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Sophia Girls' College (Autonomous), Ajmer

Department of Mathematics

Lesson Plan

Faculty Name: - Ms. Shivani Indora

Course Plan

2021 - 2022

Subject - Maths

Submitted by

Ms. Shivani Indora

[M.Sc. Maths, JRF-NET, Ph.D Pursuing]

SOPHIA GIRL'S COLLEGE, AJMER (*AUTONOMOUS*)

B. Sc. I (SEMESTER I)

MATRICES (PAPER I) (MAT-101)

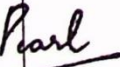Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04
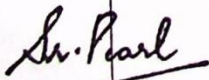
COURSE PLAN

SEM I Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
September	**UNIT I** Matrix, Types of matrix, Elementary operations on matrices, Symmetric and Skew Symmetric matrices, Hermitian and Skew Hermitian matrices, unitary matrix.	Matrix	Lecture method,	Identify types of Matrix, its rank by using Normal form and Echelon form method and nature of vectors.	*Knowledge Based* -Define eigen value and eigen vector? What do you mean by Unitary matrix ?	Knowledge--60 Understanding-30 Higher Order-10
	Inverse of matrix, Linear Independence of row and column matrices.	Linear combination of vectors	Demonstration through examples,		*Understanding Based* - Examine that the following vectors are L.I. or L.D.	
	Row rank, Column rank and Rank of matrix, Equivalence of column and row rank.	Rank of a matrix	Demonstration through examples, Problem solving classs		$A = (1,0,1),$ $B = (0,0,1),$	

Month	Topic	Sub-topic	Methodology	Learning Outcome	HOTS / Application
October	**UNIT II** Applications of matrices to solve a system of linear (both homogeneous and non-homogenous) equations, Theorems on consistency of a system of linear equation	Homogeneous and non-Homogeneous system of equation	Group Discussion, Demonstration through examples, Quiz	Solve System of Linear Equation by Matrix method, Problems related to Eigen value and Eigen vector.	$C = (0,1,0)$ -Use Cayley Hamilton theorem to find inverse of matrix A $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$.
	Eigen values, Eigen vectors and the Characteristic equation of a matrix, Cayley - Hamilton theorem and its use in finding Inverse of a matrix.	Cayley - Hamilton theorem	Demonstration through examples, Problem solving classs		*Higher Order Thinking Skills Based* - Prove that the characteristic roots of a unitary matrix are of unit modulus.
November	**UNIT III** Relation between roots and coefficients of general polynomial equation in one variable Transformation of equations.	General properties of polynomial equation	Lecture Method, Quiz	Evaluate roots of Cubic equation by Cardan's method and Biquadratic equations by Ferrari's method.	- Evaluate characteristic polynomial and Spectrum of the matrix A = $\begin{bmatrix} 1 & 5 \\ 6 & 3 \end{bmatrix}$
	Descartes' rule of signs, Solution of cubic equation by Cardan's method, Solution of Biquadratic equations by Ferrari's method.	Solution of cubic and Biquadratic equation.	Demonstration through examples, Problem solving class		
	REVISION CLASSES				

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B. Sc. I (SEMESTER I)　　　　　　　　　　　　　**ABSTRACT ALGEBRA (PAPER II) (MAT-102)**

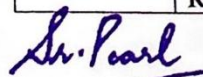Max. Marks: 100 (70 External; 30 Internal)　　　Min. Marks: 40 (28 External; 12 Internal)　　　Credit: 04

COURSE PLAN

SEM 1 Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
october –November	**UNIT I** Definition of a group with examples, Order of finite group, General properties of groups, Integral power of an element of a group, Order of an element of a group.	Groups and its properties	Demonstration through examples, Quiz	Explain Groups, general properties of groups and Application of Lagrange's theorem.	*Knowledge Based* -State Fundamental theorem of Homomorphism. -What do you mean by Field? *Understanding Based* -Sow that intersection of two ideal is again an ideal. -List Four properties of normal subgroup.	Knowledge--60 Understanding-30 Higher Order-10
	Subgroup, Generation of groups, Cyclic group, cosets decomposition, Lagrange's theorem and its consequences.	Subgroups	Lecture method, Problem solving class			
November	**UNIT II** Normal subgroups and Quotient groups,Permutation, permutation group, cyclic	Normal subgroup and its properties ,Permutation group	Lecture method	Analyze Normal subgroups, Quotient		

