TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

2-Year Master of Science (M.Sc.) Curriculum and Syllabus for Mathematics

Second Semester

Course Code	Course Title	Contact Hrs/Week			Credit
		L	T	P	
Theory					
TIU-PMA-T114	INTEGRAL TRANSFORMS	3	1	0	4
TIU-PMA-T104	GENERAL TOPOLOGY	3	1	0	4
TIU-PMA-T106	ALGEBRA-I	3	1	0	4
TIU-PMA-T108	FUNCTIONAL ANALYSIS	3	1	0	4
TIU-PMA-T110	PROBABILITY AND STATISTICS	3	0	0	4
TIU-PMA-L198	CAREER ADVANCEMENT SKILL DEVELOPMENT – II	3	0	0	3
Sessional					
TIU-PES-S198	ENTREPRENEURSHIP SKILL DEVELOPMENT	0	0	0	2
	Total Credits				**25**

INTEGRAL TRANSFORMS

Fourier Transforms: Fourier integral Theorem. Definition and properties. Fourier transform of the derivative. Derivative of Fourier transform. Fourier transforms of some useful functions. Fourier cosine and sine transforms. Inverse of Fourier transforms. Convolution. Properties of convolution function. Convolution theorem. Applications. Laplace transforms: Definition and properties. Sufficient conditions for the existence of Laplace transform. Laplace transform of some elementary functions. Laplace transform of the derivatives. Inverse of Laplace transform. Bromwich Integral Theorem. Initial and final value theorems. Convolution theorem. Applications. Z-transform : Definition and properties. Z-transform of some standard functions. Inverse Z-transforms. Applications.

Books:

1. Fourier Series and Boundary Value Problems by Brown and Churchill
2. Advanced Differential Equations by MD Raisinghania

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GENERAL TOPOLOGY

Topological Spaces: Examples of Topological spaces, open sets, closed sets, neighbourhoods, bases, sub bases, limit points, closures, interiors, Nets and Filters and their convergence continuous functions, homeomorphisms. Subspace topology, product topology, metric topology, order topology. Quotient Topology: Construction of cylinder, cone, Moebius band, torus, etc. Connectedness and Compactness: Connected spaces, Connected subspaces of the real line, Components and local connectedness, Compact spaces, Heine-Borel Theorem, Local–compactness. Separation Axioms: Hausdorff spaces, Regularity, Complete Regularity, Normality, Urysohn Lemma, Tychonoff embedding. Tietze Extension Theorem.

Books:

1. Introduction to Topology and Modern Analysis by GF Simmons
2. Topology: A First Course by JR Munkres

ALGEBRA – I

Homomorphism of groups, Normal Subgroups, Quotient Groups, Isomorphism Theorems, Cayley's Theorem. Generalized Cayley's Theorem, Cauchy's Theorem, Group Action, Sylow Theorems and their applications. Normal and Subnormal Series, Composition Series, Solvable Groups and Nilpotent Groups, Jordan-Hölder Theorem and its applications.
Ideals and Homorphisms, Prime and Maximal Ideals, Quotient Field of an Integral Domain, Polynomial and Power Series Rings. Divisibility Theory: Euclidean Domain, Principal Ideal Domain, Unique Factorization Domain.

Books:

1. Abstract Algebra by DS Dummit and RM Foote
2. Fundamentals of Abstract Algebra by Malik, Mordersen and Sen
3. Topics in Abstract Algebra by Herstein

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FUNCTIONAL ANALYSIS

Complete metric spaces and function spaces, Characterization of compact metric spaces, equicontinuity, Ascoli-Arzela Theorem, Baire Category Theorem. Norm linear space, Banach space with examples, Bounded linear transformation, Dual space, equivalence of two norms in a linear space, bounded linear functional, Hahn-Banach theorem and its consequences, separability, reflexivity, Open mapping theorem, closed graph theorem and uniform boundedness principle and some applications, Inner product space, Hilbert spaces, orthonormality, orthogonal complement, orthonormal basis, Bessel's inequality, Gram-Schmidt orthonormalisation process, Riesz representation theorem.

Books:

1. Functional Analysis by Bachman and Narici
2. Introduction to Topology and Modern Analysis by G. F. Simmons
3. Introduction to Functional Analysis by A. E. Taylor
4. Functional Analysis by M. Thamban Nair
5. Functional Analysis : Brown and Page.

PROBABILITY AND STATISTICS

Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem. Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function, Chebyshev's inequality. Discrete probability distribution-uniform, binomial, geometric, negative binomial, hypergeometric, Poisson. Continuous probability distribution-uniform, exponential, gamma, normal, beta, lognormal, Weibull, Laplace, Cauchy, Pareto distributions. Functions of a random variable. Joint, marginal and conditional distributions, product moments, correlation, independence of random variables, bivariate normal distribution, simple, multiple and partial correlation, regression. Law of large numbers, Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions. The method of moments and the method of maximum likelihood estimation, properties of best estimates, confidence intervals for the mean(s) and variance(s) of normal populations.

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Books:

1. A First Course in Probability by Sheldon Ross
2. Probability and Statistics for Engineering and the Sciences by JL Devore

CASD-II (NUMERICAL ANALYSIS)

System of linear equations and eigen value problem :

Eigenvalue problem. Gauss-Jacobi and Gauss-Seidel methods. Relaxation method. Necessary and sufficient conditions for convergence. Speed of convergence. S.O.R. and S.U.R. methods. Gerschgorin's circle theorem. Determination of eigen value by iterative methods, Ill conditioned system.

System of non-linear equations :

Newton's method. Existence of roots. Stability and convergence under variation of initial approximations. General iterative method for the system $\mathbf{x} = g(\mathbf{x})$ and its sufficient condition for convergence. Method of Steepest Descent.

Finite difference method :

Solution of partial differential equations by finite difference method. Partial difference quotients. Idea of convergence and stability. Explicit and Crank-Nicolson implicit method for solution of one dimensional heat conduction equation: convergence and stability.

NUMERICAL ANALYSIS (LAB)

List of Practical Problems

1. Gauss Elimination and Gauss-Jordon methods.
2. S.O.R. / S.U.R. method
3. Relaxation method
4. Solution of one dimensional heat conduction equation by

i) Explicit method

ii) Crank-Nicolson implicit method.

Books:

1. The finite elements method in partial differential equations by A.R.Mitchell.
2. Numerical solution of differential equations by M.K.Jain