials.

(2 Questions)

Hypergeometric Functions: Special cases, integral representation, summation theorem.

(1 Question)

Laplace Transforms: Definition, Laplace Transform of elementary functions, properties, uniqueness and inverse Laplace Transform, Laplace Transform of derivatives and integrals.

(1 Question)

Book Recommended:

- 1. Advance Differential Equations – M.D. Raisinghania.
- 2. Differential Equations – J.N. Sharma.
- 3. Integral Transforms – M.D. Raisinghnia, R. Vashitha and Gupta.

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Paper Code : MCC 13

Sem VI

Credits: 6, Full Marks: 75

MECHANICS II**UNIT I - STATICS**

Condition of equilibrium of forces in three dimension. Central axis, Wrench, Pitch, Null lines. (1 Question)

Principle of virtual work and its application in two dimensional cases. (1 Question)

Common Catenary (1 Question)

Stable equilibrium, energy test of stability (problems involving one variable only).

(1 Question)

UNIT II - DYNAMICS

Motion of a particle under a central force, Differential equations of Central orbit in both polar and pedal co-ordinates. (1 Question)

Newton's law of gravitation, planetary orbits, Kepler's laws of motion. (1 Question)

Motion of a Projectile under gravity in a non-resisting medium. (1 Question)

Motion of Center of mass and motion relative to center of mass, D'Alembert's principle. Two dimensional motion of a rigid body, compound pendulum.

(1 Question)

Books Recommended:

1. Statics-SL Loney.
2. Statics-Goyal & Gupta
3. Dynamics-SL Loney.
4. Dynamics — R K Gupta & D C Agarwal.

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Paper Code : CC 14

Sem - VI

Credits: 6, Full Marks: 75

NUMERICAL ANALYSIS**UNIT I**

Solution of algebraic and transcendental equations: Bisection method, Regula-Falsi method, Newton-Raphson method. (1 Question)

Solution of simultaneous equations: Gauss's elimination method, Matrix inversion by triangularization method. (1 Question)

Calculus of finite difference: The operators Δ , ∇ , E , factorial notation, their properties and inter-relation between them, Fundamental theorem of difference calculus, divided differences. (1 Question)

Interpolation: Newton's forward and backward difference interpolation formula, Lagrange's interpolation formula, central difference interpolation, Gauss's forward, backward and central difference interpolation formula. (2 Questions)

UNIT II

Numerical differentiation: Derivative using forward, backward and central difference interpolation formulae. (1 Question)

Numerical integration: General quadrature formula, Simpson's one-third and three-eighth rule, Weddle's rule, Newton-Cote's method. (1 Question)

Solution of ordinary differential equations: Picard's method of successive approximations. (1 Question)

NB': USE OF SCIENTIFIC CALCULATOR ALLOWED.**Books Recommended:**

1. Numerical Analysis – J B Scarborough.
2. Numerical Methods – B S Grewal.
3. Numerical Analysis – G Shankar Rao, New Age Int. Publishers
4. Numerical Analysis – Gupta & Mallik.

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Paper Code : DSE 3

Sem VI

Credits: 6, Full Marks: 75

LINEAR PROGRAMMING

UNIT I

Convex sets and their properties, Introduction to linear programming problem, Solution by Graphical method. (2 Questions)

Simplex method, Optimality and unboundedness, Artificial variables, Two-phase method, Big-M method. Duality, Formulation of the dual problem, Primal-dual relationships, Economic interpretation of the dual. (2 Questions)

UNIT II

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. (1 Question)

Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem. (1 Question)

Deterministic replacement of models, Sequencing problems on two machines and n jobs. (2 Questions)

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.
4. G. Hadley, *Linear Programming*, Narosa Publishing House, New Delhi, 2002.
5. Operations Research- S D Sharma.
6. Linear Programming Problems – R K Gupta.

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Paper Code : DSE 4

Sem VI

Credits: 6, Full Marks: 75

FLUID MECHANICS

UNIT I- HYDROSTATICS

Nature and properties of fluid pressure, pressure of heavy liquids. (1 Question)

Equilibrium of fluids under given system of forces. (1 Question)

Centre of pressure. (1 Question)

Thrust on plane and curved surfaces. (2 Questions)

UNIT II – HYDRODYNAMICS

Lagrangian and Eulerian methods. Equation of continuity. (1 Question)

Euler's equation of motion for perfect fluid, Bernoulli's theorem. (2 Questions)

Book Recommended:

1. Hydrostatics – M Rahman
2. Hydrostatics – J P Sinha/ Das Gupta
3. Hydrodynamics – Shanti Swaroop
4. Hydrodynamics – M D Raisinghania

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B.SC (General)

Question paper will contain two groups.

Group A: 2 Questions

Q1- Containing 10 questions carrying 1 mark each.

Q2- Containing 2 question of 5 marks each.

Group B:

Containing 8 questions carrying 20 marks each. Each question contains 2 parts (a) ans (b).

Candidates will be required to answer 4 questions.

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For B.Sc .General Science Students having Mathematics as one of the subjects.