						Higher Order Thinking Skills Based
	permutation, Even and Odd permutation, The alternating group A$_n$.				group, Permutation group and Morphism of group.	
						- Find the order of every element of the group $(\{0,1,2,3,4,5,6\},+_7)$ .Also Check the group is cyclic or not. If cyclic find its all generators.
	Morphism of groups, Homomorphism and isomorphism, The fundamental theorem of homomorphism.	Group Morphism	Lecture method, Problem solving class			
December	**UNIT III** Ring, ring with unity, zero divisors, integral domain and field and their properties. Characteristic of a ring and integral domain, Subring, subfield, prime field, Ring morphism.	Ring and their Subrings	Demonstration through Examples	Solve problem related to Ring, Ideals, Quotient rings, Integral domains, and Fields.		−Prove that if H is a normal subgroup of a group G then product of every left cosets is again a left coset. -
	Ideals (Principle, Prime and Maximal) and field of quotients of an Integral Domain. **REVISION CLASSES**	Ideals	Demonstration through examples.			

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B. Sc. II (SEMESTER III)

LINEAR ALGEBRA (PAPER I) (MAT-301)

Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04

COURSE PLAN

SEM III Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
October	**UNIT I** Vector space: Definition and examples of vector space, subspace, sum and direct sum of subspace, linear span, linear dependence, independence and their basic properties.	Vector space	PPT, Demonstration through theorems	Explain the concepts of vector spaces, subspaces, basis, dimension and their properties.	*Knowledge Based* -State an existence theorem? - What do you mean by minimal polynomial? *Understanding Based* - Tes whether the given set is L.I. or L.D. A = (1,0,2) B = (2,4,1) C = (0,1,2)	Knowledge--50 Understanding-35 Higher Order-15
	Basis, Finitely generated vector space, Existence theorem for basis of a finitely generated vector space, Invariance of the number of elements of basis set, dimensions, Quotient space and its dimension.	Basis and Dimension of a Vector space	Demonstration through examples and theorems , Problem solving class			

November	**UNIT III** Eigen values and Eigen vectors, similar matrices, equivalent matrices, minimal polynomial.	Properties of Eigen value of matrix A	Quiz, Demonstration through examples	Compute Eigen values and Eigen vectors, minimal polynomial, Jordan Canonical of Matrix.	- Show that the following matrix is Diagonalizable $A = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$
	Diagonalization of matrices, Jordan blocks and Jordan forms.	Diagonalizable matrix	Demonstration through examples, Problem solving class		
November – December	**UNIT II** Homomorphism and isomorphism of vector space, theorems on space morphism, Rank and Nullity, Sylvester law of nullity, Algebra of linear transformation.	Homomorphism of Vector space	PPT, Demonstration through examples and theorems	Construct Homomorphism of vector space, matrix related to linear transformation and verify Sylvester law of nullity.	*Higher Order Thinking Skills Based* - Prove the fundamental theorem on Space Morphism. -Evaluate the Eigen values of the following matrix A find their corresponding Eigen vectors
	Dual spaces, Bidual spaces, Adjoint of a linear transformation, Matrix representation of a linear transformation. **REVISION CLASSES**	Matrix of Linear transformation	Demonstration through examples, Problem solving class		$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 2 \\ 0 & 0 & -1 \end{bmatrix}$

COURSE_PLAN_2021-22_Ms._SHIVANI_INDORA

SOPHIA GIRL'S COLLEGE, AJMER (*AUTONOMOUS*)

B. Sc. II (SEMESTER III) DIFFERENTIAL EQUATIONS (PAPER II) (MAT-302)

Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04

COURSE PLAN

SEM III Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
September October	**UNIT I** Concept and formation of a differential equation, Order and degree of a differential equation, Differential equations of first order and first degree, Bernoulli's equation, Exact differential equation, integrating factors.	Differential equations of first order and first degree.	Demonstration through examples, Quiz	Formulate the ordinary the Ordinary differential equation and solve Differential equations of first order and first degree.	*Knowledge Based* -Define exact differential equations? -write the Clairaut's equations. *Understanding Based* -Solve : $\{(D+2)(D-1)^3\}y = e^x$ - Calculate the solution of given differential equation $P(1+q^2)=q(z-a)$	Knowledge--50 Understanding-35 Higher Order-15
	First order higher degree equations solving for x, y, p. Lagrange's equation, Clairaut's equation, equation reducible to Clairaut's form, Singular solution.	Differential equations of first order and higher degree.	Demonstration through examples, Problem solving class			

