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3- Vaishalinagar
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M.Sc. MATHEMATICS SEMESTER – 1

1	CMT – 1001	Algebra-1

Name of the Course   :Algebra-1

Course credit   :04

Teaching Hours   :95 (Hours)

Total marks   :70+30

Objectives :

List and understand basic as well as advance concepts of Group theory and rind theory. In group theory understand one of important theory which is sylow theory. Also understand some special domains like PID, UFD, ED and some of its properties.

Unit	Content	No. of Lectures
1	Basic concepts of group theory: Group, abelian group, cyclic group, normal subgroup, quotient group, permutation group, Group isomorphism and their properties, Cayley's theorem, Automorphisms of groups	30
2	Direct Products, Finitely Generated Abelian Groups, Invariants of a finite Abelian Groups, Sylow Theorems.	20
3	Quick look at basic ring theory: Euclidean ring, Quotient ring and zero divisors, Ideals, principal ideal, maximal ideal and prime ideal, Homomorphisms of ideals, Sum and Direct Sum of Ideals, Nilpotent and Nil Ideals.	25
4	Euclidean domains, Principal Ideal Domains, Unique Factorization Domains and Polynomial Rings over UFD. Polynomial rings over rational field, irreducible polynomials, Einstein irreducibility criterion.	20
	Total Lectures	95

Important instructions for paper setter –

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UNIVERSITY EXAMINATION

(All questions are compulsory for all student candidates)

Sr. No.	Particulars	Marks
1	QUESTION - 1 Short question. 07/10	14
2	QUESTION - 2 Long answer question 02/03	14
3	QUESTION - 3 (A) Long answer question 02/02 **OR** (B) Long answer question 02/02	14
4	QUESTION - 4 Long answer question 02/02	14
5	QUESTION - 5 Long answer question 02/03	14
	Total Marks for candidates	70

Recommended Reading:

☐ P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, **Basic Abstract Algebra,** Second Edition, Cambridge University Press, 1995.

☐ M. Artin, Algebra, Prentice-Hall of India Private Ltd., New Delhi, 1994.

☐ J. A. Gallian, Contemporary Abstract Algebra, Fourth Edition, Narosa Publishing House, New Delhi, 1999.

☐ N. S. Gopalakrishnan, University Algebra, New Age International Private Ltd. Publishers, New Delhi, Sixth Reprint, 1998.

☐ I. N. Herstein, Topics in Algebra, Second Edition, Wiley Pub. , New York, 1975

2	**CMT – 1002**	**Real Analysis**

Name of the Course   :**Real Analysis**

Course credit   :**04**

Teaching Hours   :**80 (Hours)**

Total marks   :**70+30**

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Objectives:

Understand Algebra of sets, understand measurable sets and various types of measures, understand and utilize the concept of differentiation of monotone functions and absolute continuity, Holder's inequality and Minkowski's inequality for Lp spaces.

Unit	Content	No. of Lectures
1	Algebra of sets, σ-algebra of sets, Borel sets, Lebesgue outer measure, Measurable sets and Lebesgue measure, A nonmeasurable set, Measurable Functions, and Littlewood's three principles.	35
2	Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, The integral of a nonnegative function, The general Lebesgue integral, and Convergence in measure	15
3	Differentiation of monotone functions, Functions of bounded variation, Differentiation of an integral, and Absolute continuity.	15
4	*lLp* spaces, The Holder's inequality, The Minkowski's inequality, and Convergence and completeness	15
	Total Lectures	60

Important instructions for paper setter –

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UNIVERSITY EXAMINATION

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1	QUESTION - 1 Short question. 07/10	14
2	QUESTION - 2 Long answer question 02/03	14
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5	QUESTION - 5 Long answer question 02/03	14

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Total Marks for candidates	70

Recommended Reading:

The course is covered by Chapter 1 Section 4, Chapter 2 Section 7, Chapter 3 (full), Chapter 4(full), Chapter 5 (Sections 1 to 4), and Chapter 6 (Sections 1 to 3) from the book Real Analysis by H. L. Royden, Third Edition, PHI Learning Private Limited (2009) New Delhi.

☐ Real Analysis by N. L. Carothers, Cambridge University Press (2000).

☐ Measure Theory and Integration by G de Barra, Wiley Eastern Limited, First Wiley Eastern Reprint (1987).

☐ Real Analysis by V. Karunakaran, Pearson (2012).

☐ Fundamentals of Real Analysis by S. K. Berberian, Universitext, Springer (1999).

☐ An introduction to Measure and Integration by I. K. Rana, Narosa Publishing House, New Delhi

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3	CMT – 1003	Topology-1

Name of the Course   :Topology-1
Course credit   :04
Teaching Hours   :80 (Hours)
Total marks   :70+30

Objectives:

   Interpret the topological structures and their characterizations, Identify and understand the subspace topology and product topology, Understand and differentiate the hierarchy of the topological spaces and their Characterizations.

