INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: I
Name of the Course: Real Analysis Course Code: M24-MAT-l0l
Dates: 1 Sept., 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours
End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Definition and existence of the Riemann-Stieltjes integral. properties of the integral.Integration and differentiation, the fundamental theorem of calculus.Integration of vector-valued functions, rectifiable curves.	15
Unit: II	Pointwise and uniform convergence of sequences of functions, Cauchy criterion for uniform convergence. Dini's theorem.Uniform convergencs and continuity, uniform convergence and Riemann integration, uniform convergence and differentiation. Convergence and uniform convergence of series of functions.Weierstrass M test, integration and differentiation of series of functions, existence of a continuous nowhere-differentiable function, the Weierstrass approximation theorem.	15
Unit: III	Linear transformations, the space of linear transformations on Rn to Rm as a metric space.Open sets, continuity, derivative in an open subset of Rn, chain rule, partial derivatives, continuously differentiable mappings.The contraction principle, the inverse function theorem, the implicit function theorem.	15
Unit: IV	Formulation of convergence problems, the necessary and sufficient condition f,or the Fouriesr series for f at x to converge to f(x), The (C, I) summability of Fourier series.Fejer theorem The L2 theory of Fourier series, Bessel's inequality, Riesz Fischer theorem.Parseval's equality, convergence of Fourier series, Riemann-Lebesgue theorem.Orthonormal expansions in $L^2[a,b]$, Bessel's inequality for generalized Fourier series.	15

Text Books:

1. H.L. Royden, P.M. Fitzpatrick Real Analysis (4th Edition) Prentice Hall/Pearson Publication

2. J.N. Sharma,A.R. Vasishtha Real Analysis Krishna Prakashan Media (p)Ltd.

Course Outcomes:

After completing this course, the learner will be able to:

1. Understanding the Riemann-Stieltjes integral, its properties, and the integration of vector-valued functions with application to rectifiable curves.
2. Understanding and handling convergence of sequences and series of functions. This includes constructing continuous nowhere-differentiable functions and demonstrating knowledge of the Weierstrass approximation theorem.
3. Understanding the concepts of differentiability and continuity of functions of several variables, and applying the knowledge to prove inverse and implicit function theorems.
4. Formulating convergence problems related to Fourier series, understanding the summability of Fourier series, and applying concepts like the Fejer theorem, Bessel’s inequality, and others.

Lesson Plan

SR. No	Date	Course Content
1	1 Sept. – 5 Sept.	Basics, Definition and existence of the Riemann-Stieltjes integral. properties of the integral.
2	7 Sept. – 12 Sept.	Integration and differentiation, the fundamental theorem of calculus, Integration of vector-valued functions, rectifiable curves.
3	14 Sept. – 19 Sept.	Pointwise and uniform convergence of sequences of functions, Cauchy criterion for uniform convergence. Dini's theorem .
4	21 Sept. – 26 Sept.	Uniform convergencs and continuity, uniform convergence and Riemann integration, uniform convergence and differentiation. Convergence and uniform convergence of series of functions.
5	28 Sept. – 3 Oct.	Weierstrass M test, integration and differentiation of series of functions, existence of a continuous nowhere-differentiable function, the Weierstrass approximation theorem.
6	5 Oct. – 10 Oct.	Linear transformations, the space of linear transformations on Rn to Rm as a metric space.
7	12 Oct. – 17 Oct.	Open sets, continuity, derivative in an open subset of Rn, chain rule
8	19 Oct. – 24 Oct.	Partial derivatives, continuously differentiable mappings , The contraction principle, The inverse function theorem, the implicit function theorem.
9	26 Oct. – 31 Oct.	Formulation of convergence problems, the necessary and sufficient condition f,or the Fouriesr series for f at x to converge to f(x),
10	10 Nov. – 14 Nov.	The (C, I) summability of Fourier series. Fejer theorem The L2 theory of Fourier series,
11	16 Nov. – 21 Nov.	Bessel's inequality, Riesz Fischer theorem, Parseval's equality, Convergence of Fourier series, Riemann-Lebesgue theorem.
12	23 Nov. – 28 Nov.	Orthonormal expansions in $L^2[a,b]$, Bessel's inequality for generalized Fourier series.
13	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA ,KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: I

Name of the Course: Complex Analysis Course Code: M24-MAT-l02

Dates: 1 Sept., 2026 – 5 Dec, 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Analytic functions; Harmonic functions; Reflection principle. Elementary functions: Exponential, Logarithmic, Trigonometric, Hyperbolic, Inverse trigonometric. Inverse hyperbolic, Complex exponents; Complex Integration: Definite integral; Contours; Branch cuts	15
Unit: II	Cauchy-Goursat theorem; Simply/ multiply connected domains; Cauchy integral formula; Morera's theorem. Liouville's theorem; Fundamental theorem of algebra; Maximum modulus principle. Power series: Taylor series; Laurent series; Uniform/ absolute convergence.	15
Unit: III	Differentiation. integration, multiplication, division of power series. Singularities; Poles; Residues; Cauchy's residue theorem; Zeros of an analytic function. Evaluation of improper integrals; Jordan's lemma.	15
Unit: IV	Indented paths; Integration along a branch cut; Definite integrals involving sines and cosines; Winding number of closed curve. Argument principle; Rouche's theorem; Schwarz Lemma .Transformations: linear, bilinear (Mobius), sine, Z^2, $Z^{1/2}$;mapping: Isogonal. Conformal; Scale factors; Local inverses; harmonic conugates.	15

Text Books:

1. Churchill, R.V. and Brown, J.W., Complex Variables and Applications, Mc Graw-Hill Publication .

2. S.Ponnusamy,Foundations of Complex Analysis ,Narosa Publishing House.

Course Outcomes

After completing this course, the learner will be able to:

1. Understand the fundamental concepts of limit, continuity, differentiation, and integration for functions defined over the complex plane, as well as for elementary functions.
2. Solve complex integrals of various types using the application of relevant theorems, formulas, and power series expansions.
3. Analyze complex functions that have singularities, including zeroes and residues at poles, and apply these analyses to solve improper integrals.
4. The student will be able to solve complex improper integrals using indentation, transformation, or mapping of integration paths to avoid singularities and branch points/cuts.