October – Nov.	**UNIT III** Partial differential equation: Formation, order and degree, linear and non-linear partial differential equation of first order. Complete solution, singular solution, General solution, solution of Lagrange's linear equations, non-linear partial differential equation of first order: solution by four standard forms. Solution of non-linear differential equation by Charpit's method	Solution of linear and non-linear partial differential equation of first order.	Demonstration through examples, Quiz	Solve non-linear Partial differential equation by Charpit's method, Homogeneous and non-Homogeneous linear partial differential equation with constant coefficients.	*Higher Order Thinking Skills Based* - Solve: $(D - D')^2 z = x + f(x+y)$ -Evaluate the solution of given differential equation $(1 - x^2)D^2 - xD - a^2 y = 0$
	Homogeneous and non-Homogeneous linear partial differential equation with constant coefficients, Partial differential equation with variable coefficients redu cible to equations with constant coefficients,their complimentary function and particular integrals.	Partial differential equation with constant and variable coefficients	Group discussion, Demonstration through examples, Problem solving class		
November – Dec.	**UNIT II** Linear differential equations	Linear differential equations with constant	Demonstration through	Learn various techniques of	

	with constant coefficients: Homogeneous and non-homogeneous linear ordinary differential equation, Geometrical meaning of a differential equation and orthogonal trajectories.	coefficients.	examples, Quiz	getting solutions of linear differential equations with constant coefficients, linear differential equation of second order.	
	Linear differential equation of second order: Reduction to normal form, Method of variations of parameters, Ordinary Simultaneous differential equations. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. **REVISION CLASSES**	Linear differential equation of second order.	Demonstration through examples, Problem solving class	This paper will help in skill development in the field of Real Number and their Applications.	

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B. Sc. III (SEMESTER V)   METRIC SPACES AND COMPLEX ANALYSIS (PAPER I) (MAT -501)

Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04

COURSE PLAN

SEM V Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
September	**UNIT I** Definition and examples of a metric space, Diameter of a set, Bounded set, Open sphere, Closed sphere, Open set, Properties of open set .	Metric space and Open set	Demonstration through examples and theorems	Explain several standard concepts of Metric space and their properties, Open and Closed sets.	*Knowledge Based* -What do you mean by limit point and derived set? -Define Harmonic function. *Understanding Based* -Show that a subset A of a metric space X is closed iff it contains all of its limit points.	Knowledge--40 Understanding-35 Higher Order-25
	Interior point and interior of a set, Closed set, Properties of closed set, Limit point of a set, Derived and closure of a set, Boundary point of a set.	Limit Point and Closed set	Quiz, Demonstration through theorems, Problem solving class			
October	**UNIT II** Continuity and Differentiability of complex valued function, Analytic function, Necessary and Sufficient condition for analytic function, Cauchy –	Differentiability of complex valued function	Demonstration through examples, Quiz	Analyze	-Using definition of the derivative, find the derivative of the following functions at the point mentioned against	

					them
	Riemann Equations (Cartesian and Polar form)			Analyticity of function and Construct analytic function by Milne Thomson method.	$f(z) = z^3 - 2z$ at $z = -1$
	Harmonic function, Conjugate Harmonic function, Construction of an analytic function by Milne Thomson method.	Analytic Functions	Group Discussion, Demonstration through examples, Problem solving class		_Higher Order Thinking Skills Based_ -Prove the necessary condition for conformal mapping.
November	**UNIT III** Conformal mapping, Isogonal mapping, Necessary and sufficient conditions for a conformal mapping. Some elementary transformations: Translation, Rotation, Magnification, Inversion.	Conformal mapping	Demonstration through examples	Apply the concepts of the conformal mapping, Bilinear transformation in real life problems.	- Evaluate the f (z) in terms of z if f(z) = u + i v is an analytic function and u – v = $e^x (\cos y - \sin y)$
	Linear transformation, Bilinear transformation, Properties of Bilinear transformation, Cross ratio, Invariant point of Bilinear transformation. **REVISION CLASSES**	Bilinear transformation	Demonstration through examples, Problem solving class	This paper will help in skill development in the field of higher order research related to Complex Analysis.	