Unit	Content	No. of Lectures
1	Topology, Open sets and closed sets, Finer and Coarser topology, Basis for a topology, Simply ordered topology	20

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2	Subspace topology, Product topology, Continuous functions, Homeomorphism.	20
3	Limit points, Closure, Interior points and interior, Convergent Sequence.	15
4	Metric topology, Uniform convergence, Topology of R^n.	
5	Connectedness, Local connectedness, Components, Path connectedness	15
	Total Lectures	60

Important instructions for paper setter –

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UNIVERSITY EXAMINATION

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1	QUESTION - 1 Short question. 07/10	14
2	QUESTION - 2 Long answer question 02/03	14
3	QUESTION - 3 (A) Long answer question 02/02 **OR** (B) Long answer question 02/02	14
4	QUESTION - 4 Long answer question 02/02	14
5	QUESTION - 5 Long answer question 02/03	14
	Total Marks for candidates	70

Recommended Reading:

The Course is covered by following Chapter 1, 2 and 3(Upto article 25) of Topology-A first course, J. M. Munkres, Printice Hall of India (2000). ☐ NUMBER THEORY (Authors: Z. I. Borevich and I. R. Shafarevich)

☐ Introduction to Topology and Modern Analysis - G. F. Simmons, Tata McGraw Hill edition-2004.

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☐ General Topology by S. Willard, Addison – Wesley Publishing Company (1970)

4	CMT – 1004	**Theory of Ordinary Differential Equations**

Name of the Course   :Theory of Ordinary Differential Equations

Course credit   :04

Teaching Hours   :80 (Hours)

Total marks   :70+30

Objectives:

Understand and solve the Linear System of Differential Equations, Non-Linear System of Differential Equations, Ordinary Differential Equations, some population problems, an electric circuit.

Unit	Content	No. of Lectures
1	Linear System of Differential Equations The existence and uniqueness theorem, Linear Homogenous systems, Linear Non-Homogenous systems, Nonlinear system of first order equations.	20
2	Linear System with constant coefficients: The exponential of matrix, Eigen values and eigen vectors of matrices, calculation of fundamental matrix, two dimentional linear systems, some population problems, an electric circuit .	15
3	Series solutions of Linear Differential Equations, Review of properties of power series, second order linear equations with analytic coefficients, theorem on solutions in power series, singular points of linear differential equations, solutions about a regular singular point, exceptional cases, the Bessel equation and some properties of Bessel functions, singularities at infinity, irregular singular points with an introduction to asymptotic expansions	15
4	Existence theory Existence of solutions, uniqueness of solutions, continuation of solutions, the non linear simple pendulum, existence theory for system of first order equations and higher order equations, linear systems, dependence on initial conditions.	15

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5	Laplace Transforms Linearity, existence theorem, Laplace transform of derivatives and integrals, shifting theorem, differentiation and integraton of transforms, convolution theorem, inverse Laplace transform, solution of Ordinary Differential equations and integral equations.	15
	Total Lectures	60

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UNIVERSITY EXAMINATION

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3	QUESTION - 3 (A) Long answer question 02/02 **OR** (B) Long answer question 02/02	14
4	QUESTION - 4 Long answer question 02/02	14
5	QUESTION - 5 Long answer question 02/03	14
	Total Marks for candidates	70

Recommended Reading:

This course is covered by "**Ordinary Differential Equations**", First course by R. Brauer and J. A. Nohel, Second edition, Benjamin Inc.

☐ Ordinary Differential Equations by G. Birkoff and G. C. Rota, Second edition, Ginn and Co(1995)

☐ Introduction to Ordinary Differential Equations by E. A. Coddington, Prentice Hall of India, 1996.

☐ Elements of Ordinary Differential Equations by M Golom and M. E. Shinks, Second Edition, McGraw-Hill Books Co., 1965.

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☐ Theory and Problems of Differential Equations by F. Ayers, McGraw Hill, 1972.

☐ Advanced Engineering Mathematics by E. Kreyzig, John Willey and Sons, 2002.

5	EMT – 1001	**Classical Mechanics-1**

Name of the Course :Classical Mechanics-1

Course credit :04

Teaching Hours :60 (Hours)

Total marks :70+30

Objectives:

Understand and define linear momentum and angular momentum for a particle. Understand Two Body Central force problem & Equations of Motion and Rigid bodies.

Unit	Content	No. of Lectures
1	D'Alemberts principle and Lagrange's Equations Conservation theorem for linear momentum and angular momentum for a particle. Conservation theorem for linear momentum and angular momentum for a system of particles. Classification of dynamical system. Constraints. Virtual displacement and principle of virtual work. Generalized force in holonomic system, Mathematical expression for principle of virtual work D'Almbert's principle, Lagrange's equation for holonomic system, Lagrange's equation for conservative non-holonomic system, Problems on above topics.	15
2	Variational principle and Lagrange's equations, Variational principle, Calculus of variations, Hamilton's principle, Derivation of Hamilton's principle from Lagrange's equation, Derivation of Lagrange's equations from Hamilton's principle, Cyclic co-ordinates, servation theorems, Problems on above topics.	15
3	Two Body Central force problem, Reduction to equivalent one body problem, The equations of motion and first integrals, The equivalent one dimensional problem and classification of orbits, The inverse square law of force.	15

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4	Equations of Motion and Rigid bodies Independent co-ordinates of rigid bodies, generalized coordinates of a rigid bodies, Euler angles, Cayley-Klein parameters and related quantities, components of angular velocity along the body set of axes, Euler's theorem on the motion of a rigid body, rate of change of a vector, the Coriolis force, Euler's equations of motion for a rigid body, finite rotations, infinitesimal rotations.	15
	Total Lectures	60

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4	QUESTION - 4 Long answer question 02/02	14
5	QUESTION - 5 Long answer question 02/03	14
	Total Marks for candidates	70

Recommended Reading:

☐ Classical Mechanics **by H. Goldstein, 2nd Edition, Narosa Publishing House.**

☐ Classical Mechanics **by C. R. Mondal, Prentice Hall of India Pvt. Ltd.**