Punjab Technical University
Kapurthala

Scheme and Syllabus
of
M.Phil. Mathematics

Batch 2012 onwards

By

Board of Studies Applied Mathematics

M.Phil. Mathematics is a one year course consisting of two semesters. Eligibility: M.Sc. Mathematics/ Applied Mathematics with 55% marks. MPHM: The course code of M.Phil. Mathematics

First Semester **Contact Hours: 12 Hrs.**

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
MPHM-101	Advanced Analysis	3	1	-	50	100	150	4
MPHM-102	Methods in applied Mathematics	3	1	-	50	100	150	4
MPHM-103	Research Methodology and Introduction to Mathematical Software	3	1	-	50	100	150	4
MPHM-104	Seminar (General Topic)	-	-	-	50		50	1
	Total	09	03	-	200	300	500	13

Second Semester **Contact Hours: 12 Hrs.**

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
MPHM-201	Mathematical Modelling	3	1	-	50	100	150	4
MPHM-202	Continuum Mechanics	3	1	-	50	100	150	4
MPHM-203	Seminar (Dissertation Based)	-	-	-	50	-	50	1
MPHM-200	Dissertation*	Thesis: 200 Marks Viva Voce: 50 Marks					250	5
	Total	09	03	-	150	450	600	14

Thesis will be evaluated externally and Viva Voce will be done in the presence of the external expert.

MPHM-102 Methods in Applied Mathematics

UNIT-I

Integral Equations: Their origin and classification, Relation between differential and Integral equations, IVP AND BVP reducible to Integral equations, Integral equation with separable kernals, Method of successive approximations, Classical Fredolm theory.

UNIT-II

Fourier series and its convergence, Gibbs phenomenon, Integration and Differentiation of Fourier Series, the phase angle form of Fourier series, Complex Fourier series and frequency spectrum, Fourier Integrals, Fourier Cosine and sine Integrals, Complex Fourier Integrals.

UNIT-III

Fourier transforms Properties of Fourier Transform and its Applications, Convolution, Fourier cosine and Sine transforms, Discrete Fourier Transforms, Fast Fourier Transform, Solution of equations, Hankel and Mellin transforms and their Applications.

UNIT-IV

Wavelets: History of wavelets, The Haar wavelets, The Stromberg Wavelet, Wavelet expansion, Multiresolution analysis with Haar wavelets, Periodic wavelets, General Construction of wavelets, Wavelet transform versus Fourier transform.

Suggested Readings/ Books:

1. Ram P. Kanwal: Linear Integral Equations, Academic Press (1971)
2. Abdul J. Jerri: Introduction to Integral Equations with Applications, Monographs and Text Books in Pure and Applied Mathematics, Marcel Dekker, INC (1985)
3. F B Hildebrand: Methods of Applied Mathematics, Dover Publication (1965)
4. Lokenath Debnath and Dambaru Bhatta: Integral Transforms and Their Applications, Second Edition Chapman and Hall/ CRC (2006)
5. Brian Davies: Integral Transforms and Their Applications, Text Book in Applied Mathematics, Vol 41, 3rd Edition, Springer (2002)
6. P. Wojtaszczyk, A Mathematical Introduction to wavelets, London Mathematical Society Students Text, 73, (1999)
7. Veronique Delouille**:** An Introduction to Wavelet Analysis, Connexions, (2009)
8. Willard Miller, Introduction to the Mathematics of Wavelets**,** University of Minnesota, (2006)
9. Peter V. O'Neil, Advanced Engineering Mathematics, Thomson.

MPHM 202 Continuum Mechanics

Unit-I

Continuum Hypothesis: Notion of Continuum, Configuration of a Continuum, Mass and Density, Description of motion, Material and Spatial Coordinates

Analysis of Strain: Affine Transformation, Infinitesimal Affine Deformation, Geometrical Interpretation of the Components of Strain, Strain Quadric of Cauchy, Principal Strains, Invariants, General Infinitesimal Deformation, Examples of strain, Notation, Equations of Compatibility, Finite Deformation

Unit-II

Analysis of Stress: Body and Surface Forces, Stress Tensor, Note on Notation and Units, Equations of Equilibrium, Transformation of Coordinates, Stress Quadric of Cauchy, Maximal Normal and Shear Stresses, Examples of Stresses

Stress Strain Relations: Hookes law, Generalized Hookes law, Homogeneous isotropic bodies, Elastioc moduli of isotropic bodies, Equilibrium Equations for an isotropic elastic solid, Dynamical equations of an isotropic elastic solid.

Unit-III

The strain energy function and its connection with Hooke's law, Uniqueness of solution of the Boundary-value problems of Elasticity, Saint-Venant's Principle.

Fundamental laws of continuum mechanics: Conservation of mass, Balance of linear momentum, Balance of angular momentum, General solutions of the Equation of Equilibrium, Balance of energy, Entropy inequality, Constitutive Equations

Unit-IV

Equations of fluid mechanics: Viscous and non-Viscous fluids, Stress tensor for a non-viscous fluid, Governing Equations for a non-viscous fluid flow, Initial and boundary conditions, Euler's equation of motion, Equation of motion of an elastic fluid, Stress tensor for a viscous fluid, Shear viscosity and bulk viscosity, Governing equation for a viscous fluid flow, Initial and boundary conditions, Navier-Stokes equation.

Suggested Readings/ Books:

1. Sokolnikoff, I.S., *Mathematical Theory of Elasticity*, Krieger Publishing Company (1983).
2. Chandrasekharaiah and Debnath, *Continuum Mechanics*, Academic Press (1994).
3. Jog, C. S., *Foundations and Applications of Mechanics: Volume I: Continuum Mechanics*, Norosa Publications, (2006).