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B. Sc. III (SEMESTER V)   **LINEAR PROGRAMMING (PAPER II) (MAT -502 (A))**

Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04

COURSE PLAN

SEM V Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
October	**UNIT I** Linear programming problem: Definition of Linear programming problem, Formulation and Solution of Linear programming problem, Feasible solution.	Graphical approach to solve LPP	Demonstration through examples	Explain several standard concepts of Metric space and their properties, Open and Closed sets.	*Knowledge Based* -Define Linear programming problem. - What do you mean by symmetric and unsymmetric dual problem ?	Knowledge--40 Understanding-35 Higher Order-25
	Basic Feasible solution, Optimal solution, Convex set and their properties, Hyperplane, Basic solutions and properties.	Convex set and its properties	Group discussion, Demonstration through examples, Problem Solving class		*Understanding Based* - Test wheather the following set is L.I. and L.D. A = (1,0,-1) B = (2,3,1)	
November	**UNIT II** Theory of Simplex method, Fundamental Theorem of Linear Programming	Simplex method to solve LPP	Demonstration through examples			

	(Statement only), The Simplex algorithm, Simplex method in tableau format.			Analyze Analyticity of function and Construct analytic function by Milne Thomson method.	$C = (3,0,-1)$ -Apply graphical method to solve the L.P.P. Max z = x-y s.t. 2x+3y $\leq$ 0 x+4y $\geq$ 0 x $\geq$ 0,y $\geq$ 0
	introduction to artificial variables, case of unbounded solutions, Big- M method, Two phase method, Degeneracy in linear programming problem.	Degeneracy in linear programming problem	Demonstration through examples, Group discussion, Problem solving class		
December	**UNIT III** Duality in Linear programming problem: Formulation of the dual problem, Primal-Dual relationships, Symmetric and Un-symmetric dual problem with restriction in sign, Theorems related to dual problem.	Primal-Dual relationships	Demonstration through examples, Quiz	Apply the concepts of the conformal mapping , Bilinear transformation in real life problems. This paper will help in skill development in the solution of Analytical Problems.	*Higher Order Thinking Skills Based* -Explain two phase method. -Write the dual of given L.P.P. and find its solution. Max z = 2x+y s.t.
	Revised Simplex method (standard form I and II). **REVISION CLASSES**	Revised Simplex method	Demonstration through examples, Problem solving class		x-y $\leq$ 0 2x-y $\geq$ 0 x $\geq$ 0,y $\geq$ 0

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B. Sc. III (SEMESTER V) Advanced Complex Analysis (PAPER II) (MAT -502 (B))

Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04

COURSE PLAN

SEM V Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
October	**UNIT I** Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions.	Complex Integration	Demonstration through examples	Explain the concept of Complex integration and Application of cauchy's integral formula.	*Knowledge Based* - State the Fundamental theorem of integral calculus for complex functions. - Define zero of an analytic function.	Knowledge--40 Understanding-35 Higher Order-25
	Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula, Liouville's theorem.	Cauchy integral Formula	Group discussion, Demonstration through examples, Problem Solving class		*Understanding Based* - Show that if f(z) is a regular function and if f'(z) is continuous at each point within and on a closed contour C, then	
November	**UNIT II** Power Series, Sum function of a power series, Absolutely convergent, Conditionally	Power Series	Demonstration through examples			

	convergent, Abel's theorem.			Create Power series; find its circle and radius of convergence.	$\int f(z)dz = 0$
	Circle and Radius of convergence of Power series, Weierstrass M – test, Cauchy – Hadamard theorem, Analyticity of the sum function of a power series.	Radius of Convergence of power series	Demonstration through examples, Group discussion, Problem solving class		-Apply Cauchy integral formula to find $\int \dfrac{e^{3z}}{z - \pi i}dz$ When C is the circle $|z - 1| = 4$
December	**UNIT III** Expansion of analytic function as power series, Taylor's theorem, Laurent's theorem, Maximum Modulus Principle, Schwarz-lemma.	Taylor's theorem, Laurent's theorem	Demonstration through examples, Quiz	Solve problem related to Zero of an analytic function and Kinds of singularities.	_Higher Order Thinking Skills Based_ - Prove Riemann's Theorem.
	Zero of an analytic function, Singularities, kinds of singularities, Theorems on singularities. **REVISION CLASSES**	Singularities	Demonstration through examples, Problem solving class		- Evaluate the singularities of the function $e^{c/(z-a)} / (e^{z/a} - 1)$ indicating the character of each singularity.

