BHARATHIAR UNIVERSITY: COIMBATORE 641046

M.PHIL. / Ph.D. – (FT/PT) - APPLIED MATHEMATICS

PART – 1 SYLLABUS
(Effective from October 2011 onwards)

Note:

There is no change in the existing papers except Paper **III- Special Paper : Convection Heat Transfer and Magnetohydrodynamics.**

The revised syllabi for the Paper **III- Special Paper : Convection Heat Transfer and Magnetohydrodynamics &** Newly framed syllabi for the **Paper III – Special Paper : Hamiltonian Dynamics and Chaos** is furnished below.

Paper III SPECIAL PAPER

CONVECTION HEAT TRANSFER AND MAGNETOHYDRODYNAMICS

Unit I : Laminar Boundary Layer Flow - Fundamental Problem in Convective Heat Transfer - Concept of Boundary Layer- Velocity and Thermal Boundary Layers - Integral Solutions - Similarity Solutions-Methods- Flow Solution - Heat Transfer Solution.

Unit II: Laminar Boundary Layer Flow - Other wall heating conditions - Unheated starting length - Arbitrary wall Temperature - Uniform Heat flux - Film Temperature - Effect of longitudinal Pressure Gradient: Flow past a wedge and stagnation flow - Effect of flow through the wall: Blowing and suction - Effect of conduction across a solid coating deposited on a wall.

Laminar Duct Flow – Hydrodynamic Entrance length - Fully Developed Flow - Hydraulic Diameter and Pressure Drop.

Unit III: Laminar Duct Flow - Heat Transfer to Fully Developed Duct Flow - Mean Temperature - Fully Developed Temperature Profile- Uniform Wall Heat Flux - Uniform Wall Temperature - Tube Surrounded by Isothermal Fluid - Heat Transfer to Developing Flow - Scale Analysis - Thermally Developed Uniform (Slug) Flow - Thermally Developing Hagen - Poiseuille Flow.

Unit IV: Introduction and Fundamental equations of MHD and Steady Laminar Flow - The electrodynamics of moving media - The electromagnetic effects and the magnetic Reynolds number - Alfven's theorem - The magnetic energy - The mechanical equations - The mechanical effects - The electromagnetic stresses - Steady laminar motion.

Unit V : Magnetohydrodynamic waves and stability - Waves in an infinite fluid of infinite electrical conductivity - Alfven waves -Magnetohydrodynamic waves in a compressible fluid – Stability – Introduction - Simple illustrative examples - Instability of linear pinch - Flute instability - A general stability criterion- The method of small oscillations - Boundary conditions - Solution of the equations - Illustrative example.

Text book for Units I, II, III

A.Bejan, "Convection Heat Transfer", Third Edition, John Wiley & Sons, Hoboken, (2004).

Unit I – Sections 2.1 to 2.5 from Chapter 2.

Unit II – Sections 2.6 to 2.9 from Chapter 2 and Sections 3.1 to 3.3 from Chapter 3.

Unit III – Sections 3.4 to 3.5.3 from Chapter 3.

Text book for Units IV & V

V.C.A Ferraro & C. Plumpton, "An introduction to Magneto-Fluid Mechanics" Clanendon Press, Oxford, (1966).

Unit IV – Sections 1.1 to 1.7 from Chapter I and Section 2.5 from Chapter II.

Unit V – Sections 3.1 to 3.3 from Chapter III and Sections 5.1 to 5.3 from Chapter V.

Paper III - Special Paper : Hamiltonian Dynamics and Chaos

Unit I: The Dynamics of Differential Equations
Integration of linear second order equations - Integration of nonlinear second order equations - Dynamics in the phase plane - Linear Stability analysis.

Unit II: Hamiltonian Dynamics
Lagrangian formulation of Mechanics - Hamiltonian formulation of Mechanics Canonical transformations - Hamilton-Jacobi equation and action - angle variables -integrable Hamiltonians.

Unit III: Classical Perturbation Theory
Elementary perturbation theory - Canonical perturbation theory - Many degrees of freedom and the problem of small divisors - The Kolmogrov- Arnold-Moser theorem.

Unit IV: Chaos in Hamiltonian systems and area-preserving mapping
Area preservingmapping-Fixed points and the poincare-Birkhoff fixed point theorem Homoclinic and heteroclinic points-Criteria for local Chaos.

Unit V: Nonlinear Evolution Equations and Solitons
Basic properties of the Kdv equation - The inverse Scattering transforms: Basic principles, KdV equation - Other soliton systems - Hamiltonian structure of integrable systems.

Treatment as in:
Chaos and Integrability in Nonlinear Dynamics by M.Tabor, **John Wiley and Sons, New York, 1989.**
Unit I Chapter 1 Sections 1.1 - 1.4,
Unit II Chapter 2 Sections 2.1 - 2.5
Unit III Chapter 3 Sections 3.1 - 3.4
Unit IV Chapter 4 Sections 4.2 -4.5
Unit V Chapter 7 Sections 7.2 – 7.6