

OFFICE OF THE PRINCIPAL GOVT. COLLEGE FOR GIRLS, PALWAL (KURUKSHETRA)

LESSON PLAN (2024-25 Odd Semester)

Name of Assistant Professor: Dr. Hardish Kaur

Class: B.SC/B.A 5th Semester

Subject: Groups & Rings

Week	Topics	Remarks (Pedagogical Approaches)
22-30 July 2024	Groups and subgroups	
1-8 August 2024	Problem Solving of Groups and subgroups	Assignment-1
9-17 August 2024	Cosets	
19-24 August 2024	Problem Solving of Cosets	
26-31 August 2024	Problem Solving of Cosets	
2-7 September 2024	Homomorphisms and automorphisms	Group teaching and Learning
9-14 September 2024	Problem Solving of Homomorphisms	Assignment-2
16-21 September 2024	Permutation groups	
24-30 September 2024	Rings and Fields	Class Test-1
1-6 October 2024	Problem Solving of Rings and Fields	
7-12 October 2024	Problem Solving of Rings and Fields	
14-19 October 2024	Ideal and quotient rings	Presentation
21-26 October 2024	Problem Solving of Ideal and quotient rings	
4-9 November 2024	Homomorphism of rings	
11-16 November, 2024	Euclidean Rings	Class Test-2
18-22 November, 2024	Polynomial rings	

Class: M.SC. 1st Semester

Subject: Theory of Ordinary differential equations

Course Learning Outcomes (CLOs): After completing this course, the learner will be able to:

CLO: 1 Understand concepts of an initial value problem and its exact and approximate Solutions, Apply the knowledge to prove specified theorems and to solve relevant exercises.

CLO: 2 Have deep understanding of theory of linear differential equations of higher order by getting knowledge of basic theory, Wronskian theory and fundamental sets. Apply methods of reduction of order and variation of parameters to solve linear and non-linear differential equations respectively.

CLO: 3 Understand preliminary, oscillation and Sturm theory of second order ordinary differential equations and comparison theorems. Apply this knowledge to solve problems of checking second order ODEs for oscillatory and finding common zeros.

CLO: 4 Have good understanding of boundary value problems of second order, their classification and solution. Attain skills to solve boundary value problems which find great applications in areas of applied mathematics, science and engineering.

Week	Topics	Remarks (Pedagogical Approaches)
22-30 July 2024	Existence and Uniqueness of Solutions:	
1-8 August 2024	Existence of solutions; Initial value problem, e-approximate solution, Equicontinuous set of functions,	
9-17 August 2024	Ascoli Lemma, Cauchy-Peano existence theorem and its corollary	
19-24 August 2024	Uniqueness of solutions; Lipschitz condition, Gronwall's inequality, Inequality involving approximate solutions, Method of successive approximations, Picard-Lindelf theorem. Continuation of solutions, theorem. Maximal interval of existence, Extension	Assignment-1
26-31 August 2024	Theory of linear differential equations: Linear Differential Equation of order n, Basic theory of	

	homogeneous linear equation, Of Wronskian theory:	
2-7 September 2024	Definition, necessary and sufficient condition for linear dependence and linear independence of solutions of homogeneous DE, Abel's Identity, Fundamental sets, More Wronskian theory,	Group teaching and Learning
9-14 September 2024	Reduction of order. Non-homogeneous linear differential equation of order n: Variation of parameters.	Assignment-2
16-21 September 2024	Adjoint equations, Lagrange's Identity, Green's formula, Self adjoint equation of second order.	Class Test-1
24-30 September 2024	Linear differential equation of order n with constant coefficients Characteristic roots, Fundamental set	
1-6 October 2024	Linear second order equations: Preliminaries, Superposition principle	
7-12 October 2024	Riccati's equation, Pruffer transformation	
14-19 October 2024	Oscillations of second order differential equations: Zero of a solution, Oscillatory and non-oscillatory equations	
21-26 October 2024	Abel's formula, Common zeros of solutions and their linear dependence	Presentation
4-9 November 2024	Second order boundary value problems (BVP): Linear problems periodic boundary conditions, regular linear BVP, singular linear BVP,	
11-16 November, 2024	Non-linear BVP, Sturm-Liouville BVP; Definition, Characteristic	Class Test-2

	values Characteristic functions. Orthogonality of characteristic functions	
18-22 November, 2024	Green's functions: Definition and Properties. Applications of boundary value problems, Picard's Theorem	

Class: M.SC. (F)(Math)

Paper: Integral Equations

Course Learning Outcomes (CLOs): After completing this course, the learner will be able to:

CLO: 1 Understand the concept of integral equations to identify different constituents to classify them and to apply the eigen system method for solving the Fredholm type with separable kernel.

CLO: 2 Learn procedures for iterative methods to solve integral equations of both Fredholm and Volterra types without restricting the kernel to be separable.

CLO: 3 Design methods for solving the integral equations with symmetric kernel as linear/bilinear expansions over an orthonormal system of functions and to prove various theorems to analyse these methods.

CLO: 4 Learn the use of numerical method for finding an eigen value and the analytical methods to solve the singular integral equations from Cauchy type to Hilbert type.