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2021-22

Even Semester

SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER

B. Sc. I (SEMESTER II)   Vector calculus and Geometry (PAPER I) (MAT-201)

Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04

COURSE PLAN

SEM II Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
MARCH	**UNIT II** General equation of second degree, Tracing of conics, centre of a conic, coordinates of the centre. Equation of the conic referred to centre as origin, Asymptotes of a conic, Length and position of axes of a standard conic, Tracing of Ellipse, Parabola and Hyperbola.	Tracing of conic	Demonstration through examples on board, Flipped Classroom. Recorded video lectures	Design different types of conic like Ellipse, Parabola and Hyperbola in Cartesian coordinate.	*Knowledge Based* - State Stoke's Theorem. - Write equation of the conic referred to centre as origin. *Understanding Based* - Prove that div (a X b) = b. curl a – a. curl b - A plane passes through a fixed point (a, b, c) and cut the axes in A,B,C. Show	Knowledge- **60** Understanding **30** Higher Order **10**
	The Polar equation of Conic: polar equation of a straight line, circle and conic chord, Auxiliary circle, Tracing of conic l/r = 1+ecosθ.	Polar and Cartesian coordinates relation	Demonstration through examples on board , Explain concept of tracing of conic through PPT			
	UNIT III Sphere, Plane section of a	Properties related to Sphere	Demonstration through	Solve Problem related to 3-		

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MARCH-APRIL	sphere, tangent line and tangent plane of sphere.		examples on board, Recorded video lectures	Dimensional figure like Sphere, Cone and Cylinder.	that the locus of the centre of the sphere OABC is $a/x + b/y + c/z = 2$	
	Cone, Enveloping cone, Tangent plane of cone, Reciprocal cone. Cylinder, Right circular cylinder, enveloping cylinder.	Cone and Cylinder concepts	Lecture Method, Problem solving class, PPT to explain 3D figures	This paper will help in skill development in the field of Operators, 2 D and 3 D Geometry	*Higher Order Thinking Skills Based* - Find the asymptotes of the following hyperbolas and equation to their conjugate hyperbola $y^2 - xy - 2x^2 - 5y + x - 6 = 0$ - Prove that $\nabla^2 f(r) = f(r) + (2/r) f(r)$	
MAY	**UNIT I** Vector differentiation, Gradient. Divergence and Curl, Identities involving these operators and related problems.	Vector differentiation, identities related to curl, gradient and divergence	Demonstration through examples on board, Flipped Classroom, Recorded video lectures	Evaluate vector Differentiation, gradient, divergence, curl, line integral and surface integral.		
	Vector integration, Line and surface integral, Theorem of Gauss, Green's and Stoke's. **Revision Classes**	Application of Gauss, Green's and Stokes Theorem	Inducto-Deductive method, Group Discussion. Lecture Method			

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SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER

B. Sc. I (SEMESTER II)　　　　　　**Advanced Calculus (PAPER II) (MAT-202)**

Max. Marks: 100 (70 External; 30 Internal)　　Min. Marks: 40 (28 External; 12 Internal)　　Credit: 04

COURSE PLAN

SEM II Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
FEBRUARY-MARCH	**UNIT II** Partial Differentiation, Change of variables, Euler's theorem on homogeneous functions, Differentiation of implicit functions, Jacobians.	About Differentiation of implicit and explicit functions	Lecture method, Group Discussion, Recorded video lectures, PDF notes	Evaluate Maxima, Minima and saddle points of function of two variables.	*Knowledge Based* - Write the condition for a point to be a point of inflexion. - State Liouvilles extension of Dirichlet's Integral.	Knowledge--60 Understanding-30 Higher Order-10
	Envelopes, Evolutes, Maxima, Minima and saddle points of function of two variables.	Two variable function maxima and minima point	Lecture method, Problem solving class			
APRIL	**UNIT III** Beta and Gamma function, Double integral, change of order of integration.	Application of double integration to find area, Beta and Gamma Relation	Demonstration through examples on board, Quiz, Recorded video lectures, PDF notes	Solve Problem related to beta function, Gamma function, Double integral and Triple integral	*Understanding Based* - Find all the asymptotes of the following curve: $(y-2x)^2 (3x+4y) + 3(y-2x)(3x+4y) - 5 = 0$	
	Triple integral, Dirichlet's integral and Liouville's	Application of integration Triple integration and	Demonstration through			