Lesson Plan

SR. No	Date	Course Content
1	1 Sept. – 5 Sept.	Basic, Analyic functions; Harmonic functions; Refl ection principle.
2	7 Sept. – 12 Sept.	Elementary functions: Exponential, Logarithmic,Trigonometric, Hyperbolic, Inverse trigonometric.
3	14 Sept. – 19 Sept.	Inverse hyperbolic, Complex exponents; Complex Integration: Definite integral; Contours; Branch cuts
4	21 Sept. – 26 Sept.	Cauchy-Goursat theorem; Simply/ multiply connected domains; Cauchy integral formula; Morera's theorem
5	28 Sept. – 3 Oct.	Liouville's theorem; Fundamental theorem of algebra; Maximum modulus principle.
6	5 Oct. – 10 Oct.	Power series: Taylor series; Laurent series; Uniform/ absolute convergence.
7	12 Oct. – 17 Oct.	Differentiation, integration, multiplication, division of power series.
8	19 Oct. – 24 Oct.	Singularities; Poles; Residues; Cauchy's residue theorem; Zeros of an analyic function.
9	26 Oct. – 31 Oct.	Evaluation of improper integrals; Jordan's lemma, Indented paths; Integration along a branch cut
10	10 Nov. – 14 Nov.	Definite integrals involving sines and cosines; Winding number of closed curve.
11	16 Nov. – 21 Nov.	Argument principle; Rouche's theorem; Schwarz Lemma .
12	23 Nov. – 28 Nov.	Transformations: linear, bilinear (Mobius), sine, Z^2, $Z^{1/2}$;mapping: Isogonal, Conformal; Scale factors; Local inverses; harmonic conugates.
13	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher

Head of Department

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: I

Name of the Course: Theory of Ordinary Differential Equations Course Code: M24-MAT-l03

Dates: 1 Sept., 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Existence and Uniqueness of Solutions: Existence of solutions; Initial value problem, e-approximate solution. Equi continuous set of functions. Ascoli Iemma, Cauchy-Peano existence theorem and its corollary. Uniqueness of solutions; Lipschitz condition. Gronwall's Inequality, Inequality involving approximate solutions, Method of successive approximations, Picard-Lindeldf theorem. Continuation of solutions.Maximal interval of existence, Extension theorem.	15
Unit: II	Linear Differential Equation of order n, Basic theory of homogeneous linear equation. Wronskian theory: Definition, necessary and sufficient condition for linear dependence and linear independence of solutions of homogeneous LDE, abel's Identity. Fundamental sets, More Wronskian theory.Reduction of order. Non-homogeneous linear differential equation of order n: Variation of parameters. Adjoint equations. Lagrange's Identity, Green's formula, Self adjoint equation of second order. Linear differential equation of order n with constant coefficients. Characteristic roots, Fundamental set	15
Unit: III	Linear second order equations: Preliminaries, Superposition principle, Riccati's equation, Pruffer transformation. Oscillations of second order differential equations: Zero of a solution, oscillatory and non-oscillatory equations, Abel's formula, Common zeros of solutions and their linear dependence. Sturm separation theorem, Sturm fundamental comparison theorem and its corollaries. Elementary linear oscillations. Comparison theorem of Hille-Wintner oscillations of $x'' + a(t)x = 0$.	15
Unit: IV	Second order boundary value problems (BVP): Linear problems; periodic boundary conditions,regular linear BVP.Singular linear BVP; Non linear BVP, Sturm-Liouville BVP; Definition, Characteristic values and characteristic functions. Orthogonality of characteristic functions.Green's functions: Definition and Properties. Applications of boundary value problems, Picard's theorems.	15

Text Books:

D.Somasundaram, Ordinary differential equations **,**Narosa Publishing House.

Course Outcomes

After completing this course, the learner will be able to:

1. Understand the concepts of initial value problems, including their exact and approximate solutions, existence and uniqueness, and the continuation of solutions for first-order differential equations. Students will also apply relevant theorems and solve related exercises.
2. Have deep understanding of the theory of linear differential equations of higher order. This includes knowledge of basic theory, Wronskian theory, fundamental sets, adjoint equations, and standard theorems. Students will apply techniques like reduction of order and variation of parameters to solve both linear and non-linear differential equations, especially those with constant coefficients.
3. Understand preliminary concepts, oscillation theory, and Sturm's theory related to second-order ordinary differential equations and comparison theorems. They will apply this knowledge to problems involving oscillatory behavior, common zeros, and the use of Prüffer transformations.
4. Have strong understanding of boundary value problems for second-order differential equations, their classification, and solutions. They will also appreciate and apply the concept of Green's function, gaining skills to solve boundary value problems commonly used in applied mathematics, science, and engineering.

Lesson Plan

SR. No	Date	Course Content
1	1 Sept. – 5 Sept.	Basic, Existence and Uniqueness of Solutions: Existence of solutions; Initial value problem, e-approximate solution. Equicontinuous set of functions.
2	7 Sept. – 12 Sept.	Ascoli Iemma, Cauchy-Peano existence theorem and its corollary. Uniqueness of solutions; Lipschitz condition.
3	14 Sept. – 19 Sept.	Gronwall's Inequality, Inequality involving approximate solutions, Method of successive approximations, Picard-Lindeldf theorem. Continuation of solutions.
4	21 Sept. – 26 Sept.	Maximal interval of existence, Extension theorem. Linear Differential Equation of order n, Basic theory of homogeneous linear equation.
5	28 Sept. – 3 Oct.	Wronskian theory: Definition, necessary and sufficient condition for linear dependence and linear independence of solutions of homogeneous LDE, abel's Identity. Fundamental sets, More Wronskian theory.
6	5 Oct. – 10 Oct.	Reduction of order. Non-homogeneous linear differential equation of order n: Variation of parameters. Adjoint equations, Lagrange's Identity, Green's formula, Self adjoint equation of second order.
7	12 Oct. – 17 Oct.	Linear differential equation of order n with constant coefficients. Characteristic roots, Fundamental set, Linear second order equations: Preliminaries, Superposition principle, Riccati's equation, Pruffer transformation.
8	19 Oct. – 24 Oct.	Oscillations of second order differential equations: Zero of a solution, oscillatory and non-oscillatory equations, Abel's formula, Common zeros of solutions and their linear dependence.
9	26 Oct. – 31 Oct.	Sturm separation theorem, Sturm fundamental comparison theorem and its corollaries. Elementary linear oscillations. Comparison theorem of Hille-Wintner oscillations of $x'' + a(t)\,x = 0$.
10	10 Nov. – 14 Nov.	Second order boundary value problems (BVP): Linear problems; periodic boundary conditions, regular linear BVP.
11	16 Nov. – 21 Nov.	Singular linear BVP; Non linear BVP, Sturm- Liouville BVP; Definition, Characteristic values and characteristic functions. Orthogonality of characteristic functions.
12	23 Nov. – 28 Nov.	Green's functions: Definition and Properties. Applications of boundary value problems, Picard's theorems.
13	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: I

