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

RAM BAGH CIRCLE, JAIPUR-302004

DETAILED COURSE STRUCTURE & SCHEME OF EXAMINATION

AS PER

UGC CURRICULUM AND CREDIT FRAMEWORK FOR UNDERGRADUATE

PROGRAMMES UNDER NEP 2020

FOR

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

SUBJECT–MATHEMATICS

(2023-2024 & ONWARDS)

Medium of Instruction: Hindi/ English

Programme outcomes

PO1: Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science stream.

PO2: Students will become employable; they will be eligible for career opportunities in Industry, or will be able to opt for entrepreneurship.

PO3: Students will possess basic subject knowledge required for higher studies, professional and applied courses like Management Studies, Law etc.

PO4: Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.

Programme specific outcomes

PSO1: A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology.

PSO2: A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.

PSO3: Student is equipped with mathematical modelling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.

PSO4: Student should be able to apply their skills and knowledge that is translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

PSO5: Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Scheme for Choice Based Credit System B.Sc. /B.A.

NHEQF Level	Subject Code	Course Title	Course Category	Credit	Contact Hours per week			ESE Duration (Hrs.)	
					L	T	P	T	P
			Semester-I						
5	MAT 101	Differential Calculus	DSC	3	3	-	-	3	-
	MAT 102	Analytic Geometry	DSC	3	3	-	-	3	-
			Semester-II						
5	MAT 201	Integral Calculus	DSC	3	3	-	-	3	-
	MAT 202	Abstract Algebra	DSC	3	3	-	-	3	-
			Semester-III						
6	MAT 301	Real Analysis	DSC	3	3	-	-	3	-
	MAT 302	Differential Equations	DSC	3	3	-	-	3	-
			Semester-IV						
6	MAT 401	Complex Analysis	DSC	3	3	-	-	3	-
	MAT 402	Numerical Analysis	DSC	3	3	-	-	3	-
			Semester-V						
7	MAT 501A/ 501B	DSE A	DSE	3	3	-	-	3	-
	MAT 502A/ 502B	DSE B	DSE	3	3	-	-	3	-
			Semester-VI						
7	MAT 601A/ 601B	DSE C	DSE	3	3	-	-	3	-
	MAT 602A/ 602B	DSE D	DSE	3	3	-	-	3	-

Discipline Subject Elective (DSE)

DSE A (Choose any one)	DSE B (Choose any one)
1. MAT 501A: Advanced Abstract Algebra	1. MAT 502A: Advanced Complex Analysis
2. MAT 501B: Discrete Mathematics	2. MAT 502B: Optimization Theory

DSE C (Choose any one)	DSE D (Choose any one)
1. MAT 601A: Linear Algebra	1. MAT 602A: Mechanics
2. MAT 601B: Graph Theory	2. MAT 602B: Theory of Equations

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Examination Scheme for Each Paper

Part A- Question1 is compulsory comprises eight very short questions (Two from each Unit).

Candidate has to attempt any seven questions. Each question carries 2 marks.

7×2 mark each = 14 Marks

Part B- Comprises 4 questions (one question from each unit with internal choice) and all questions

are compulsory. Each Question carries 10 Marks.

4×10 mark each = 40 Marks

Total of End semester exam (duration of exam 3 hours) = 54 Marks

Internal Assessment = 21 Marks

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Semester	Subject1/Discipline1 (DSC/DSE) (credits)	Subject2/Discipline2 (DSC/DSE) (credits)	Subject3/Discipline3 (DSC/DSE) (credits)	Generic Elective (GE) (credits)	Ability Enhancement Course (AECC) (credits)	Skill Enhancement Course (SEC) (credits)	Internship/Apprenticeship/Project/Community outreach (4)	Value Addition Course (VAC) (credits)	Credits
I	DSC-1 Differential Calculus (3)	DSC-3 (2)	DSC-5 (2)		English (2)			Choose one from a pool of courses (0)	20 credits
	DSC-2 Analytic Geometry (3)	DSC-4 (2)	DSC-6 (2)						
		DSCP (2)	DSCP (2)						
II	DSC-7 Integral Calculus (3)	DSC-9 (2)	DSC-11 (2)		Hindi (2)			Choose one from a pool of courses (0)	20 credits
	DSC-8 Abstract Algebra (3)	DSC-10 (2)	DSC-12 (2)						
		DSCP (2)	DSCP (2)						