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	extension of dirichlet's integral (statement only).	Dirichlet's integral to solve triple integration	examples on board, Problem solving class		- Evaluate $$\int_{-1}^{1}\int_{0}^{z}\int_{y-z}^{y+z}(x-y+z)\,dx\,dy\,dz$$
APRIL-MAY	**UNIT I** Derivative of length of an arc, Asymptotes in Cartesian coordinates, intersection of curve and its asymptote, Curvature, radius of curvature for (Cartesian, polar, parametric and pedal curves) Curvature, centre of curvature, chord of curvature Tests for concavity and convexity, test for point of inflexion, singular points, curve tracing(in Cartesian and polar co-ordinates). **Revision Classes**	Trace different types of curves in Cartesian and polar co-ordinates.	Demonstration through examples on board, PDF notes, open Book Test ,Recorded video lectures	Sketch curves in Cartesian and polar coordinate systems.	*Higher Order Thinking Skills Based* -Find the points where the function $x^3 + y^3 - 3\,a\,x\,y$ has maximum or minimum value. -Examine the nature of the origin on the following curve: $x^7 + 2\,x^4 + 2\,x^3 y + x^2 + 2\,x\,y + y^2 = 0$

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SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER

B. Sc. II (SEMESTER IV)

Real Analysis (PAPER I) (MAT-401)

Max. Marks: 100 (70 External; 30 Internal)   Min. Marks: 40 (28 External; 12 Internal)   Credit: 04

COURSE PLAN

SEM IV Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
FEBRUARY	**UNIT I** Real number system as a complete ordered field: Field and its properties, ordered field, lower bound, upper bound, supremum and infimum of sets, the completeness property of Real number system, the Archimedean property.	Different properties of set , Application of Archimedean properties	Demonstration through examples on board, PPT to explain some theorems, PDF notes, Recorded video lectures	Explain properties of the Real number $\mathbb{R}$ and nature of Real Sequences.	*Knowledge Based* - Write the Rolle's theorem. -Define Pointwise convergence *Understanding Based* -Find the supremum and infimum of the set $S = \{ n(-1)^n : n \in N \}$ if exist. -Prove that the following function is not continuous at $(0,0)$	Knowledge--50 Understanding-35 Higher Order-15
	Definition of sequence theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion.	Nature of sequences	Lecture Method, Problem solving class			
MARCH	**UNIT II** Infinite series of non-negative terms, different tests of convergence of infinite series comparison test, ratio test,	Nature of infinite series	Demonstration through examples on board, Group	Apply the ratio, Leibnitz', Cauchy n^{th} root test for		

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	Logarithmic, Morgen and Bertrand test (without proof).		Discussion	Convergence of an Infinite series of Real number.	$f(x,y) = \begin{cases} \frac{x^2 + y^2}{x - y} & if\ x \neq y \\ 0 & if\ x = y \end{cases}$
	Alternating series, Leibnitz' theorem Absolute and conditional convergence, Pointwise convergence of sequence of functions, Uniform convergence	Convergence criteria for alternating series also uniform convergence	Lecture method, Problem solving class, open book test, PDF notes, Recorded video lectures		_Higher Order Thinking Skills Based_ - Prove that Between any two different real numbers there lie an infinite number of irrational numbers.
MAY	**UNIT III** Logarithmic function, exponential function and its standard properties (Covid - 19), Limit, continuity, differentiability of two variable functions.	Criteria to check limit, continuity, differentiability of two variable functions.	Demonstration through examples on board, PPT to explain some theorems, Recorded video lectures, PDF notes	Test Continuity and Differentiability of two variable function and the application of mean value Theorem. This paper will help in skill development in the field of Real Number and their Application.	- Test the convergence of the following series: $1 + \frac{2^p}{2!} + \frac{3^p}{3!} + \cdots \ldots \ldots$
	Mean value theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Riemann integral, Fundamental theorem of integral calculus. **Revision Class**	Application of Riemann integration.	Lecture method, Problem solving class, open book test.		