Name of the Course: Mechanics of Solids Course Code: M24-MAT-104

Dates: 1 Sept., 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Tensor Algebra: Coordinate-transformation, Cartesian Tensors of different orders. Properties of tensors. Isotropic tensors of different orders and relation between them. Symmetric and skew symmetric tensors. Tensor invariants. Deviatoric tensors. Eigen-values and eigen vector of a tensor. Tensor Analysis: Scalar, vector, tensor functions, Comma notation, Gradient, divergence and curl of a vector / tensor field.	15
Unit: II	Analysis of Strain: Affine transformation, Infinitesimal affine deformation. Strain tensor, Geometrical Interpretation of strain components. Strain quadric of Cauchy. Principal strains invariants, General infinitesimal deformation. Examples of strain, equations of compatibility.Analysis of Stress: Stress Vector, Stress tensor, Equations of equilibrium, Transformation of coordinates. Stress quadric of cauchy, Principal stresses. Maximum normal and shear stresses.Mohr's circles. Examples of stress.	15
Unit: III	Generalised Hooke's Law, Anisotropic symmetries, Homogeneous Isotropic media. Elasticity moduli for isotropic media. Equilibrium and dynamic equations for an isotropic elastic solid. Strain energy function and its connection with Hookes law. BeItrami-Michell compatibility equations. Uniqueness of solution. Clapeyron's theorem. Saint-Venant's principle.	15
Unit: IV	Variational problems and Euler's equations, Theorem of minimum potential energy. Theorem of minimum complementary energy. Reciprocal theorem of Betti and Rayleigh. Ritz method: one and two dimensional cases.Galerkin method. Method of Kantorovich. Wave propagation in infinite regions. Surface waves.	15

Text Books:

l.S. Sokolnikoff, Mathematical Theory of Elasticity, Mc Graw-Hill Book Company

Course Outcomes

After completing this course, the learner will be able to:

1. Understand the concept of tensors as a generalized form of directional entities, and learn their properties through algebraic and calculus operations.
2. Understand affine transformation and infinitesimal deformation analysis of strain and stress tensors. They will build a strong foundation to learn the theory of elasticity and apply it to solve scientific problems.
3. Relate strain and stress tensors through anisotropic elastic moduli, apply reflection/rotational symmetries to define elastic isotropy, and use relevant theorems/principles to explore their roles in strain energy, compatibility conditions, and uniqueness of solutions.
4. Learn variational methods to solve boundary value problems in elasticity. They will understand and prove standard theorems in variational theory, apply these methods to minimize potential/strain/complementary energies, and use them to solve scientific problems in the mechanics of solids. The student will also gain exposure to research in elasticity and understand wave propagation in infinite elastic media.

Lesson Plan

SR. No	Date	Course Content
1	1 Sept.– 5 Sept.	Basic, Tensor Algebra: Coordinate-transformation, Cartesian Tensors of different orders. properties of tensors.
2	7 Sept. – 12 Sept.	Isotropic tensors of different orders and relation between them. Symmetric and skew symmetric tensors, Tensor invariants. Deviatoric tensors. Eigen-values and eigen vector of a tensor.
3	14 Sept. – 19 Sept.	Tensor Analysis: Scalar, vector, tensor functions, Comma notation, Gradient, divergence and curl of a vector / tensor field.
4	21 Sept. – 26 Sept.	Analysis of Strain: Affine transformation, Infinitesimal affin deformation. Strain tensor, Geometrical Interpretation of strain components.
5	28 Sept. – 3 Oct.	Strain quadric of Cauchy. Principal strains invariants, General infinitesimal deformation. Examples of strain, equations of compatibility.
6	5 Oct. – 10 Oct.	Analysis of Stress: Stress Vector, Stress tensor, Equations of equilibrium, Transformation of coordinates. Stress quadric of cauchy, Principal stresses. Maximum normal and shear stresses.
7	12 Oct. – 17 Oct.	Mohr's circles. Examples of stress. Generalised Hooke's Law, Anisotropic symmetries, Homogeneous Isotropic media.
8	19 Oct. – 24 Oct.	Elasticity moduli for isotropic media. Equilibrium and dynamic equations for an isotropic elastic solid.
9	26 Oct. – 31 Oct.	Strain energy function and its connection with Hookes law, BeItrami-Michell compatibility equations.
10	10 Nov. – 14 Nov.	Uniqueness of solution. Clapeyron's theorem, Saint-Venant's principle, Variational problems and Euler's equations
11	16 Nov. – 21 Nov.	Theorem of minimum potential energy, Theorem of minimum complementary energy. Reciprocal theorem of Betti and Rayleigh. Ritz method: one and two dimensional cases.
12	23 Nov. – 28 Nov.	Galerkin method. Method of Kantorovich. Wave propagation in infinite regions. Surface waves.
13	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: I

Name of the Course: Abstract Algebra Course Code: M24-MAT-105

Dates: 1 Sept., 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Normal subgroup, quotient gtoup, normalizer and centralizer of a nonempty subset of a group G, commutator subgroups of a group.First, second and third isomorphism theorems, correspondence theorem, Aut(G), Inn(G), automorphism group of a cyclic group, G-sets. Orbit of an element in group G, Cayley's theorem. Conjugate elements and conjugacy classes, class equation of a finite group G and its applications.Bumside theorem. normal series, composition series, Jordan Holder theorem, Zassenhaus lemma, Scheier's refinement theorem, solvable group, nilpotent group.	15
Unit: II	Cyclic decomposition, even and odd permutation, Alternation group An. Simplicity of the Alternating group An, (n:5). Cauchy's theorem, Sylow's first, second and third theorems and its applications to group of smaller orders .Groups of order p2 and pq (q>p).	15
Unit: III	Modules, submodules, direct sums. Finitely generated modules, cyclic module. R-homomorphism, quotient module, completely reducible modules. Schur's lemma, free modules, representation of linear mapping. rank of linear mapping.	15
Unit: IV	Similar linear transformation, invariant subspaces of vector spaces, reduction of a linear transformation to triangular form. Nilpotent transformation, index of nilpotency of a nilpotent transformation. Cyclic subspace with respect to a nilpotent transformations. Uniqueness of the invariants of a nilpotent transformation. Primary decomposition theorem. Jordan blocks, Jordan canonical forms, cyclic module relative to a linear transformation. Rational canonical form of a linear transformation and its elementary divisors, uniqueness of elementary divisors.	15

Text Books:

P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, Basic Abstract Atgebra, Cambridge University Press.

Course Outcomes

After completing this course, the learner will be able to:

1. Understand the concepts of normal subgroup, quotient group, isomorphism, automorphism, conjugacy, G-sets, normal series, composition series, solvable group, nilpotent group, and the refinement theorem.
2. Learn about cyclic decomposition , alternating group An, the simplicity of An for $n \geq 5$, and Sylow's theorem along with its applications.
3. Understand the concepts of modules, submodules, direct sum, R-homomorphism, quotient modules, completely reducible modules, free modules, and the representation of linear mappings along with their ranks.
4. Learn about similar linear transformations, triangular form, nilpotent transformations, primary decomposition theorem, Jordan form, rational canonical form, and elementary divisors.