Students on exit shall be awarded Undergraduate Certificate in Science after securing the requisite 40 credits in Semesters I and II — 40+4

Semester	Subject1/Discipline1	Subject2/Discipline2	Subject3/Discipline3	Generic Elective (GE)	AECC	SEC	Internship	VAC	Credits
III	DSC-13 Real Analysis (3)	DSC-15 (2)	DSC-17 (2)	Choose one from pool of courses, GE-1 (2)**		Computer Science (2)		Choose one from a pool of courses (0)	22 credits
	DSC-14 Differential Equations (3)	DSC-16 (2)	DSC-18 (2)						
		DSCP (2)	DSCP (2)						
IV	DSC-19 Complex Analysis (3)	DSC-21 (2)	DSC-23 (2)	Choose one from pool of courses GE-2 (2)**		Env. Sc. and Sustainable Dev. (2)		Choose one from a pool of courses (0)	22 credits
	DSC-20 Numerical Analysis (3)	DSC-22 (2)	DSC-24 (2)						
		DSCP (2)	DSCP (2)						

Students on exit shall be awarded Undergraduate Diploma in Science after securing the requisite 84 credits on completion of Semester IV — 84+4

Semester	Subject1/Discipline1	Subject2/Discipline2	Subject3/Discipline3	GE	AECC	SEC	Internship	VAC	Credits
V	Choose two from pool of courses, DSE-1 Advanced Abstract Algebra or Discrete Mathematics (3)	Choose two from pool of courses, DSE-3 (2)	Choose two from pool of courses, DSE-5 (2)			Mental ability & reasoning (2)		Choose one from a pool of courses (0)	20 credits
	DSE-2 Advanced Complex Analysis or Optimization Theory (3)	DSE-4 (2)	DSE-6 (2)						
	DSEP (2)	DSEP (2)	DSEP (2)						
VI	Choose two from pool of courses, DSE-7 Linear Algebra or Graph Theory (3)	Choose two from pool of courses, DSE-9 (2)	Choose two from pool of courses, DSE-11 (2)			Anandam - Joy of giving (2) or NCC/NSS/Rovers and Rangers/ Red Ribbon Club/ Sports/ Extra-curricular and co-curricular activities (2)		Choose one from a pool of courses (0)	20 credits
	DSE-8 Mechanics or Theory of Equations (3)	DSE-10 (2)	DSE-12 (2)						
	DSEP (2)	DSEP (2)	DSEP (2)						

Students on exit shall be awarded Bachelor of Science (3 years) after securing the requisite 124 credits on completion of Semester VI — 124+4

** Students may select Generic elective paper in Semester III and IV from the pool of courses given. The GE paper must be from the other faculty or discipline.

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Semester: I

Paper I: Differential Calculus
Paper Code: MAT 101
Course Type: DSC

Prerequisite: Student must know about differentiation and its applications.
Course Objective: The primary objective of this course is to gain proficiency in Differential Calculus and introduce the basic tools which are used to solve application problems in a variety of settings ranging from chemistry and physics to business and economics. Differential calculus develops the concepts of Series, Partial order derivatives, Envelopes and Maxima-Minima and fundamental for various fields of mathematics.

Unit I: Infinite Series: Convergence of series of non-negative terms, their various tests (Comparison; D'Alembert's ratio, Cauchy's n^{th} root, Raabe's, Gauss, Logarithmic, DeMorgan 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: 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, Total differential Coefficient, Differentiation of implicit functions.
Unit IV: Envelops, Maxima and Minima of function of two variables, Lagrange's Method of undetermined multipliers.

Course Outcome: On successful completion of this course, Students is able to understand the idea of derivative, tangent line to the graph of a function, how a derivative can be used to describe the rate of change of one quantity with respect to another, and how to relate the geometric ideas to the analytic ideas.

Learner support Material: Swayam (https://swayam.gov.in), E-library, E-books, online PDF material etc.

Reference Books:
1. MD. Anwarul Haque, 1992 (First Edition), "Calculus of one Variable", New Age International Publication, New Delhi
2. Gupta &Kapoor, 2000 (First Edition), "Text book of differential calculus", S. Chand Publication, New Delhi.
3. A.R. Vasishtha, S.K. Sharma, A. K. Vasishtha, 1989 (First Edition)"Differential Calculus", Krishna Prakashan Media, Meerut.

