

**MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR**  
**SEMESTER I M. Sc. MATHEMATICS 2016-17**

**M1 MAT 01-CT01**

**ALGEBRA-I**

L-T-P	4-1-0
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TIME: 3 hours

External Assessment 80  
Internal Assessment 20

**UNIT I**

External and Internal direct product of two and finite number of subgroups; Commutator subgroup; Cauchy's theorem for finite abelian and non abelian groups.

**UNIT II**

Sylow's three theorem and their easy applications, Subnormal and Composition series, Zassenhaus lemma and Jordan Holder theorem.

**UNIT III**

Solvable groups and their properties, Nilpotent groups, Fundamental theorem for finite abelian groups.

**UNIT IV**

Annihilators of subspace and its dimension in finite dimensional vector space, Invariant, Projection, adjoints.

**UNIT V**

Singular and nonsingular linear transformation, quadratic forms and Diagonalization.

**Books recommended:**

1. Surjeet Singh and Quazi Zameeruddin : Modern Algebra.
2. Herstein, I.N. : Topics in algebra.
3. Agrawal, R.S. : Algebra.
4. Jacobson, N. : Basic Algebra Vol. I, II.
5. Lang, S. : Algebra IIIrd Edition.
6. Bhattacharya, P.B., Jain, S.K. and Etc. : Basic Abstract Algebra (IIInd Edition).

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**SEMESTER I M. Sc. MATHEMATICS 2016-17**

**M1 MAT 02-CT02**

**REAL ANALYSIS**

L-T-P	4-1-0
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TIME: 3 hours

External Assessment 80

Internal Assessment 20

**UNIT I**

Measure Theory: Length of an interval, outer measure of a subset of  $\mathbb{R}$ , Lebesgue outer measure of a subset of  $\mathbb{R}$ , Existence, non-negativity and monotonicity of Lebesgue outer measure, Translation Invariance of outer measure, Countable sub-additivity of Lebesgue outer measure, the relation between outer measure and length of an interval.

**UNIT II**

Lebesgue outer Measure:  $\sigma$ - algebra, Definition of measures with equations, signed measure, measurable space, measurable sets (Lebesgue), Complement, Lebesgue measure, union intersection and difference of measurable sets, Denumerable union and intersection of measurable sets, countable additivity of measure, counting measure Haar measure, Borel measure, Measures of infinite union of measure sets (intersection), convergence in measure,  $F_\sigma$  and  $G_\sigma$  sets, the measure of the intersection of a decreasing sequence of measure sets.

**UNIT III**

Measurable functions; Different equivalent definition of a measurable function; almost every where Scalar multiple constant function, modules  $f/g$ , inverse image of a mean function, sum, difference and product of measurable functions of measurable function. Measurability of a continuous function and measurability of a continuous image of measurable function. Supremum, infimum, limit superior, limit inferior and limit of a sequence of measurable functions. Convergence pointwise and convergence in measures of a sequence of measurable functions.

**UNIT IV**

Convergence of sequence of Measurable function: Convergence pointwise, uniform Convergence, Convergence almost every where (a.e.), Convergence in measure of a sequence of measurable functions, characteristic function of a set, simple function, step function, pointwise Convergence, theorem of measure functions.

## UNIT V

Lebesgue Integral; Characteristic function of a set; Simple functions, Lebesgue integral of a simple function; Lebesgue integral of a bounded measurable function; Lebesgue integral and Riemann integral of a bounded function defined on a closed interval; Lebesgue integral of a non-negative function; Lebesgue integral of a measurable function; Properties of Lebesgue integral. Convergence Theorems and Lebesgue integral; the bounded convergence theorem; Fatou's Lemma: Monotone convergence theorem; Lebesgue convergence theorem.

### Books Recommended:

1. Pal R. Halmos : Measure Theory, (D.Van Nostrand Company, INC), 6<sup>th</sup> Edition, Univ. of Chikago.
2. Murray R. Spiegel : Theory and Problems of Real Variables (Schaum's Outline series, McGraw-Hill Book)
3. P.K. Jain & V.P. Gupta : Measure and Integration (New age International Publishers)
4. M.E. Munroe : Introduction to Measure and Integration (Deptt. Of Mathematics, Univ. of Illinoi's)
5. G.D. Barra : Measure and Integration (New age International Publishers)

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

SEMESTER I M. Sc. MATHEMATICS 2016-17

M1 MAT 03-CT03

DIFFERENTIAL EQUATIONS & CALCULUS OF VARIATION

L-T-P	4-1-0
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TIME: 3 hours

External Assessment 80  
Internal Assessment 20

## UNIT I

Partial differential equation: Lipschitz condition and question based on it. Existence and Uniqueness theorem and Existence and uniqueness solutions of I.V.P.