Lesson Plan

SR. No	Date	Course Content
1	1 Sept.– 5 Sept.	Basic, Normal subgroup, quotient gtoup, normalizer and centralizer of a nonempty subset of a group G, commutator subgroups of a group.
2	7 Sept. – 12 Sept.	First, second and third isomorphism theorems, correspondence theorem, Aut(G), Inn(G), automorphism group of a cyclic group, G-sets.
3	14 Sept. – 19 Sept.	Orbit of an element in group G, Cayley's theorem. conjugate elements and conjugacy classes, class equation of a finite group G and its applications.
4	21 Sept. – 26 Sept.	Bumside theorem. normal series, composition series, Jordan Holder theorem, Zassenhaus lemma, Scheier's refinement theorem, solvable group, nilpotent group.
5	28 Sept. – 3 Oct.	Cyclic decomposition, even and odd permutation, Alternation group An, Simplicity of the Alternating group An, (n:5). Cauchy's theorem, Sylow's first, second and third theorems and its applications to group of smaller orders.
6	5 Oct. – 10 Oct.	Groups of order p2 and pq (q>p). Modules, submodules, direct sums, Finitely generated modules, cyclic module. R-homomorphism, quotient module, completely reducible modules.
7	12 Oct. – 17 Oct.	Schur's lemma, free modules, representation of linear mapping. rank of linear mapping.
8	19 Oct. – 24 Oct.	Similar linear transformation, invariant subspaces of vector spaces, reduction of a linear transformation to triangular form.
9	26 Oct. – 31 Oct.	Nilpotent transformation, index of nilpotency of a nilpotent transformation. Cyclic subspace with respect to a nilpotent transformation.
10	10 Nov. – 14 Nov.	Uniqueness of the invariants of a nilpotent transformation. Primary decomposition theorem. Jordan blocks.
11	16 Nov. – 21 Nov.	Jordan canonical forms, cyclic module relative to a linear transformation.
12	23 Nov. – 28 Nov.	Rational canonical form of a linear transformation and its elementary divisors, uniqueness of elementary divisors.
13	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA ,KAITHAL

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Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: I

Name of the Course: Practical-1 Course Code: M24-MAT-106

Dates: 1 Sept., 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 4 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Practical course will consist of two components Part A and Part B. The examiner will set 5 questions at the time of practical examination asking 2 questions from the Part-A and 3 questions from the Part-B by taking course learning outcomes (CLO) into consideration. The examiner will be required to solve one problem from the Part-A and to write and execute 2 programs from the Part-B.

Part	**Topics**	**Contact Hours**
Part A	Problems based on the theory courses M24-MAT-101 to M24-MAT-105 will be solved in this part and their record will be maintained in the Practical Note Book direct results and theorems will not be asked rather exercises or numerical problems or applied problems based on the theory parts will be done, as identified or given by the teacher concerned.	30
Part B	The following practicals will be done using the programming language C and record of those will be maintained in the practical Note Book: l. Use of nested if.. .else in finding the smallest of four or more numbers. 2. To find ifa given 4-digit year is a leap year or not. 3. To compute AM. GM and HM of three given real values. 4. To invert the order ofdigits in a given positive integral value. 5. Use series sum to compute sin(x) and cos(x) for given angle x in degrees. Then, check error in verifying sin2x+cos2(x) = I or other such T-identities. 6. Verify summation of n^3={summation of n}^2 , (where n=I, 2,..., m) & check that prefix and postfix increment operator gives the same result. 7. Compute simple interest and compound interest for a given amount, time period, rate of interest and period of compounding. 8. Program to multiply two given matrices in a user defined function. 9. Calculate standard deviation for a set of values {x(j),j=1,2,..., n} having the corresponding frequencies {f(j), j = 1,2,...,n}. 10. Write the user-defined function to compute GCD of two given values and use it to compute the LCM of three given integer values. 11. Compute GCD of 2 positive integer values using recursion / pointer to pointer. 12. Check a given square matrix for its positive definite/ negative definite forms. 13. To find the inverse ofa given non-singular square matrix' 14. To convert a decimal number to its binary representation and vice-versa' 15. To solve an algebraic or transcendental equation by Newton- Raphson and Regula-Falsi methods. 16. To solve initial value problems by Runge-Kutta methods. 17. To solve a system of linear equations by Gauss-Seidel method' 18. To solve a definite integral using Simpson rules. 19. Use array of pointers for alphabetic sorting of given list of English words. 20. To search a number in an array by binary search method.	90

Text Books:

Rudra Pratap, Getting Started With MATLAB, Oxford University Press.

Course Outcomes

After completing this course, the learner will be able to:

1. Solve practical problems related to theory courses undertaken in Semester-I from the application point of view.
2. Understand the syntax of expressions, statements, and structures, and write source code for a program in C.
3. Edit, compile, and execute source programs to achieve the desired results.
4. Debug, verify/check, and obtain the output of results.

Lesson Plan

SR. No	Date	Course Content
1	1 Sept.– 5 Sept.	Introduction of C, constants,variables, conditional statements,loops,switch statement.
2	7 Sept. – 12 Sept.	Use of nested If ....else in finding the smallest of four numbers. To find If a given 4-digit year is a leap year or not.
3	14 Sept. – 19 Sept.	To compute AM. GM and HM of three given real values. To invert the order of digits in a given positive integral value.
4	21 Sept. – 26 Sept.	Use series sum to compute sin(x) and cos(x) for given angle x in degrees. Then, check error in verifying sin2 x+cos2 (x)=1.Verify ∑n3 ={∑n } 2 , (where n=1,2,..,m) & check that prefix and postfix increment operator gives the same result.
5	28 Sept. – 3 Oct.	Compute simple interest and compound interest for a given amount, time period, rate of interest and period of compounding. Program to multiply two given matrices in a user defined function.
6	5 Oct. – 10 Oct.	Calculate standard deviation for a set of values {xC) ,j :1,2,..., n} having the corresponding frequencies {(i), j : 1,2,...,n}. Write the user-defined function to compute GCD of two given values and use it to compute the LCM of three given integer values.
7	12 Oct. – 17 Oct.	Compute GCD of 2 positive integer values using recursion / pointer to pointer. Check a given square matrix for its positive definite/ negative definite forms.
8	19 Oct. – 24 Oct.	To find the inverse of a given non- singular square matrix .To convert a decimal number to its binary representation and vice-versa.
9	26 Oct. – 31 Oct.	Calculate the eigen values and eigenvectors of a given symmetric matrix of order.
10	10 Nov. – 14 Nov.	To solve an algebraic or transcendental equation by Newton-Raphson and Regula-Falsi methods. To solve initial value problems by Runge-Kutta methods.
11	16 Nov. – 21 Nov.	To solve a system of linear equations by Gauss-Seidel method' . To solve a definite integral using Simpson rules.
12	23 Nov. – 28 Nov.	Use array of pointers for alphabetic sorting of given list of English words', To search a number in an array by binary search method'.
13	30 Nov. –5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

