S. S. Jain Subodh P. G. (Autonomous) College

Affiliated to University of Rajasthan

Re-Accredited with 'A' Grade with (Highest Rating in Northern India) CGPA - 3.72 by NAAC - UGC

SCHEME OF EXAMINATION

&

DETAILED COURSE STRUCTURE

FOR

BACHELOR OF SCIENCE / ARTS (B.Sc. / B.A.)

SUBJECT – MATHEMATICS

(2017-2020)

DEPARTMENT OF MATHEMATICS

S.S. JAIN SUBODH P.G. AUTONOMOUS COLLEGE

RAMBAGH CIRCLE, JAIPUR-302004

S. S. Jain Subodh PG (Autonomous) College, Jaipur
Department of Mathematics
Bachelor of Science (B.Sc. / B.A. Pass Course)

Examination Scheme:

Semester - I		
Paper	**Nomenclature of paper**	**Max. Marks (B.Sc. / B.A.)**
PAPER -I	MAT 101: DISCRETE MATHEMATICS	75/66 Marks
PAPER – II	MAT 102: CALCULUS-I	75/67 Marks
PAPER-III	MAT 103: THREE DIMENSIONAL GEOMETRY AND VECTOR CALCULUS	75/67 Marks
Semester - II		
Paper	**Nomenclature of paper**	**Max. Marks (B.Sc. / B.A.)**
PAPER -I	MAT 201: GRAPH THEORY	75/66 Marks
PAPER – II	MAT 202: CALCULUS-II	75/67 Marks
	MAT 203: PRACTICAL (using scientific calculator to solve linear programming problems)	75/67 Marks
Semester - III		
Paper	**Nomenclature of paper**	**Max. Marks (B.Sc. / B.A.)**
PAPER -I	MAT 301 - REAL ANALYSIS- I	75/66 Marks
PAPER – II	MAT 302 - DIFFERENTIAL EQUATION-I	75/67 Marks
PAPER – III	MAT 303- NUMERICAL ANALYSIS	75/67 Marks
Semester - IV		
Paper	**Nomenclature of paper**	**Max. Marks (B.Sc. / B.A.)**
PAPER -I	MAT 401 – ADVANCED ANALYSIS AND METRIC SPACE	75/66 Marks
PAPER – II	MAT 402 - DIFFERENTIAL EQUATION-II	75/67 Marks
	MAT 403- PRACTICAL (Programming in C)	75/67 Marks
Semester - V		
Paper	**Nomenclature of paper**	**Max. Marks (B.Sc. / B.A.)**
PAPER -I	MAT 501: ABSTRACT ALGEBRA-I	75/66 Marks
PAPER – II	MAT 502: COMPLEX	75/67 Marks

	ANALYSIS-I	
PAPER – III	MAT 503: DYNAMICS	75/67 Marks
Semester - VI		
Paper	**Nomenclature of paper**	**Max. Marks (B.Sc. / B.A.)**
PAPER -I	MAT 601: ABSTRACT ALGEBRA-II	75/66 Marks
PAPER – II	MAT 602: COMPLEX ANALYSIS-II	75/67 Marks
	MAT 603: PRACTICAL (Operations Research) 2017 and onwards.	75/67 Marks

Examination Scheme for Each Paper

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carry 2 marks.
(For Science) 7× 2mark each = 14 Marks
(For Arts) 7× 2mark each = 14 Marks
Part B- 4 questions (1 question from each unit with internal choice)
(For Science) 4×10 mark each = 40 Marks
(For Arts) 4×8 mark each = 32Marks
Total of End semester exam (duration of exam 3 hours) = 54/46 Marks
Internal Assessment = (21, 21, 21) / (20, 21, 21) Marks
Max. Practical Marks 75 /67 Marks for science/ arts
(Internal Marks 21+ 54/46 External marks)

Semester – I

PAPER- I: DISCRETE MATHEMATICS
Duration: 3 hrs. Max. Marks: 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Sets and Propositions: Russell's paradox, fundamental operations of set, Mathematical Induction. Principle of inclusion and exclusion.
UNIT II: Relations and Functions: Binary Relations, Equivalence Relations and Partitions. Partial Order Relations and Lattices.Chains and Anti-chains. Pigeon Hole Principle.
UNIT III: Boolean algebras: - Boolean functions and expressions (Using Identity / Truth table), Lattices and algebraic structure, Duality, Distributive and complemented lattices, Boolean Lattices.
UNIT IV: Discrete numeric Function and Generating Function, Recurrence Relations and recursive algorithm- Linear recurrence relations with constant coefficients. Homogeneous solutions, particular solution, Total solution, Solution by the method of generating functions.