Week	Topics	Remarks (Pedagogical Approaches)
22-30 July 2024	Definition of Integral equations and their classifications, Eigen values and eigen functions, Special kinds of kernel	
1-8 August 2024	Convolution Integral, The inner or scalar product of two functions, Reduction to a system of algebraic equations	
9-17 August 2024	Fredholm alternative, Fredholm theorem, Fredholm alternative theorem, an approximate method	Assignment
19-24 August 2024	Method of successive approximations, iterative scheme for Fredholm and Volterra integral equations of the second kind	Class Test
26-31 August 2024	Conditions of uniform convergence and uniqueness of series solution, some results about the resolvent kernel	Students Presentations

2-7 September 2024	Applications of iterative scheme to volterra integral equations of the second kind	
16-21 September 2024	Classical Fredholm's theory, the method of solution of Fredholm equation, Fredholm's First, second and third theorem	
24-30 September 2024	Symmetric Kernels, Complex Hilbert space, An orthonormal system of functions, Riesz-Fisher theorem, a complete 2D orthonormal set over the rectangle	Seminar/Presentation
1-6 October 2024	Fundamental properties of eigen values and eigen functions for symmetric kernels, expansions in eigen functions and bilinear form	
7-12 October 2024	Hilbert-Schmidt theorem and some immediate consequences, Definite Kernels and Mercer's theorem, Solution of a symmetric integral equation	Assignment
14-19 October 2024	Approximation of a general kernel by a separable kernel, The operator method	
21-26 October 2024	Rayleigh-Ritz method for finding the first eigen value, An Abelian Integral equation	
4-9 November 2024	Inversion formula for singular integral equation, Cauchy's principal value for integral solution of the Cauchy type singular integral equations	Class Test
11-16 November, 2024	Closed contour, unclosed contours and the Riemann-Hilbert problem	

18-22 November, 2024	The Hilbert –Kernel, solution of the Hilbert type singular integral equations	
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Class: M.SC. (F) (Math)

Paper: Analytic Mechanics and Calculus of Variations

Course Learning Outcomes (CLOs): After completing this course, the learner will be able to:

CLO: 1 Understands moments and products of inertia, kinetic energy of rigid rotating body, laws of conservation of momentum, angular momentum and energy.

CLO: 2 Learn about three dimensional rigid body dynamics and generalized coordinates.

CLO: 3 Understand Lagranges equation for potential forces, Variational Principles, Hamiltonian Canonical transformations.

CLO: 4 Understand concepts of Calculus of variation and to solve variational problems of different forms of functionals.

Week	Topics	Remarks (Pedagogical Approaches)
22-30 July 2024	Moments and products of inertia, The theorems of parallel and perpendicular axes, Angular momentum of a rigid body about a fixed point and about fixed axes, Principal axes. Kinetic energy of a rigid body rotating about a fixed point, Momental ellipsoid-equipomental system, Coplanar distributions, General motion of a rigid body.	
1-8 August 2024	Kinetic energy of a rigid body rotating about a fixed point, Momental ellipsoid-equipomental system, Coplanar distributions, General motion of a rigid body.	
9-17 August 2024	Problems illustrating the laws of motion, Problems illustrating the law of conservation of angular momentum, Problems illustrating the law of conservation of energy, Problems illustrating impulsive motion.	Assignment

19-24 August 2024	Euler's dynamical equations for the motion of a rigid body about a fixed point, Further properties of rigid motion under no forces, Some problems on general three-dimensional rigid body motion, The rotating earth.	Class Test
26-31 August 2024	Note on dynamical systems, Preliminary notions, Generalized coordinates and velocities, Virtual work and generalized forces, Derivation of Lagrange's equations for a holonomic system, Case of conservative forces, Generalized components of momentum and impulse.	Students Presentations
2-7 September 2024	Lagrange's equations for impulsive forces, Kinetic energy as a quadratic function of velocities.	
16-21 September 2024	Equilibrium configurations for conservative holonomic dynamical systems, Theory of small oscillations of conservative holonomic dynamical systems.	
24-30 September 2024	Lagrange's equations for potential forces, Variational principles in Mechanics: Hamilton's principle, The principle of least action.	Seminar/Presentation
1-6 October 2024	Hamiltonian and canonical equations of Hamilton. Basic integral invariant of Mechanics.	
7-12 October 2024	Canonical transformations, Hamilton Jacobi equation.	Assignment
14-19 October 2024	Functional and its variation, Euler's (Euler-Lagrange) equations, Variational problems for functionals	

	depending on one independent and one dependent variable(s) and its (i) first derivative (ii) higher derivatives with fixed end conditions	
21-26 October 2024	Variational problems for functionals depending on n functions of a single independent variable and functional depending on a function and its n derivatives	
4-9 November 2024	Functionals dependent on functions of several independent variables. Variational problems in parametric form.	Class Test
11-16 November, 2024	Natural boundary conditions and transition conditions, Invariance of Euler's equation. Conditional extremum.	
18-22 November, 2024	Variational problem with moving boundaries. Some basic problems in calculus of variations: shortest distance, minimum surface of revolution, Brachistochrone problem, isoperimetric problem and geodesic problems.	