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B. Sc. II (SEMESTER IV)

Mechanics (PAPER II) (MAT-402)

Max. Marks: 100 (70 External; 30 Internal)
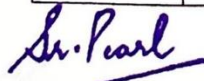
Min. Marks: 40 (28 External; 12 Internal)

Credit: 04

COURSE PLAN

SEM IV Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
MARCH	**UNIT II** Kinematics and Kinetics Rectilinear motion, Velocity and acceleration along radial, transverse, tangential and normal directions, Simple harmonic motion.	Kinematics and Kinetic Rectilinear motion	Lecture method, PPT, Group Discussion, PPT to explain Kinematics motion, PDF notes, Recorded video lectures	Deal with the Kinematics and Kinetics of the rectilinear motions of a particle, Problem related to horizontal and vertical elastic string.	*Knowledge Based* - Write tangential and normal velocity - Define Simple Harmonic Motion. *Understanding Based*	Knowledge--50 Understanding-35 Higher Order-15
	Rectilinear motion in resisting medium, Hook's law and related problem.	Vertical and horizontal string, motion of body in resisting medium	Demonstration through examples on board, Group Discussion, PDF notes		- A particle moves in a curve so that its tangential and normal acceleration are equal and the angular velocity of the tangent is	

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					constant. Find the curve.
APRIL	**UNIT I** General Conditions of equilibrium of coplanar forces: Reduction of coplanar forces into a force with couple, Equilibrium of a rigid body under three forces, Equilibrium of rigid body under more than three forces. Friction, Common Catenary **Revision Class**	Coplanar forces concept, different types of friction and application of catenary	Lecture Method, Problem solving class, Open book test, Recorded video lectures, PDF notes	Explain necessary conditions for the equilibrium of Coplanar Forces and Application of Friction.	- Explain Hooke's Law for vertical string. - _Higher Order Thinking Skills Based_ -Derive motion of a particle slides from rest from the highest point of a smooth vertical circle
MAY	**UNIT III** Constrained motion in vertical and horizontal circles, central orbit, inverse square law (Planetary motion), Impact (Direct and Oblique). Revision Class	Constrained medium, Kepler's law, Collision between bodies	Lecture Method, Group discussion, Problem solving class, Practically explain the Oblique and Direct Impact Recorded video lectures, PDF notes	Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions.	- A particle starts form rest at infinity and falls on the surface of the earth. Find its velocity at the surface and at the centre of the earth.

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SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER

B. Sc. III (SEMESTER VI)

Statistics (PAPER I) (MAT -601)

Max. Marks: 100 (70 External; 30 Internal)

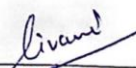Min. Marks: 40 (28 External; 12 Internal)

Credit: 04

COURSE PLAN

SEM VI Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
FEBRUARY-MARCH	**UNIT I** Random experiment, Sample space, Definition of Probability, Conditional probability, Addition theorem of probability, Multiplication theorem of compound probability, Baye's theorem.	Probability law, different types of events, Baye's theorem Application	Demonstration through examples on board, Group Discussion, PDF notes, Recorded video lectures	Apply several concepts of Probability, Application of Baye's theorem, Regression and Correlation Coefficient for solving real life situation.	*Knowledge Based* - Define Conditional Probability. - Write the equation of regression line of Y on X	Knowledge--40 Understanding-35 Higher Order-25
	Random variate, Probability distribution, Mathematical expectation, Moment, Mathematical expectation of the Sum and product of two random variate, Covariance, Curve fitting, Regression and Correlation Coefficient.	Moments, Curve fitting of straight line and parabola	Lecture method, Problem solving class, PPT to explain some theoretical part		*Understanding Based* - Prove that for any three events A, B & C	
APRIL	**UNIT II** Moment Generating Functions, Theorems on moment generating function,	Moment Generating Functions and cumulants of different distribution	Lecture Method, Group Discussion, Open book test,	Explain Discrete probability distributions like Binomial	$P(A \cup B/C) = P(A/C) + P(B/C) - P(A \cap B/C)$	