$\frac{dy}{dx} = f(x, y)$  ,  $y(x_0) = y_0$  Solution of second order partial differential equations through Mange's method.

## UNIT II

Canonical forms and reduction of second order Semilinear partial differential equations to canonical forms. Classification of second order partial differential equations having more than two independent variables. Cauchy's problem.

## UNIT III

Boundary value problems of second order ordinary differential equations. Orthogonality, Sturm-Liouville B.V.P. Lagrange's Identity. Relevant theorems and properties based on eigen values and eigen functions. Expansion of function in terms of eigen functions. Periodic Sturm problem.

## UNIT IV

Solution of second order P.D. equations by the method of separation of variables. Green's function and its construction and solution of second order Homogenous B.V.P's through Green's function. Dirac delta function and its important properties.

## UNIT V

Calculus of variations: Functionals, Euler- Lagrange differential equation for externals and its alternative forms. Variational problems involving several dependent variables, several independent variables and higher order derivatives. Isoperimetric Problems. Solution of variational problems using Ritz method.

### Books recommended:

1. Sneddon, I.N. : Element of Practical differential equation.
2. Forsyth, A.R. : A Treatise of Differential equations.
3. Gupta, A.S. : Calculus of variations with Applications.
4. Bansal, J.L. : Differential equations Vol. II.
5. Gelfand, I.M. and Fomin, S.V. : Calculus of variations.

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**SEMESTER I M. Sc. MATHEMATICS 2016-17**

**M1 MAT 04-CT04**

**MECHANICS-I**

L-T-P	4-1-0
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TIME: 3 hours

External Assessment 80

Internal Assessment 20

**UNIT I**

Hydrodynamics: Lagrange's and Euler's, Methods; Acceleration, Equation of Continuity, Boundary surface, Stream lines, velocity potential.

**UNIT II**

Euler's dynamical Equations, Bernoulli's Theorem, Lagrange's Equations under conservative forces, the motion once irrotational is always irrotational.

**UNIT III**

Central Orbit, Kapler's Law of Planetary motion.

**UNIT IV**

Michelson-Morley experiment, Lorentz-Fitzgerald contraction, postulates of special theory of Relativity, Lorentz transformations.

**UNIT V**

Mass-Energy formula, transformation formulas for momentum and energy. Minkowski's 4-dimensional continuum space, Space like and time like intervals, Relativistic Hamiltonian and Lagrangian.

**Books Recommended:**

1. Ramsay, A.S. : A Text book of Hydrodynamics.
2. Ray, M. : Hydrodynamics.
3. Gaur, Mathur & Goyal : Hydrodynamics.
4. Ray, M. : Dynamics of a particle.
5. Roy & Bali : Theory of Relativity.

**MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR**  
**SEMESTER I M. Sc. MATHEMATICS 2016-17**

**M1 MAT 05-CT05**  
**DIFFERENTIAL GEOMETRY-I**

L-T-P	3-1-0
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TIME: 3 hours

External Assessment 80  
Internal Assessment 20

**UNIT I**

The Axes of Plane Sections: Circular sections, Axes of central sections of a central conicoid, Axes of non central section of a central conicoid.

**UNIT II**

Axes of any section of a central conicoid, Circular sections. Generating Lines: Introduction, properties of generating line, intersection of generators of hyperboloid of one sheet, generators through any point of hyperboloid, direction cosines of generating line, The section of a surface by a tangent plane.

**UNIT III**

Systems of generators of a central hyperboloid, Locus of the points of intersection of perpendicular, generators, The projection of generators, Generators' of the hyperbolic paraboloid.

**UNIT IV**

Confocal Conicoids: The three confocals through a point,- Elliptic coordinates, confocal touching a given plane, confocal touching a given line, The parameter of the confocals through a point on a central conicoid, The normals. The self polar tetrahedron, The axes of an enveloping cone.

**UNIT V**

Conoids; Equation to a conoid, surface in general, The degree of a surface, tangents and tangent planes, The inflexional tangents; the equations  $\zeta=f(\xi,\eta)$ . The indicatrix and representation by parameters.

**Books recommended:**

1. Robert, L., Bell, J.T. : Coordinate Geometry of the three dimensions.
2. Bansal & Sharma : Differential Geometry.
3. N. Saran & R. S. Gupta : Analytical Geometry of Three Dimension.