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Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: III

Name of the Course: Fluid Mechanics Course Code: M24-MAT-301

Dates: 1 August, 2026- 5 Dec.,2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Kinematics of fluid in motion: Real fluids and ideal fluids, Velocity at a point of a fluid. Lagrangian and Eulerian methods. Stream lines, Path lines and Streak lines. Vorticity and Circulation, Vortex lines, Velocity potential, Irrotational and rotational motions. Acceleration at a point of fluid, Local and particle rates of change. Equation of continuity. Raynold‟s Transport Theorem. Rates of change of material integrals. Analysis of local fluid motion.	15
Unit: II	Properties of fluids. Boundary Conditions, Boundary surfaces. Equation of Motion: Lagrange's and Euler's equations of Motion. Bernoulli's equation, Applications of the Bernoulli Equation in one–dimensional flow problems, Steady motion under conservative body forces. Kelvins circulation theorem, Vorticity equation. Energy equation for incompressible flow. Kinetic energy of irrotational flow. Kelvins minimum energy theorem. Mean value of the velocity potential. Kinetic energy of infinite liquid. Uniqueness theorems.	15
Unit: III	Axially symmetric flows. Sphere at rest in a uniform stream, Sphere in motion in fluid at rest at infinity. Equation of motion of a sphere. Kinetic energy generated by impulsive motion. Motion of two concentric spheres. Three-dimensional sources, sinks and doublets. Images of sources, sinks and doublets in rigid impermeable infinite plane and in impermeable spherical surfaces.	15
Unit: IV	Two-dimensional flows: Use of cylindrical polar coordinates, Stream function, Some fundamental stream functions, Axisymmetric flow, Equations satisfied by Stokes‟s stream function in irrotational flow, Basic Stokes‟s stream functions, Boundary conditions satisfied by the stream function. Irrotational plane flows: Complex potential, Image systems in plane flows. Milne-Thomson circle theorem. Circular cylinder in uniform stream with circulation. Blasius theorem.	15

Text Books: F. Chorlton, Text book of Fluid Dynamics, CBS Publishers and Distributors Pvt. Ltd.

Course Outcomes

After completing this course, the learner will be able to:

1. Be familiar with continuum model of fluid flow, classify fluid/flows, Stream, path and streak lines, rotational and irrotational motion. Understand Eulerian and Lagrangian descriptions of fluid motion, law of conservation of mass and boundary surfaces. Attain ability to derive equation of continuity and problem solving.
2. Learn to derive equations of motion, Bernouli equation, vorticity equation corresponding to different problems of fluid dynamics and to solve those equations. Prove theorems on circulation and energy in fluid flow. Make strong foundation for doing research in the area of fluid mechanics and bio-mechanics.
3. Understand motion of sphere in a fluid and fluid flow past a sphere at rest; sources, sinks, doublets and their images. Learn to solve three dimensional flow problems of fluid dynamics.
4. Understand two dimensional flow problems, stream function, axi-symmetric flow, complex potential, source, sink and doublets in two dimensions, Milne-Thomson circle theorem, Blasius theorem. Attain skills to solve fluid flow problems in two dimensions. Get exposure to research problems in fluid dynamics.

Lesson Plan

SR. No	Date	Course Content
1	1 August 2026	Basics
2	3 August – 8 August	Kinematics of fluid in motion: Real fluids and ideal fluids, Velocity at a point of a fluid. Lagrangian and Eulerian methods.
3	10 August – 14 August	Stream lines, Path lines and Streak lines. Vorticity and Circulation.
4	17 August – 22 August	Vortex lines, Velocity potential, Irrotational and rotational motions.
5	24 August – 29 August	Acceleration at a point of fluid, Local and particle rates of change. Equation of continuity. Raynold‟s Transport Theorem.
6	31 August – 5 Sept.	Rates of change of material integrals. Analysis of local fluid motion.
7	7 Sept. – 12 Sept.	Properties of fluids. Boundary Conditions, Boundary surfaces. Equation of Motion: Lagrange's and Euler's equations of Motion.
8	14 Sept. – 19 Sept.	Bernoulli's equation, Applications of the Bernoulli Equation in one–dimensional flow problems.
9	21 Sept. – 26 Sept.	Steady motion under conservative body forces. Kelvins circulation theorem, Vorticity equation.
10	28 Sept. – 3 Oct.	Energy equation for incompressible flow. Kinetic energy of irrotational flow. Kelvins minimum energy theorem. Mean value of the velocity potential.
11	5 Oct. – 10 Oct.	Kinetic energy of infinite liquid. Uniqueness theorems.Axially symmetric flows. Sphere at rest in a uniform stream, Sphere in motion in fluid at rest at infinity.
12	12 Oct. – 17 Oct.	Equation of motion of a sphere. Kinetic energy generated by impulsive motion. Motion of two concentric spheres.
13	19 Oct. – 24 Oct.	Three-dimensional sources, sinks and doublets. Images of sources, sinks and doublets in rigid impermeable infinite plane and in impermeable spherical surfaces.
14	26 Oct. – 31 Oct.	Two-dimensional flows: Use of cylindrical polar coordinates, Stream function, Some fundamental stream functions, Axisymmetric flow, Equations satisfied by Stokes‟s stream function in irrotational flow.
15	10 Nov. – 14 Nov.	Basic Stokes‟s stream functions, Boundary conditions satisfied by the stream function.
16	16 Nov. – 21 Nov.	Irrotational plane flows: Complex potential, Image systems in plane flows.
17	23 Nov. – 28 Nov.	Milne-Thomson circle theorem. Circular cylinder in uniform stream with circulation. Blasius theorem.
18	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: III

Name of the Course: Functional Analysis Course Code: M24-MAT-302

Dates: 1 August, 2026- 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Normed linear spaces, Banach spaces, finite dimensional normed spaces and subspaces, equivalent norms, compactness and finite dimension, F.Riesz‟s lemma. Bounded and continuous linear operators, differentiation operator, integral operator, bounded linear extension, bounded linear functionals, normed spaces of operators, dual spaces with examples.	15
Unit: II	Hahn-Banach theorem for normed linear spaces, application to bounded linear functionals on C[a,b], Riesz-representation theorem for bounded linear functionals on C[a,b], adjoint operator, norm of the adjoint operator. Reflexive spaces, uniform boundedness theorem and some of its applications to the space of polynomials and Fourier series.	15
Unit: III	Strong and weak convergence, open mapping theorem, bounded inverse theorem, closed linear operators, closed graph theorem. Inner product spaces, Hilbert spaces and their examples, Schwarz inequality, continuity of inner product, orthogonal complements and direct sums, minimizing vector, orthogonality, projection theorem, characterization of sets in Hilbert spaces whose span is dense.	15
Unit: IV	Orthonormal sets and sequences, Bessel‟s inequality, series related to orthonormal sequences and sets, total (complete) orthonormal sets and sequences, Parseval‟s identity, separable Hilbert spaces. Riesz representation theorem for bounded linear functionals on a Hilbert space, sesquilinear form, Riesz representation theorem for bounded sesquilinear forms on Hilbert spaces. Hilbert-adjoint operator, its existence and uniqueness, properties of Hilbert-adjoint operators, selfadjoint, unitary and normal operators.	15

Text Books: P.K.Jain ,O.P. Ahuja ,Functional Analysis, Second Edition, New Age International(P) Ltd. & Wiley Eastern Ltd., New Delhi.

