S.S. JAIN SUBODH P.G. COLLEGE

RAM BAGH CIRCLE, JAIPUR-302004

SYLLABUS

&

SCHEME OF EXAMINATION

Three/Four Years Bachelor of Science (Mathematics)

Medium of Instruction: Hindi and English

SEMESTER SCHEME

I-II Semester

Examination-2025-26

And Onwards

As per NEP-2020

Name of College	**S.S. Jain Subodh P.G. College**
Name of Faculty	**Science**
Name of Discipline	**Mathematics**
Type of Discipline	**Major**

SEMESTER-WISE PAPER TITLES WITH DETAILS

Three/Four Years Bachelor of Science (Mathematics)								
				Mathematics	**Credits**			
S. No.	**Level**	**Sem**	**Type**	**Title**	**L**	**T**	**P**	**Total**
1.	**5**	**I**	**MJR**	**Discrete Mathematics & Optimization Techniques-I**	**6**	**0**	**0**	**6**
2.	**5**	**I**	**MJR**	**Number Theory**	**6**	**0**	**0**	**6**
3.	**5**	**II**	**MJR**	**Calculus**	**6**	**0**	**0**	**6**
4.	**5**	**II**	**MJR**	**Operations Research**	**6**	**0**	**0**	**6**
5.	**6**	**III**	**MJR**	**Real Analysis-I & Differential Equations-I**	**4**	**0**	**0**	**4**
6.	**6**	**III**	**MJR**	**Introduction to Scilab: A Mathematical Tool**	**0**	**0**	**2**	**2**
7.	**6**	**III**	**MJR**	**Mathematical Statistics**	**6**	**0**	**0**	**6**

8.	**6**	**IV**	**MJR**	**Real Analysis-II & Numerical Analysis**	**4**	**0**	**0**	**4**
9.	**6**	**IV**	**MJR**	**Introduction to C Programming: As Mathematical Tool**	**0**	**0**	**2**	**2**
10.	**6**	**IV**	**MJR**	**Advanced Analysis**	**6**	**0**	**0**	**6**
11.	**7**	**V**	**MJR**	**Abstract Algebra & Three Dimensional Geometry**	**6**	**0**	**0**	**6**
12.	**7**	**V**	**MJR**	**Optimization Techniques-II**	**6**	**0**	**0**	**6**
13.	**7**	**VI**	**MJR**	**Complex Analysis & Mechanics**	**6**	**0**	**0**	**6**
14.	**7**	**VI**	**MJR**	**Linear Algebra & Differential Equations-II**	**6**	**0**	**0**	**6**

Examination Scheme for Theory Paper

70% weightage for End of Semester Exam (EoSE) and 30% weightage of Continuous Internal Assessment (CIA)

Passing Marks:

40% marks in each paper/ subject including sessional/ CIA and EoSE put together.

Question Paper Pattern

Total Marks for a subject/ paper: 150
Practical Max Marks: 50 (If Applicable)

CIA Max Marks: 30 (If Practical Applicable) /45 Marks

EoSE Max. Marks: 70 (If Practical Applicable) /105 Marks

The question paper (EoSE) will consist of two parts A & B.

Part A- 14/21 Marks

Part A is compulsory comprises 10 very short answer-type questions (with a limit of 20 words) of two/ three marks each and candidate can attempt any seven questions.

Part B- 56/81 Marks

Part B of the question paper shall be divided into four units comprising question number 2-5. There will be one question from each unit with internal choice. Each Question Carries will carry 14/21 Marks.

Examination Scheme for Practical Paper

Max. Practical Marks = 50 Marks
Internal = 20 Marks
External = 30 Marks
Distribution of Marks:
Two Practical one from each group 10 Marks each = 20 Marks
Practical Record: 5 Marks
Viva-voice: 5 Marks

Note: 1. Each Candidate has to prepare his/ her practical record.
2. Each Candidate has to pass in Practical and Theory examination separately.