Paper Code: IGE I Sem I GE

Credits:6, Full Marks:100,

UNIT I-DIFFERENTIAL CALCULUS

Successive Differentiation, nth derivatives of some standard functions, Leibnitz theorem. nth derivatives of some rational functions. (1 Questions)

Expansion, Taylor's Theorem, Maclaurin's Theorem, Partial Differentiation. (2 Question)

Tangents and Normals, (1 Question)

Maxima and Minima of functions of two variables. (1 Question)

UNIT II-COORDINATE GEOMETRY 2D & TRIGONOMETRY

Transformation of axes with and without change of origin (1 Questions)

Condition of general equation of second degree to represent parabola, ellipse, hyperbola and reduction to standard forms. (1 Question)

Equations of tangents and normals (using Calculus) Chord of contact, Polar and pair of tangents. (2 Question)

De- Moivre's theorem, Trigonometric and exponential Functions of complex arguments and Hyperbolic functions. (2 Question)

Summation of trigonometric series (1 Question)

Books Recommended:

1. Differential Calculus: A Das Gupta & S B Prasad.
2. Differential Calculus: Lalji Prasad.
3. Coordinate Geometry: A Das Gupta / Laljee Prasad.
4. Trigonometry by Das and Mukherjee / Laljee Prasad

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 Steena Kaur 8/4/21

Paper Code: GBW 2

Sem - 2 GE

Credits:6, Full Marks:100,

UNIT I-INTEGRAL CALCULUS

Integration of rational and irrational functions.	(1 Question)
Evaluation of definite integrals, Reduction formulae,	(1 Question)
Length and Area,	(1 Question)
Volume and Surface area of solids of revolution.	(1 Question)

UNIT II-VECTOR CALCULUS & REAL ANALYSIS

Product of three and four vectors.	(1 question)
Work done, Moment of a Vector about a fixed point and about fixed line.	(1 Question)
Point function, Differentiation of a Vector function of a scalar variable	(1 Question)
Gradient, Divergence and Curl and second order vector differential operators in Cartesian coordinate systems.	(1 Question)

Axioms for the real number system, Least Upper Bound and Greatest Lower Bound. Limit of a sequence, Subsequence, Cauchy sequence, Cauchy's general principal of convergence, Algebraic operations on limits, Monotonic Sequences and their convergence. (2 Questions)

Notion of convergent and divergent series of positive terms, Cauchy's general principal of convergence, Comparison test, D' Alemberts' ratio test, Cauchy's root test, Cauchy's Condensation test, Raabe's test. (2 Questions)

Books Recommended;

1. Integral Calculus: Dasgupta & Prasad.
2. Integral Calculus :Lalji Prasad.
3. Vector Calculus: Dasgupta & Prasad.
4. Vector calculus: Lalji Prasad.
5. Trigonometry: Dasgupta & Prasad.
6. Trigonometry: Lalji Prasad.
7. Elements of Analysis : Dr. K.K. Jha / Shanti Narayan & M D Raisinghania

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8/4/21Pallavi
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Paper Code : GE-3 Sem - 3 (Gen)

Credits: 6, Full Marks: 100

UNIT I – MATRICES

Preliminaries, Transpose, Conjugate, Special types (Singular, Non singular) Symmetric, Non-symmetric, Hermitian, Skew-Hermitian, Orthogonal and unitary, Algebra of matrices. Scalar multiplication, Addition, Multiplication, Laws of operation.

(1 Question)

Adjoint, Inverse, Partitioning, Characteristic equation, Caley Hamilton theorem.

(2 Question)

Rank of a matrix: Definition, Elementary transformations of a matrix, Invariance of rank through elementary transformations.

(1 Question)

UNIT II – GROUP THEORY & DIFFERENTIAL EQUATION

Binary operations, Notion of groups and Abelian groups with examples, Preliminary results, Equivalent definitions of group.

(1 Question)

Sub groups, cyclic groups, cosets of a subgroup, Lagrange's theorem.

(2 Question)

Normal subgroups and Quotient Groups.

(1 Question)

Differential equations of first order higher degree, clairaut's form, singular solutions, Orthogonal Trajectories.

(1 Question)

Linear equations with constant co-efficient. Homogeneous linear equations with variable co-efficient.

(1 Question)

Second order linear equations: Solution by changing independent variable and by variation of parameters.

(2 Question)

Books Recommended:

1. Text book of Matrices – Shanti Narayan / J.N. Sharma/ A.R. Vasishtha.
2. Modern Algebra – Surjeet Singh and Quazi Zameerudin / A.R. Vasishtha.
3. Ordinary and partial Differential Equation – M.D. raisinghanian
4. Differential Equations : J.N. Sharma / Das Gupta.

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Paper Code : JGE 4

Sem - IV Gen

Credits: 6, Full Marks: 100

UNIT I – REAL ANALYSIS

Limit, Continuity, Discontinuities, Uniform continuity, Properties of functions continuous in closed intervals. (2 Question)

Derivability of a function, Relationship with continuity, Rolle's theorem, Lagrange's and Cauchy's theorem, Mean value theorems, Taylor's theorem and its remainder after n terms, Maclaurin's theorem, Power series expansion of $(1+x)^n$, $\sin x$, $\cos x$, e^x , $\log(1+x)$ using suitable remainder after n terms. (2 Questions)

UNIT II – SET THEORY & MECHANICS

Indexed family of sets, Generalized set operations De Morgan's Laws, Set Mappings. (1 Question)

Equivalence Relation, Partition, Fundamental theorem of equivalence. (1 Question)

Bisection : Countable and uncountable sets. (1 Question)

Partial ordering and total ordering relations, Concepts of l.u.b. g.l.b., supremum and infimum, Maximal and minimal elements (Definitions and Examples). (1 Question)

Reduction of system of coplanar forces, Equation of resultant, Condition for equilibrium. (1 Question)

Laws of friction, Angle and cone of friction, Equilibrium on a rough inclined plane, Particle constrained to move on a rough curve under given forces. (1 Question)

Rectilinear motion, Compounding of two simple harmonic motion, Motion under inverse square law. (1 Question)

Radial and Transverse: Tangential and Normal velocities and accelerations. Angular velocity and acceleration. (1 Question)

Books Recommended:

1. Real Analysis – Shanti Narayan / Sharma & Vasishta
2. Advanced set theory - Dr. K.K. Jha.
3. Mechanics – Singh & Sen / Dr Shaligram Singh.

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