Course Outcomes

After completing this course, the learner will be able to:

1: Know about the requirements of a norm; completeness with respect to a norm; understand relation between compactness and dimension of a space; check boundedness of a linear operator and relate to continuity; convergence of operators by using a suitable norm; apply the knowledge to compute the dual spaces.

2. Extend a linear functional under suitable conditions; apply the knowledge to prove Hahn Banach Theorem for further application to obtain the representation of bounded linear functionals on C[a,b]; know about adjoint of operators; understand reflexivity of a space and demonstrate understanding of the statement and proof of uniform boundedness theorem.
3. Know about the notions of strong and weak convergence; understand open mapping theorem, bounded inverse theorem and closed graph theorem; distinguish between Banach spaces and Hilbert spaces; decompose a Hilbert space in terms of orthogonal complements.
4. Understand totality of orthonormal sets and sequences; represent a bounded linear functional in terms of inner product; classify operators into self-adjoint, unitary and normal operators.

Lesson Plan

SR. No	Date	Course Content
1	1 August 2026	Basics
2	3 August – 8 August	Normed linear spaces, Banach spaces, finite dimensional normed spaces and subspaces,
3	10 August – 14 August	Equivalent norms, compactness and finite dimension.
4	17 August – 22 August	F.Riesz‟s lemma. Bounded and continuous linear operators.
5	24 August – 29 August	Differentiation operator, integral operator, bounded linear extension.
6	31 August – 5 Sept.	Bounded linear functionals, normed spaces of operators, dual spaces with examples.
7	7 Sept. – 12 Sept.	Hahn-Banach theorem for normed linear spaces, application to bounded linear functionals on C[a,b], Riesz-representation theorem for bounded linear functionals on C[a,b]
8	14 Sept. – 19 Sept.	Adjoint operator, norm of the adjoint operator. Reflexive spaces, uniform boundedness theorem and some of its applications to the space of polynomials and Fourier series.
9	21 Sept. – 26 Sept.	Strong and weak convergence, open mapping theorem, bounded inverse theorem, closed linear operators, closed graph theorem.
10	28 Sept. – 3 Oct.	Inner product spaces, Hilbert spaces and their examples, Schwarz inequality, continuity of inner product, orthogonal complements and direct sums.
11	5 Oct. – 10 Oct.	Minimizing vector, orthogonality, projection theorem, characterization of sets in Hilbert spaces whose span is dense.
12	12 Oct. – 17 Oct.	Orthonormal sets and sequences, Bessel‟s inequality, series related to orthonormal sequences and sets.
13	19 Oct. – 24 Oct.	Total (complete) orthonormal sets and sequences, Parseval‟s identity, separable Hilbert spaces.
14	26 Oct. – 31 Oct.	Riesz representation theorem for bounded linear functionals on a Hilbert space.
15	10 Nov. – 14 Nov.	Sesquilinear form, Riesz representation theorem for bounded sesquilinear forms on Hilbert spaces.
16	16 Nov. – 21 Nov.	Hilbert-adjoint operator, its existence and uniqueness, properties of Hilbert-adjoint operators.
17	23 Nov. – 28 Nov.	Self adjoint, unitary and normal operators.
18	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics
Semester: III
Name of the Course: Elasticity
Course Code: M24-MAT-306

Dates: 1 August, 2026- 5 Dec., 2026

SYLLABUS

Maximum Marks: 100
Time: 3 hours
End Term Exam Marks: 70 Marks
Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Extension: Extension of beams by longitudinal forces, Beam stretched by its own weight, Bending of beams by terminal couples. Torsion: Torsion of a circular shaft, Torsion of cylindrical bars, Torsional rigidity. Torsion and stress functions. Lines of shearing stress. Torsion of an elliptic cylinder. Simple torsion problems, effect of grooves.	15
Unit: II	Torsion of rectangular beam, Torsion of a triangular prism. Solution of torsion problems by means of conformal mapping. Torsion-membrane analogy, Torsion of hollow beams, Torsion of anisotropic beams. Flexure of beams by terminal loads, Flexure of circular and elliptic beams, Bending of rectangular beams, Bending of circular pipes.	15
Unit: III	Two dimensional problems: Plane deformation, Generalized plane stress, Plane elastostatic problems. Airy stress function. General solution of biharmonic equation, Stresses and displacements in terms of complex potentials. The structure of functions $\varphi(z)$ and $\psi(z)$. First and second boundary value problems in plane elasticity. Existence and uniqueness of the solutions.	15
Unit: IV	Three dimensional problems: General solutions; Concentrated forces; Deformation of elastic half-space by normal loads; The problem of Boussinesq. Elastic sphere: pressures, harmonics, equilibrium. Betti‟s Integration method. Vibrations of elastic solids, Wave propagation in infinite regions, Surface waves.	15

Text Books:

I.S. Sokolnikoff, Mathematical Theory of Elasticity, Tata McGraw Hill Publishing Company Ltd., New Delhi

Course Outcomes

After completing this course, the learner will be able to:

1. Understand concepts of extension and torsion and learn to solve different elastostatics problems of extension and torsion of beams.
2. Learn techniques to make use of complex analysis (analytic functions, conformal mappings) for solving elastostatics problems. Be familiar with flexure of beams of different cross-sections.
3. Understand plane deformation, plain stress and Airy Stress function and attain capability to solve two dimensional problems in elasticity for analytical solutions.
4. Learn techniques for solving some scientifically important elastodynamics problems in three-dimensions and understand vibrations of elastic solids and wave propagation in such solids.