PAPER – II CALCULUS-I
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Infinite Series: Convergence of series of non-negative terms, their various tests (Comparison; D'Alembert's ratio, Cauchy's nth root, Raabe's, Gauss, Logarithmic, De-Morgan and Bertrand's, Cauchy's condensation (proof of tests not required)) for convergence. Alternating series, Leibnitz's test, Series of arbitrary terms, absolute and conditional convergence.
UNIT II: Taylor's theorem, Maclaurin's Theorem. Power series, Expansion of a function, power series expansion of Sin x, Cos x, e^x, $\log_e(1+x)$, $(1+x)^n$. Derivative of the length of an arc, Pedal Equations, Curvature- various formulae, Centre of curvature, Chord of curvature and related problems.
UNIT III: Partial differentiation, Euler's Theorem for Homogeneous functions, Chain Rule of Partial Differentiation, Differentiation of implicit functions
UNIT IV: Envelops, Maxima and Minima of function of two variables, Lagrange's Method of undetermined multipliers.

PAPER – III THREE DIMENSIONAL GEOMETRY AND VECTOR CALCULUS
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.

UNIT I: Sphere:- Equation of sphere, intersection of two spheres, diameter form, tangent line and tangent plane, condition of tangency, pole and polar plane, condition of orthogonality. Cone: Enveloping cone, tangent plane, condition of tangency, reciprocal cone, right circular cone.

UNIT II: Cylinder: Equation of cylinder, enveloping cylinder, circular cylinder. Right circular cylinder. Central Conicoid: Ellipsoid, Hyperboloid of one and two sheets, condition of tangency for a plane, Director Sphere, Normal.

UNIT III: Generating lines of hyperboloid of one sheet and its properties,Reduction of general equation of second degree.Principal plane and principal direction, centre of a conicoid, canonical form

UNIT IV: Differentiation and integration of scalar and vector functions, Directional derivative.Differential operators- Gradient, divergence and Curl. Applications of Theorem of Gauss, Green, Stokes (Without proof).

Semester – II

PAPER- I GRAPH THEORY

Duration: 3 hrs. Max. Marks: 54/46 (Science/Arts)

Note: There will be two parts of end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.

UNIT I:. Graph Theory- Basic Terminology, Multi graphs, Weighted Graphs, Paths and circuits, Shortest paths, Eulerian paths and Circuits.

UNIT II: Union, Join, Product, and composition of graphs,. Digraphs- Simple Digraph, Symmetric & Asymmetric Digraph and Complete Digraph, Digraph and Binary Relations,

UNIT III: Trees- Properties, Spanning Tree, Minimal Spanning Tree, Binary and Rooted Tree.

UNIT IV: Planar graph, region, homeomorphic graph and Dual graphs, Matrix representation of graphs.

PAPER – II CALCULUS-II

Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)

Note: There will be two parts of end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.

UNIT I: Asymptotes, Multiple points, Curve tracing of standard curves (Cartesian and polar curves).

UNIT II: Introduction of Beta and Gamma functions. Double integrals in Cartesian and polar coordinates.

UNIT III: Evaluation of Double Integration by change of order and changing into polar coordinates, Triple integrals, Dirichlet's Integration.

UNIT IV: Rectification, Areas, Volumes and surfaces of solids of revolution.

Practical (Using Scientific Calculator to Solve Linear Programming Problem)

Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)

Max. Practical Marks = 75 /67 (Science/Arts) Marks

Internal Marks = 21/21(Science/Arts) Marks

External Practical Exam. (Duration : 3 hrs.) = 54/46(Science/Arts) Marks

Note: This Question Paper contains four questions two question taken from each unit. Student attempt all questions**.**

I. Each question will carry (10/8) marks,

II. Viva-voce(10) marks,and

III. Record (4) Marks.

UNIT I: Linear Programming Problem, Formulation, LPP in matrix notation, graphical solution of LPP, Basic solution. Simplex method for solution of LPP to simple problems.

UNIT II: Prime problem convert into dual problem and solve by simplex method. Simple problems of Assignment and Transportation.