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			Recorded videos lectures, PDF notes	and Poisson distribution.	- Find the variance of Poisson Distribution.	
	Discrete probability distributions: Binomial, Poisson distribution and their Mean, Variance, Moment, Recurrence relation, Moment generating function.	Application of Binomial and Poisson distribution	Group Discussion, Demonstration through examples on board, Problem solving class		*Higher Order Thinking Skills Based* - The probabilities of X, Y and Z becoming managers are 4/ 9, 2/ 9 and 1 /3	
MAY	**UNIT III** Continuous probability distribution: Rectangular distribution, Normal distribution, derivation of normal distribution from binomial distribution, Mean, Variance, Moment, Recurrence relation, Moment generating function, Additive property of normal distribution, Problems related to area property of normal distribution, Exponential Distribution.(Case study related to COVID 19 based on Exponential Distribution) Revision Classes	King of all Distribution Properties	Lecture Method, PPT to explain some theoretical part, Problem solving class, PDF notes, Recorded video lectures	Solve Problems related to Rectangular Distribution and area property of normal distribution. This paper will help in skill development in the field of Probability and its Applications.	respectively. The probabilities that the Bonus scheme will be introduced if X, Y and Z become managers are 3/ 10, 1/ 2 and 4/ 5 respectively. - Derive mean and mgf of the normal Distribution.	

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SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER

B. Sc. III (SEMESTER VI) **NUMERICAL ANALYSIS (PAPER II) (MAT -602(A))**

Max. Marks: 100 (70 External; 30 Internal) Min. Marks: 40 (28 External; 12 Internal) Credit: 04

COURSE PLAN

SEM VI Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
MARCH	**UNIT I** Numerical operators, Properties of operators, Fundamental theorem of difference calculus, Factorial function.	Various Numerical operators	Demonstration through examples on board, PDF Notes, Calculation through Scientific Calculator, Recorded video lectures	Learn about various Numerical operators, interpolating and extrapolating methods.	*Knowledge Based* - Write Lagrange's Interpolation formula - Find the first difference of the function : $f(x) = x^2 + 8x$ *Understanding Based* - Given that : sin 45^0 = 0.7071 , sin 50^0 = 0.7660 sin 55^0 = 0.8192 , sin 60^0 = 0.8660 Find the value of sin 52^0 by interpolation method. - Find the real root of the	Knowledge--40 Understanding-35 Higher Order-25
	Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formula.	Newton's forward and Newton's backward interpolation with equal interval	Group discussion, Lecture Method , PPT to explain large tabular question, Problem Solving class			
APRIL	**UNIT II** Divided differences and their properties, Newton's formula for unequal intervals, Lagrange's formula, Central difference, Gauss forward	Different Interpolation formulas for unequal intervals	Demonstration through examples on board, Group Discussion, Calculation	Solve question related to unequal intervals by using Newton's		

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	and backward formula, Stirling interpolation formula Bessel formula.		through Scientific Calculator, Recorded videos lectures, PDF notes	formula, Lagrange's formula.	equation $x^3 - 3x - 5 = 0$ correct to four places of decimals by Newton Raphson Method
	Numerical Differentiation: Derivative from interpolation formulae, approximate expressions for the derivatives of a function.	Differentiation of $f(x)$ by using different Numerical differentiation formulas	Calculation through Scientific Calculator, Demonstration through examples on board,		*Higher Order Thinking Skills Based* - Given the following data , find f(x) as a polynomial in powers of (x-5) X takes values-0, 2, 3 ,4 ,7 ,9 Corresponding to that f(x) takes value 4,6,12,40,70,90
MAY	**UNIT III** Numerical Integration: General quadrature formula for equidistant ordinates, Trapezoidal, Simpson's one-third, three-eighth rule, Weddle's rule, Gauss' Quadrature formula, Euler – McLaurin's summation formula	Integration of $f(x)$ by using different Numerical integration formulas	Demonstration through examples on board, PDF notes, Calculation through Scientific Calculator, Recorded video lectures	Evaluate Numerical Integration by General quadrature formula, Trapezoidal, Simpson's one- third, three-eighth rule.	-Find the real root between 1.5 and 1.6 to four decimals of the equation $x^6 - x^4 - x^3 - 3 = 0$ by False position method.
	Solution of algebraic and transcendental equation, Newton Rapson method and Regular Falsi method. **Revision Class**	algebraic and transcendental equation solution	Demonstration through examples, Problem solving class, PDF notes, Recorded video lectures	This paper will help in skill development in the field of Research related to Operators.	

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