Lesson Plan

SR. No	Date	Course Content
1	1 August 2026	Basics
2	3 August – 8 August	Extension: Extension of beams by longitudinal forces.
3	10 August – 14 August	Beam stretched by its own weight, Bending of beams by terminal couples.
4	17 August – 22 August	Torsion: Torsion of a circular shaft, Torsion of cylindrical bars, Torsional rigidity.
5	24 August – 29 August	Torsion and stress functions. Lines of shearing stress.
6	31 August – 5 Sept.	Torsion of an elliptic cylinder. Simple torsion problems, effect of grooves.
7	7 Sept. – 12 Sept.	Torsion of rectangular beam, Torsion of a triangular prism. Solution of torsion problems by means of conformal mapping.
8	14 Sept. – 19 Sept.	Torsion-membrane analogy, Torsion of hollow beams, Torsion of anisotropic beams.
9	21 Sept. – 26 Sept.	Flexure of beams by terminal loads, Flexure of circular and elliptic beams, Bending of rectangular beams, Bending of circular pipes.
10	28 Sept. – 3 Oct.	Two dimensional problems: Plane deformation, Generalized plane stress, Plane elastostatic problems.
11	5 Oct. – 10 Oct.	Airy stress function. General solution of biharmonic equation, Stresses and displacements in terms of complex potentials.
12	12 Oct. – 17 Oct.	The structure of functions $\varphi(z)$ and $\psi(z)$.
13	19 Oct. – 24 Oct.	First and second boundary value problems in plane elasticity. Existence and uniqueness of the solutions.
14	26 Oct. – 31 Oct.	Three dimensional problems: General solutions; Concentrated forces.
15	10 Nov. – 14 Nov.	Deformation of elastic half-space by normal loads; The problem of Boussinesq.
16	16 Nov. – 21 Nov.	Elastic sphere: pressures, harmonics, equilibrium. Betti‟s Integration method.
17	23 Nov. – 28 Nov.	Vibrations of elastic solids, Wave propagation in infinite regions, Surface waves.
18	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA ,KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: III
Name of the Course: Number Theory Course Code: M24-MAT-310

Dates: 1 August, 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours
End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Greatest integer function, Arithmetic function, multiplicative function, completely multiplicative function, mobius- inversion formula, recurrence function, combinational number theory.	15
Unit: II	Solution of the equation ax+by =c, simultaneous linear equations, Unimodular matrices, Pythagorean triangles, some assorted examples, ternary quadratic forms, rational points on curves.	15
Unit: III	Farey sequences, rational approximations, Hurwitz theorem, irrational numbers, Blichfeldt‟s principle, Minkowski‟s Convex body theorem, Lagrange‟s four square theorem.	15
Unit: IV	Euclidean algorithm, finite and infinite continued fractions, approximations to irrational numbers, Best possible approximations, Hurwitz theorem, Periodic continued fractions, Pell‟s equation.	15

Text Books:

Ivan Niven, Herbert S. Zuckerman , Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Wiley & Sons (Fifth Edition), 1991.

Course Outcomes

After completing this course, the learner will be able to:

1. Understand concept of greatest integer function, arithmetic function, mobius inversion formula, recurrence function, combinatorial number theory.
2. Find solution of Diophantine equations and rational points on curve.
3. Understand concept of Farey fractions, irrational numbers and geometry of numbers.
4. Have deep understanding of simple continued fractions, approximation to irrational number, Pell‟s equation.

Lesson Plan

SR. No	Date	Course Content
1	1 August 2026	Basics
2	3 August – 8 August	Greatest integer function, Arithmetic function.
3	10 August – 14 August	Multiplicative function, completely multiplicative function.
4	17 August – 22 August	Mobius- inversion formula, recurrence function.
5	24 August – 29 August	Combinational number theory.
6	31 August – 5 Sept.	Solution of the equation ax+by =c, simultaneous linear equations.
7	7 Sept. – 12 Sept.	Unimodular matrices.
8	14 Sept. – 19 Sept.	Pythagorean triangles.
9	21 Sept. – 26 Sept.	Farey sequences, rational approximations.
10	28 Sept. – 3 Oct.	Hurwitz theorem, irrational numbers.
11	5 Oct. – 10 Oct.	Blichfeldt‟s principle, Minkowski‟s Convex body theorem.
12	12 Oct. – 17 Oct.	Lagrange‟s four square theorem.
13	19 Oct. – 24 Oct.	Euclidean algorithm, finite and infinite continued fractions.
14	26 Oct. – 31 Oct.	Approximations to irrational numbers.
15	10 Nov. – 14 Nov.	Best possible approximations.
16	16 Nov. – 21 Nov.	Hurwitz theorem.
17	23 Nov. – 28 Nov.	Periodic continued fractions, Pell‟s equation.
18	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: III

Name of the Course: Integral Equations Course Code: M24-MAT-313

Dates: 1 August, 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 3 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	Definition of Integral Equations and their classifications. Eigen values and Eigen functions. Special kinds of Kernel, Convolution Integral. The inner or scalar product of two functions. Reduction to a system of algebraic equations. Fredholm alternative, Fredholm theorem, Fredholm alternative theorem, an approximate method.	15
Unit: II	Method of successive approximations, Iterative scheme for Fredholm and Volterra Integral equations of the second kind. Conditions of uniform convergence and uniqueness of series solution. Some results about the resolvent Kernel. Application of iterative scheme to Volterra integral equations of the second kind. Classical Fredholm‟s theory, the method of solution of Fredholm equation, Fredholm‟s First theorem, Fredholm‟s second theorem, Fredholm‟s third theorem.	15
Unit: III	Symmetric Kernels, Complex Hilbert space. An orthonormal system of functions, Riesz-Fisher theorem, A complete two-Dimensional orthonormal set over the rectangle a <= *s* <= *b,c* <= *t* <= *d*. Fundamental properties of Eigenvalues and Eigenfunctions for symmetric Kernels. Expansion in eigen functions and Bilinear form. Hilbert-Schmidt theorem and some immediate consequences. Definite Kernels and Mercer‟s theorem. Solution of a symmetric Integral Equation. Approximation of a general l2 -Kernel (not necessarily symmetric) by a separable Kernel. The operator method in the theory of integral equations. Rayleigh-Ritz method for finding the first eigenvalue.	15
Unit: IV	The Abel Integral Equation. Inversion formula for singular integral equation with Kernel of the type h(s)-h(t), 0<a<1, Cauchy‟s principal value for integrals solution of the Cauchy-type singular integral equation, closed contour, unclosed contours and the Riemann-Hilbert problem. The Hilbert-Kernel, solution of the Hilbert-Type singular Intergal equation.	15

Text Books:

Ram P. Kanwal, Linear Integral Equations, Theory & Techniques, Springer Science & Business Media, 2012.

Course Outcomes

After completing this course, the learner will be able to:

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.
2. Derive procedures for iterative methods to solve integral equations of both Fredholm and Volterra types without restricting the kernel to be separable and proving specific theorems of Fredholm‟s theory.
3. Design methods for solving the integral equations with symmetric kernels as linear/bilinear expansions over an orthonormal System of functions and to prove various theorems to analyse these methods. Apply the knowledge to solve problems.
4. Learn the use of numerical methods for finding an eigenvalue and the analytical methods to solve the singular integral equations from Cauchy-type to Hilbert-type, which involve Cauchy‟s principal value, closed/open contours and the Riemann-Hilbert problem.