B.Sc. Semester I Mathematics

Discrete Mathematics & Optimization Techniques-I

1 Credit – 25 Marks
6 Credit- 150 Marks
Question Paper: 105 Marks
Internal Assessment: 45 Marks

Objectives: The objective of the course is to expose discrete structures and involve topology and optimization of real-world problems.

Prerequisites: Mathematics courses of XII Std. of Central Board of Secondary Education or equivalent.

Learning Outcomes: The course would enable the student

1. To understand the ideas in discrete structures viz. Partially ordered sets, Lattices, Graphs etc. and allied conceptual intricacies with applications.
2. To understand mathematical formulation of optimization problems and allied theoretical concepts for solution methodologies for linear programming problems, Transportation problems assignment problems.

Mark distribution in question paper:

The question paper (EoSE- End of Semester Examination) will consist of two parts A & B

Part A- 21 Marks

Part A is compulsory comprises 10 very short answer-type questions (with a limit of 20 words) of three marks each and candidate can attempt any seven questions.

Part B- 81 Marks

Part B of the question paper shall be divided into four units comprising question number 2-5. There will be one question from each unit with internal choice. Each Question Carries will carry 21 Marks.

Unit - I

Relations on a set, Equivalence class, partial order relations, Chains and Anti-chains. Lattices, Distributive and Complemented Lattices. Boolean algebra, conjunctive normal form, disjunctive normal form. Principle of inclusion and exclusion. Propositional calculus, Basic logical operations, Truth tables, Tautologies and contradictions.

Unit -II

Discrete numeric functions, generating functions, Recurrence relations, linear recurrence relation with constant coefficients and their solutions: Total solutions, Solution by the method of generating functions. Basic concepts of graph theory, Types of graphs, Walks, Paths & Circuits, Shortest path problem.

Unit -III

Planar graphs, Operations on graphs (union, join, products). Matrix representation of graphs, Adjacency matrices, Incidence matrices. Hamiltonian and Eulerian graphs. Tree, Spanning tree, Minimum spanning tree, Distance between vertices, Center of tree, Binary tree, Rooted tree.

Unit-IV

Linear programming problems. Feasible solution, Basic feasible solution. Some basic properties and theorems on convex sets. Simplex algorithm, Transportation problems. Assignment problems.

Suggested Books and References –

1. V. K. Balakrishnan, Introductory Discrete Mathematics, Prentice-Hall, 1996.

2. N. Deo, Graph Theory with Applications to Computer Science, Prentice-Hall of India.

3. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, 1986.

4. Kenneth H. Roson, Discrete Mathematics and Its Applications, Tata Mc-GrawHiils, New Delhi, 2003.

5. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

6. Hamdy A. Taha, Operations Research, An Introduction (9th edition), Prentice-Hall, 2010.

Suggested E-resources: https://www.coursera.org/ , https://www.khanacademy.org/ , https://alison.com/tag/maths

B.Sc. Semester I Mathematics

Number Theory

1 Credit – 25 Marks

6 Credit- 150 Marks

Question Paper: 105 Marks

Internal Assessment: 45 Marks

Objectives: The objective of the Course is to provide students with a comprehensive understanding of Euclidean algorithm, Congruence and Cryptography.

Prerequisites: Mathematics courses of XII std. of Central Board of Secondary Education or equivalent.

Learning Outcomes: The course would enable the student

1. To apply Euclid's algorithm and Chinese Remainder Theorem.
2. To understand the definitions of congruences, residue classes and Application to Cryptography.
3. To apply number theoretic functions in various branches of mathematics.

Mark distribution in question paper:

The question paper (EoSE- End of Semester Examination) will consist of two parts A & B

Part A- 21 Marks

Part A is compulsory comprises 10 very short answer-type questions (with a limit of 20 words) of three marks each and candidate can attempt any seven questions.