Semester – III

PAPER –I - REAL ANALYSIS- I
Duration : 3 hrs. Max. Marks: 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Real numbers as a complete ordered field, limit point, Bolzano-Weierstrass Theorem, Closed and open sets, union and intersection of such sets, concept of compactness, Heine-Borel Theorem, Connected sets. Real sequence- Limit and Convergence of a sequence, Monotonic sequences.
UNIT II: Cauchy's Sequences, Subsequences, Cauchy's general Principle of convergence, Properties of continuous function on closed intervals.
UNIT III: Properties of derivable functions, Darboux's and Roll's Theorem, Notion of Limit and Continuity for functions of two variables.
UNIT IV: Riemann Integration – Lower and upper Riemann integral, Riemann Integrability, Mean value Theorem of integral Calculus, Fundamental theorem of Integral calculus.

PAPER – II - DIFFERENTIAL EQUATION-I
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Degree and order of a differential equation, Equations of first order and first degree, Equation in which the variables are separable, Homogeneous equations and equation reducible to homogeneous form, Linear equations and Equation reducible to Linear form, Exact Differential Equations and equations which can be made exact.
UNIT II: First order but higher degree differential equations, solvable for x, y and p. Clairaut's form, and singular solutions with extraneous loci, linear differential equation with constant coefficients, complementary functions, particular integral.
UNIT III: Homogeneous Linear differential Equation, Simultaneous differential Equation.
UNIT IV: Exact Linear Differential Equation of nth order, existence and uniqueness theorem.

PAPER – III - NUMERICAL ANALYSIS
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.

UNIT I: Differences, Relation between differences and derivative, differences of polynomial, Newton's Formula for Forward and Backward interpolation, Divided Differences, Newton's Divided difference interpolation formula, Lagrange's Interpolation Formula .

UNIT II: Central Differences: Gauss's forward and backward Formula, Sterling Formula, Bessel's formula, Numerical Differentiation. (Without derivations)

UNIT III: Gauss Elimination and Iterative Method (Jacobi and Gauss Seidal Method) for solving system of linear algebraic simultaneous equations.

UNIT IV: Numerical Integration, Trapezoidal Rule, Simpson's 1/3 and 3/8 Rule, Gauss Quadrature Formula (up to three points).

Semester – IV

Paper –I ADVANCED ANALYSIS AND METRIC SPACE
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Sequence and series of functions- Point wise and Uniform Convergence, Cauchy's Criterion, Weiertrass M- Test, Abel's Test, Drichlet's test for Uniform Convergence of series of function. Uniform convergence and continuity of series of functions, Term by Term Differentiation and Integration.
UNIT II: Metric Space- Definition and Examples, open and closed sets, Interior and closure of a set, limit point of a set.
UNIT III: Subspace of a metric space, Product space, Continuous mappings, Sequence in a metric space, Cauchy's sequence.
UNIT IV: Complete Metric space, Baire's Theorem, Compact sets and Compact spaces, Connected Metric Spaces.

PAPER – II DIFFERENTIAL EQUATION-II
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Linear Differential Equation of second order, Linear Independence of solutions, Solution by transformation of the equations by changing the dependent variable/ independent variables, Factorization of Operators, Method of Variation of parameters, Method of undetermined coefficients.
UNIT II: Non-linear differential equation of particular forms, Partial Differential Equations of first order, Lagrange's Linear Equation, Charpit's Method.
UNIT III: Homogeneous and non-homogeneous Linear Partial Differential Equations with constant coefficients, Partial Differential Equations reducible to equations with constant coefficients.
UNIT IV: Partial Differential Equations of second order: Simple problem based on Monge's method, Separation of variable and canonical form.

PRATICAL (Use of C- Programming in Numerical Analysis) Max. Practical Marks = 75 /67 (Science/Arts) Marks
Internal Marks = 21/21(Science/Arts) Marks
External Practical Exam. (Duration : 3 hrs.) = 54/46(Science/Arts) Marks
Note: This Question Paper contains two questions taken one question from each unit.

UNIT I: Numerical Solutions of algebraic and Transcendental Equations, Bisection Method, Regula-Falsi Method, Method of Iteration, Newton-Raphson Method.
UNIT II: Solutions of ordinary differential equations of first order with initial boundary condition using, fourth order Runge-Kutta Method and Shooting Method.
Note: Students have to Attempt both questions. Each question will carry equal marks (20/16 Marks each). Question to be solved through
1. Numerical Method with the help of scientific calculator. (10/8 Marks)

2. The same question to be programmed into C-language. (10/8 Marks)

3. Viva-Voce (10Marks)

4. Record (4Marks)

Semester – V

PAPER – I : ABSTRACT ALGEBRA-I
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Definition and simple properties of Groups and subgroup, cyclic group, Permutation group.
UNIT II: Cosets, Lagrange's theorem on the order of subgroups of a finite order group, Cayley's theorem.Normal subgroups and Quotient groups.
UNIT III: Morphism of groups,Fundamental theorems of Isomorphism.Definition and simple properties of Rings, Integral domain and field.
UNIT IV: Characteristics of a Ring and Field, Sub rings, Subfield, Embedding of a ring, Morphism of rings.