Lesson Plan

SR. No	Date	Course Content
1	1 August 2026	Basics
2	3 August – 8 August	Definition of Integral Equations and their classifications. Eigen values and Eigen functions.
3	10 August – 14 August	Special kinds of Kernel, Convolution Integral
4	17 August – 22 August	The inner or scalar product of two functions, Reduction to a system of algebraic equations.
5	24 August – 29 August	Fredholm alternative, Fredholm theorem.Fredholm alternative theorem, an approximate method.
6	31 August – 5 Sept.	Method of successive approximations, Iterative scheme for Fredholm and Volterra Integral equations of the second kind.
7	7 Sept. – 12 Sept.	Conditions of uniform convergence and uniqueness of series solution.
8	14 Sept. – 19 Sept.	Some results about the resolvent Kernel. Application of iterative scheme to Volterra integral equations of the second kind.
9	21 Sept. – 26 Sept.	Classical Fredholm‟s theory, the method of solution of Fredholm equation, Fredholm‟s First theorem.
10	28 Sept. – 3 Oct.	Fredholm‟s second theorem, Fredholm‟s third theorem. Symmetric Kernels, Complex Hilbert space. An orthonormal system of functions, Riesz-Fisher theorem.
11	5 Oct. – 10 Oct.	A complete two-Dimensional orthonormal set over the rectangle a <= *s* <=*b*,*c* <= *t* <= *d*. Fundamental properties of Eigenvalues and Eigenfunctions for symmetric Kernels.
12	12 Oct. – 17 Oct.	Expansion in eigen functions and Bilinear form. Hilbert-Schmidt theorem and some immediate consequences.
13	19 Oct. – 24 Oct.	Definite Kernels and Mercer‟s theorem. Solution of a symmetric Integral Equation. Approximation of a general l 2 -Kernel (not necessarily symmetric) by a separable Kernel. The operator method in the theory of integral equations.
14	26 Oct. – 31 Oct.	Rayleigh-Ritz method for finding the first eigenvalue.The Abel Integral Equation. Inversion formula for singular integral equation with Kernel of the type h(s)-h(t), 0<a<1.
15	10 Nov. – 14 Nov.	Cauchy‟s principal value for integrals solution of the Cauchy-type singular integral equation.
16	16 Nov. – 21 Nov.	Closed contour, unclosed contours and the Riemann-Hilbert problem.
17	23 Nov. – 28 Nov.	The Hilbert-Kernel, solution of the Hilbert-Type singular Intergal equation.
18	30 Nov. – 5 Dec. 2026	Revision

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Mathematics

Lesson Plan (Session 2026-2027)

Class**:** M.Sc. Mathematics Semester: III

Name of the Course: PRACTICAL-3 Course Code: M24-MAT-315

Dates: 1 August, 2026- 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 Time: 4 hours

End Term Exam Marks: 70 Marks Assessment: 30 Marks

Note: Practical course will consist of two components Part A and Part B. The examiner will set 5 questions at the time of practical examination asking 2 questions from the Part-A and 3 questions from the Part-B by taking course learning outcomes (CLO) into consideration. The examiners will be required to solve one problem from the Part-A and to write and execute 2 programs from the Part-B.

Part	**Topics**	**Contact Hours**
Part A	Problems based on the theory courses MMATH21-301 to MMATH21-302 will be solved in this part and their record will be maintained in the Practical Note Book. Direct results and theorems will not be asked rather exercises or numerical problems or applied problems based on the theory parts will be done, as identified or given by the teacher concerned.	30
Part B	The following practicals will be done on the MATLAB/SCILAB/Octave platform and record of those will be maintained in the practical Note Book: 1. Solutions of simultaneous linear equations: Gauss-elimination method and Gauss-Jordan method. 2. Solutions of simultaneous linear equations using Jacobi method and GaussSeidel method. 3. Solution of algebraic / transcendental equations using Bisection method and Regula-falsi method. 4. Solution of algebraic / transcendental equations using Secant method and Newton-Raphson method. 5. Inversion of matrices using adjoints; Jordan method. 6. Numerical differentiation: using various differentiation formulas for error reduction. 7. Numerical integration using composite methods based on trapezoidal rule. 8. Numerical integration using composite Simpson1/3 rule and 3/8 rule. 9. Solution of ordinary differential equations Euler method and Modified Euler method. 10. Solution of ordinary differential equations using Runge-Kutta methods. 11. Statistical problems on central tendency (mean, mode, median) and dispersion (standard variation, standard error). 12. Least square method to fit polynomial (curve) of given degree to given data set 13. Plotting of special functions.	90

Text Books:

Rudra Pratap ,Getting Started With MATLAB, Oxford University Press.

Course Outcomes

After completing this course, the learner will be able to:

1. Understand the algorithms for solving listed mathematical problems and to solve practical problems related to core courses undertaken in the Semester-III from application point of view.
2. Write source codes using either of MATLAB/SCILAB/Octave programming.
3. Edit, compile/interpret and execute the source program for desired results.
4. Verify/check results using built-in MATLAB/SCILAB/Octave functions.

Lesson Plan

SR. No	Date	Course Content
1	1 August 2026	Basics
2	3 August – 8 August	Solutions of simultaneous linear equations: Gauss-elimination method and Gauss-Jordan method.
3	10 August – 14 August	Solutions of simultaneous linear equations using Jacobi method
4	17 August – 22 August	Solutions of simultaneous linear equations using Gauss Seidel method.
5	24 August – 29 August	Solution of algebraic / transcendental equations using Bisection method
6	31 August – 5 Sept.	Solution of algebraic/ transcendental equations using Regula-falsi method.
7	7 Sept. – 12 Sept.	Solution of algebraic / transcendental equations using Secant method and Newton-Raphson method.
8	14 Sept. – 19 Sept.	Inversion of matrices using adjoints; Jordan method.
9	21 Sept. – 26 Sept.	Numerical differentiation: using various differentiation formulas for error reduction.
10	28 Sept. – 3 Oct.	Numerical integration using composite methods based on trapezoidal rule.
11	5 Oct. – 10 Oct.	Numerical integration using composite Simpson1/3 rule and 3/8 rule.
12	12 Oct. – 17 Oct.	Solution of ordinary differential equations using Euler method
13	19 Oct. – 24 Oct.	Solution of ordinary differential equations using Modified Euler method.
14	26 Oct. – 31 Oct.	Solution of ordinary differential equations using Runge-Kutta methods.
15	10 Nov. – 14 Nov.	Statistical problems on central tendency (mean, mode, median)
16	16 Nov. – 21 Nov.	Statistical problems on dispersion (standard variation, standard error).
17	23 Nov. – 28 Nov.	Least square method to fit polynomial (curve) of given degree to given data set.
18	30 Nov. –5 Dec. 2026	Plotting of special functions.

Signature of Teacher **Head of Department**