Part B- 81 Marks

Part B of the question paper shall be divided into four units comprising question number 2-5. There will be one question from each unit with internal choice. Each Question Carries will carry 21 Marks.

Unit - I

Divisibility – Division Algorithm, Divisibility in Z, g.c.d., the Euclidean algorithm, l.c.m., Primes, Infinitude of primes, Fundamental theorem of Arithmetic. Fibonacci sequence, Fibonacci numbers and their properties.

Unit -II

Congruence – Linear conguruence, Chinese Remainder theorem, Fermat's Little theorem, Wilson's theorem, Fermat's factorization, Euler's factorization. Number theoretic functions: tau and sigma-functions, the Mobius function and inversion formula, Greatest integer function, Euler's phi function, Euler's generalization of Fermat's theorem. and the properties of phi function.

Unit -III

Cryptography, Application of Number theory to Cryptography, Diophantine equations – $ax + by = c$, $ax + by + cz = d$, $x^2 + y^2 = z^2$, $x^4 + y^4 = z^2$, $x^4 + y^4 = z^4$, Fermat's last theorem.

Unit-IV

Quadratic congruence, Quadratic residues, Legendre symbol and its properties, Quadratic reciprocity. Order of an integer and its properties, Primitive roots for primes, Composite numbers having primitive roots, Theory of indices.

Suggested Books and References –

1. S.Telang and M. Nadkarni, Number Theory, Tata McGraw-Hill, 2001.

2. David M. Burton, Elementary Number Theory (6th Edition), Tata McGraw-Hill Edition, Indian reprint, 2007.

3. I. Niven and H. Zukerman, An Introduction to the theory of Numbers, Wiley Eastern University Edition, New Delhi, 1985.

4. Neville Robinns, Beginning Number Theory (2nd Edition), Narosa Publishing House Pvt. Limited, Delhi, 2007.

Suggested E-resources: https://www.coursera.org/ , https://www.khanacademy.org/ , https://alison.com/tag/maths

B.Sc. Semester II Mathematics

Calculus

1 Credit – 25 Marks

6 Credit- 150 Marks

Question Paper: 105 Marks

Internal Assessment: 45 Marks

Objectives: The objective of the course is to provide students with a comprehensive understanding of the fundamental concepts of calculus as a tool for dynamic systems; diverse topics find applications in many branches of science.

Prerequisites: Mathematics course of XII std. of Central Board of Secondary Education or equivalent.

Learning Outcomes: By the end of the course, students should be able to:

1. Understand the concept of curvature, padel equations, partial differentiation, envelope, asymptotes.
2. Understand the concept of maxima-minima, curve tracing, double and triple integration and their applications.

Mark distribution in question paper:

The question paper (EoSE- End of Semester Examination) will consist of two parts A & B

Part A- 21 Marks

Part A is compulsory comprises 10 very short answer-type questions (with a limit of 20 words) of three marks each and candidate can attempt any seven questions.

Part B- 81 Marks

Part B of the question paper shall be divided into four units comprising question number 2-5. There will be one question from each unit with internal choice. Each Question Carries will carry 21 Marks.

Unit - I

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 and Chord of curvature.

Unit -II

Partial differentiation. Euler's theorem for homogeneous functions. Chain rule of partial differentiation. Total differentiation, Differentiation of implicit functions. Envelopes: One parameter family of curves when two parameters are connected by a relation. Maxima and Minima of functions of two variables. Lagrange's method of undetermined multipliers.

Unit -III

Asymptotes: Definition, Parallel to coordinate axes, General rational algebraic curves, inspection method, Intersection of a curve and its asymptotes. Multiple points. Curve tracing of Cartesian, Polar and parametric curves. Beta and Gamma functions.

Unit-IV

Double integrals in Cartesian and Polar Coordinates, Change of order of integration. Triple integrals. Dirichlet's integral. Rectification, Area, Volume and Surface of solids of revolution.