Online resources: https://www.coursera.org/ , https://www.khanacademy.org/ , https://alison.com/tag/maths

Paper II: Analytic Geometry
Paper Code: MAT 102
Course Type: DSC

Prerequisite: student must know about the basic knowledge of geometry.
Course Objective: The aim of the course is to develop connection between algebra and geometry through graphs of lines and curves.to understand the concept of conic, sphere, cone and central conicoid.

Unit I: Polar equation of conic: General equation of Conic (Focus being the pole), Director Circle, Auxiliary circle, Chord, Tangent, Chord of Contact, Normal, Pole and Polar, perpendicular lines and Asymptotes.
Unit II: 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.
Unit III: Cone: Equation of Cone (whose vertex and guiding curve are given), Enveloping cone, right circular cone.
Cylinder: Equation of cylinder, enveloping cylinder, Right circular cylinder.
Unit IV: Central Conicoid: Introduction, Intersection of a line and a Central Conicoid, Tangent line and tangent planes, condition of tangency for a plane. Generating lines of hyperboloid of one sheet and its properties.

Course Outcome: On successful completion of this course, Students will be able to understand the basic applications of coordinate geometry. They will develop ability to pursue advanced studies and research in pure and applied mathematical science.

Learner support Material: Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.

Reference Books:
1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
3. S.L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London.
4. R.J.T. Bill, Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.

Online resources: https://www.coursera.org/ , https://www.khanacademy.org/ , https://alison.com/tag/maths

Semester: II

Paper I: Integral Calculus
Paper Code: MAT201
Course Type: DSC

Prerequisite: Student must know about integration and its properties.
Course Objective: The primary objective of this course is to gain proficiency in Integral Calculus. The objectives of this course are to consider applications of derivatives for sketching of curves, concept of Double and Triple integral, application of definite integrals for calculating volumes of solids of revolution, length of plane curves, Areas which are helpful in understanding their applications in planetary motion, design of telescope and to many real-world problems.

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. Change of order of integration (Cartesian and polar coordinates).
Unit III: Triple integrals, Dirichlet's Integration, Rectification.
Unit IV: Areas, Volumes and surfaces of solids of revolution.

Course Outcome: On successful completion of this course, Students will enable to sketch curves in a plane using its mathematical properties in the different coordinate systems of reference. Student will able to compute the length of curve, area bounded by the curves, area and volume of surface of solid of revolution.

Learner support Material: Swayam(https://swayam.gov.in), E-library, E-books, online PDF material etc.

Reference Books:
1. Anton, Howard, Bivens, Irl, & Davis, Stephen, Calculus (10th Ed.), John Wiley & Sons Singapore Pvt. Ltd. Reprint (2016) by Wiley India Pvt. Ltd. Delhi.
2. Strauss, M. J., Bradley, G. L., & Smith, K. J. (2007). Calculus (3rd Ed.). Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Delhi. Sixth impression 2011.
3. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

Online resources: https://www.coursera.org/ , https://www.khanacademy.org/ , https://alison.com/tag/maths

Paper II: Abstract Algebra
Paper Code: MAT 202
Course Type: DSC

Prerequisite: The student must know the basic knowledge of set, relation and functions.
Course Objective: The main aim of the course is to introduce you to basic concepts from abstract algebra, especially the notion of a group. The Abstract Algebra module focuses on the power of abstraction by developing mathematical theories from axioms in several contexts – Group Theory, Rings and Fields.

UNIT I: Definition and simple properties of Groups and subgroup, cyclic group, Permutation group. Cosets, Lagrange's theorem on the order of subgroups of a finite order group.
UNIT II: Normal subgroups and Quotient groups. Morphism of groups, Fundamental theorems of Isomorphism, Cayley's theorem.
UNIT III: 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.

Course Outcome: The students who succeeded in this course; will able construct and compare algebraic structures and substructures and analyze a given structure in detail. They also understand a new structure based on given structures.

Learner support Material: Swayam (https://swayam.gov.in), E-library, E-books, online PDF material etc.

Reference Books:
1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
4. Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
5. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
6. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
7. D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998

Online resources: https://www.coursera.org/, https://www.khanacademy.org/, https://alison.com/tag/maths.