BHARATHIAR UNIVERSITY, COIMBATORE – 641 046

M.Phil – Applied Mathematics

FT/PT Effective from 2008-2009

Paper I - Teaching Techniques in Applied Mathematics

Paper II - Research Methodology and Trends in Applied Mathematics

Paper III - Special Paper

1. Heat Transfer and Magnetohydrodynamics

PAPER I

TEACHING TECHNIQUES IN APPLIED MATHEMATICS

UNIT 1: Methods & Techniques of Teaching

Large Group Techniques: Lecture, Modified lecture, seminar, symposium, panel discussion, Team Teaching, Project Approach & workshop. Small group techniques: Group discussion, Simulation, Role playing, Buzz Technique, Brain Stroming, case discussion and assignment.

Unit II: Educational Computing

Instructional Applications of computer-Computer Assisted Instruction(CAI)-CAI programmes - Basic Assumptions, Advantages &Limitations of CAI-Role of the Teacher in CAI - e learning-What is e learning-Levels of e learning -Important features of e learning-Benefits & pitfills in e learning-Electronic journals-Innovative Instructional Software-steganography and Educational Applications.

UNIT III: Dimensional analysis and scaling

Dimensional analysis – The program of Applied Mathematics – Dimensional Methods – The Buckingham Pi theorem – Formulation – Application to a Diffusion Problem – Proof of the Pi theorem – Scaling – Characteristic Scales – A Chemical Reactor Problem – The Projectile Problem – Population Models.

UNIT IV: Regular Perturbation Method

The Perturbation Method – Motion in a Nonlinear Resistive Medium – A Non linear Oscillator – The Poincare-Lindsted Method – Asymptotics.

UNIT V: Singular Perturbation and boundary-layer analysis

Failure of Regular Perturbation – Inner and outer approximations – Algebraic equations and Balancing – The inner approximation – Matching – Uniform approximations – Worked example – Boundary Layer Phenomena

Text book for Unit I

Vedanayagam.E.G, "Teaching Technology for college Teachers", New Delhi; Sterling Publishers (P) Ltd. (1989)

Text book for Unit II

Dr.S.Rajasekar, "Computer Education & Educational Computing" Neelkamal Publications Pvt. Ltd. (2007).

Text book for Units III, IV & V

J.David Logan "Applied Mathematics**",** Second Edition, John Wiley & Sons, Inc. (1997).

Reference Books:

1. K.L.Kumar, "Educational Technology", New Delhi, New Age International (P) Ltd. (1997).
2. A.H. Nayfeh, "Perturbation Methods", John Wiley & Sons, New York, (1973).
3. R. Bellman, "Perturbation Techniques in Mathematics, Physics & Engineering", Holt, Rinehart & Winston, Inc. New York. (1963).

PAPER II
RESEARCH METHODOLOGY & RECENT TRENDS IN APPLIED MATHEMATICS

UNIT I: Finite Difference Method

Two-dimensional parabolic equations – Alternating Direction implicit method-The parabolic equation in cylindrical and in spherical polar co-ordinates – Miscellaneous methods for improving accuracy – Reduction of the local truncation error – Use of Three time –level difference equation – Solution of Non-linear parabolic equation – A three time-level method **.**

UNIT II: Finite Element Method for One Dimensional Stress Deformation

Local and global coordinate system for the One-Dimensional Problem-One-Dimensional Problem-Stress-Strain Relation-Principle of Minimum Potential Energy-Potential Energy Approach (for assembly)-Direct Stiffness Method-Boundary Conditions-Strains and Stresses-Formulation by Galerkin's Method-Complementary Energy Approach-Mixed Approach.

UNIT III: Finite Element Method for Two Dimensional Stress Deformation

Introduction-Plane Deformations-Plane Stress Idealization-Plane Strain Idealization-Axisymmetric Idealization-Strain-Displacement Relations-Finite Element Formulation-Requirements for Approximation Function-Plane Stress Idealization-Triangular element-Comment on convergence.

UNIT IV: The Finite Volume Method for Diffusion Problems

Summary of conservative form of the governing equations of fluid flow-Differential and integral forms of the general transport equations-Finite volume method for Diffusion problems-Introduction-Finite volume method for one dimensional steady state diffusion-worked examples-Finite volume method for two dimensional diffusion problems-Finite volume method for three dimensional diffusion problems.

UNIT V: The Finite Volume Method for Convection –Diffusion Problems

Introduction-steady one dimensional convection and diffusion-The central differencing scheme-Properties of discretization schemes-Assessment-The upwind differencing scheme-The hybrid Differencing scheme-Assessment-Higher Differencing scheme for multi dimensional convection diffusion-The power law scheme

Text book for Unit I

G.D.Smith, "Numerical Solution of Partial Differential Equations – Finite Difference Methods", Clarendon Press, Oxford, (1978).

Text book for Unit II & Unit III

C.S.Desai, "Elementary Finite Element Method" Prentice Hall, Inc. (1979).

Text book for Unit IV & Unit V

H.K.Versteey & W. Malalasekara,"An Introduction to Computational Fluid Dynamics (CFD) -The Finite Volume Method" Longman Scientific &Technical, England. (1995).

Reference Books:

1. T.J. Chung, "Computational Fluid Dynamics", Cambridge University Press, (2003).
2. Joel H. Ferzigen & Milovan Peric "Computational Methods for Fluid Dynamics", Springer, (2002).
3. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill, (2005).

PAPER III
SPECIAL PAPER
HEAT TRANSFER AND MAGNETOHYDRODYNAMICS

UNIT I: Flow along surfaces and in channels

Boundary layer and turbulence – The momentum equation of the boundary layer – The laminar-flow boundary-layer equation - The plane plate in longitudinal flow - Pressure gradients along a surface - Exact solutions of the laminar boundary-layer equations for a flat plate

UNIT II: Forced Convection in Laminar Flow

The heat-flow equation of the boundary layer – Laminar boundary-layer energy equation – The plane plate in longitudinal flow – The plane plate with arbitrarily varying wall temperature– Exact solutions of the laminar- boundary- layer energy equation – Flow through a tube.

UNIT III: Free Convection

Laminar heat transfer on a vertical plate and horizontal tube – Turbulent heat transfer on a vertical plate – Derivation of the boundary-layer equations – Free convection in a fluid enclosed between two plane walls – Mixed free and forced convection.

UNIT IV:Introduction and fundamental Equations of Magnetohydrodynamics and Steady Laminar motion

Introduction and fundamental equations: The electrodynamics moving media-The electromagnetic effects and the magnetic Reynolds number-Alfven's theorem-
The magnetic energy-The mechanical Equation-The mechanical effects-The Electromagnetic stresses-Steady Laminar motion.

UNIT V: Magnetohydrodynamic waves and stability

Magnetohydrodynamic waves-Waves in an infinite fluid of infinite electrical conductivity-Alfven waves- Magnetohydrodynamic waves in a compressible fluid-Stability-Introduction—Simple illustrative examples-The Method of small Oscillations

Text book for Units I, II, III

E.R.G.Eckert & Robert M. Drake, **"**Heat and Mass Transfer" McGraw-Hill, Tokyo, (1979).

Textbook for Units IV & V

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

Books for Reference:

1. B. Gebhart, "Heat Transfer", McGraw-Hill, NewYork, (1971).
2. H .Schlichiting, "Boundary Layer Theory", Mc Graw Hill, (1979).
3. Alan Jeffrey, "Magnetohydrodynamoics", Oliver & Boyd, London, (1966).