Suggested Books and References –

1. Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand & Co., N. D., 2013.
2. H.S.Dhami, Differential Calculus, Age Int. Ltd., New Delhi, 2012.
3. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
4. H. Anton, I. Bivens and S. Davis, Calculus (7th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2002.
5. G.B. Thomas, R. L. Finney, M. D. Weir, Calculus and Analytic Geometry, Pearson Education Ltd, 2003.

Suggested E-resources: https://www.coursera.org/ , https://www.khanacademy.org/ , https://alison.com/tag/maths

B.Sc. Semester II Mathematics

Operations Research

1 Credit – 25 Marks

6 Credit- 150 Marks

Question Paper: 105 Marks

Internal Assessment: 45 Marks

Objectives: The objective of the course is to enable students to learn concepts in optimization techniques viz. game theory, Inventory models, job sequencing and queueing theory.

Prerequisites: Mathematics courses of XII std. of Central Board of Secondary Education or equivalent.

Learning Outcomes: By the end of the course, students should be able to:

1. Analyze inventory models, costs, and constraints for efficient management.
2. Apply game theory principles to strategize and optimize outcomes.
3. Understand queuing theory and solve queuing models for various scenarios.
4. Master sequencing models for optimal task scheduling and job processing.
5. Apply replacement models for effective resource management and decision-making.

Mark distribution in question paper:

The question paper (EoSE- End of Semester Examination) will consist of two parts A & B

Part A- 21 Marks

Part A is compulsory comprises 10 very short answer-type questions (with a limit of 20 words) of three marks each and candidate can attempt any seven questions.

Part B- 81 Marks

Part B of the question paper shall be divided into four units comprising question number 2-5. There will be one question from each unit with internal choice. Each Question Carries will carry 21 Marks.

Unit - I

Inventory Models – Definitions, Types of inventory models, costs involved in inventory models, Classification of inventory models. Static demand models in Inventory control:

EOQ models without shortage, EOQ models with shortage, limitations of EOQ formula, EOQ model with finite replenishment rate.

Unit -II

Theory of Games – Introduction, Basic definitions, Minimax (Maximin) criterion and Optimal strategy. Solution of game with saddle point. Minimax-Maximin principle for mixed strategy games, Fundamental theorem of Game theory. Solution of 2×2 mixed strategy game. Solution of 2×2 mixed strategy game by the method of oddments. Dominance principle. Graphical method for solving 2×n or m×2 game, Linear programming method for the solution of m×n game.

Unit -III

Queueing Theory – Introduction, classification of queuing models. Distribution of arrivals. Distribution of inter-arrival time, Distribution of departures, Distribution of service time. Solution of queuing models: Model 1 (M/M/1): (∞/FCFS), Model 2 (M/M/1): (N/FCFS), Model 3 (M/M/C): (∞/FCFS), Model 4 (M/M/1): (N/FCFS).

Unit-IV

Sequencing Models: Sequencing problems, processing n jobs through two machines. Processing n jobs through three machines, processing two jobs through m machines and processing n jobs through shortest cyclic Route Models. Minimal path problem (shortest Acyclic Route Models).

Suggested Books and References –

1. J.K. Sharma, Operation research- Theory and Application, Macmillan Pub. India Ltd.
2. Kanti Swaroop, P. K. Gupta and Manmohan, Operation Research, Sultan Chand & Co., N.D., 2007.
3. S. D. Sharma, Operations Research, Kedar Nath Ram NAth and co. Meerut, 2005.
4. F. S. Hillier and G. J. Lieberman, Introduction to Operations ResearchConcepts and Cases (9th Edition), Tata McGraw Hill, 2010.
5. Hamdy A. Taha, Operations Research, An Introduction (9th edition), Prentice-Hall, 2010.

Suggested E-resources: https://www.coursera.org/ , https://www.khanacademy.org/ , https://alison.com/tag/maths