PAPER – II: COMPLEX ANALYSIS-I
Duration: 3 hrs. Max. Marks: 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Complex plane, Connected and Compact sets, Curves and Regions in complex plane. Jordan Curve Theorem (statement only), Extended complex plane, Stereographic projection, Complex valued function-Limits, Continuity and Differentiability.
UNIT II: Analytic functions, Cauchy-Riemann equations (Cartesian and polar form), Harmonic functions, Construction of an analytic function.
UNIT III: Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions.
UNIT IV: Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula, Liouville's theorem.

PAPER - III : DYNAMICS
Duration : 3 hrs. Max. Marks : 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Velocity and acceleration-along radial and transverse directions, along tangential and normal directions. Work and Energy.

UNIT II: S.H.M., Hooke's law, Motion along horizontal and vertical elastic strings. Motion in resisting medium- Resistance varies as velocity and square of velocity.

UNIT III: Projectile Motion,Motion on a smooth curve in a vertical plane.Motion on the inside and outside of a smooth vertical circle.

UNIT IV: Moment of inertia-M. I. of rods, Circular rings, Circular disks, Solid and Hollow spheres, Rectangular lamina, Ellipse and Triangle. Product of Inertia, Theorem of Parallel axis and Perpendicular axis, Momental Ellipse, Principal axis.

Semester –VI

PAPER – I ABSTRACT ALGEBRA-II
Duration: 3 hrs. Max. Marks: 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Ideals and Quotient Ring, Maximal ideal and Prime ideal, Principal Ideal domain.
UNIT II: Field of quotients of an integral domain, Prime fields. Definitions, Examples and Simple properties of Vector spaces and Subspaces.
UNIT III: Linear combination, Linear dependence and Linear independence of vectors. Basis and Dimension, Generation of subspaces. Sum of subspaces.Direct sum and Complement of subspaces
UNIT IV: Quotient space and its dimension, Linear Transformation and simple properties, Kernel of Linear transformation.
Paper – II: COMPLEX ANALYSIS-II
Duration: 3 hrs. Max. Marks: 54/46 (Science/Arts)
Note: There will be two parts of end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry10/8 marks.
UNIT I: Power series-Absolute convergence, Abel's theorem, Cauchy-Hadamard theorem. Circle and Radius of convergence, Analyticity of the sum function of a power series, Analytic continuation. Power series method of analytic continuation.
UNIT II: Taylor's theorem. Laurent's theorem, Maximal modulus theorem, Singularities of an analytic function.
UNIT III: Branch point, Meromorphic and Entire functions, Riemann's theorem, Casorati-Weierstrass theorem, Residue at a singularity, Cauchy's residue theorem, Argument Principle. Rouche's theorem.
UNIT IV: Fundamental theorem of Algebra. Conformal mapping.Bilinear transformation and its properties. Elementary mappings: $w(z) = {}^{1}/_{z}, \left(z + \frac{1}{z}\right), z^2, e^z, sinz, cosz, logz.$ Evaluation of a real definite integral by contour integration.

Practical (Operations Research)
Max. Practical Marks = 75 /67 (Science/Arts) Marks
Internal Marks = 21/21 (Science/Arts) Marks
External Practical Exam. (Duration: 3 hrs.) = 54/46 (Science/Arts) Marks
Note: This Question Paper contains four questions two question taken from each unit. Student attempt all questions**.** Each question will carry (10/8) marks. Viva-Voice 10 marks and record 4 marks.
Unit-I
Game Theory: Saddle Point (Pure Strategy), Dominance, Mixed Strategies, (2×2) game, (2×n) game, (m×2) game, (3×3) game.

Simulation: Monte Carlo Simulation, Generation of Random numbers, Simulation Languages.

Unit-II

Project Scheduling: Project Scheduling by PERT and CPM Network Analysis.

Sequencing Theory: General Sequencing problem n-jobs through 2 machines & 3 machines and 2-jobs through m machines.