

KOHIMA SCIENCE COLLEGE, JOTSOMSA
(An Autonomous PG College)
DEPARTMENT OF MATHEMATICS

Subject: Minor changes in the Ph.D. Course Work syllabus.

The total credit point has been changed from 14 points to 16 points by an addition of 2 credit points (50 marks) to the paper code MAT-04.

Revised Syllabus for Course work:

KOHIMA SCIENCE COLLEGE, JOTSOMSA
(An Autonomous PG College)
Ph.D. Course Work Syllabus
MATHEMATICS

Examination Scheme:

Sl. No	Paper Code	Credit	Name of the Paper	Max. marks
I	MAT-01	4	Research Methodology and Quantitative Techniques	100
II	MAT-02	4	General Mathematics	100
III	MAT-03	4	Advanced Fluid Dynamics	100
IV	MAT-04	4	Project work and Seminars	100
			Grand Total	400

I. RESEARCH METHODOLOGY AND QUANTITATIVE TECHNIQUES

Marks: 100

Unit-1 Research Methodology

Marks: 20

Introduction to Research, importance of research, research methods and research methodology, types of research, selection of research problem, formulation of research problem.

Unit-2 Manuscript Preparation

Marks: 20

Literature survey, knowledge of web search, importance and typology, Elements of an article: Title, Abstract, keyword, introduction, formulation, result and discussion, references, research ethics.

Unit-3 Scientific Writing

Marks: 20

Importance of science writing, meaning and nature of scientific style, writing effective scientific prose, effective word selection in science writing, common Mathematical functions and their abbreviation, symbols, operators commonly used in Mathematics.

Unit-4 Typesetting Mathematical Text with LATEX

Marks: 20

Simple document, type style, environments, lists, centering, tables, verbatim, vertical and horizontal spacing, equation environments, fonts, underlying, arrays and matrices, customised commands, document classes and overall structure, title for documents, sectioning commands, inputting files, making a bibliography, making an index.

Unit-5 MATLAB

Marks: 20

Arithmetic operations, built-in functions, scalar variable, creating arrays, Mathematical operations with arrays, script files, programming in MATLAB, solving differential equations. Basic 2-D plots and 3-D Plots.

Recommended Books:

1. Research Methodology: Methods and Techniques by C. R. Kothari & G Garg, 4th edn, 2018, New Age international, ISBN: 9789386649225.
2. The Manual of Scientific Style: A Guide for Authors, Editors, and Researchers by Harold Rabinowitz and Suzanne Vogel, 2009, Academic Press, 1st edn, ISBN: 9780123739803.
3. LATEX: A Document Preparation System by Leslie Lamport, 1994, 2nd edn, Pearson, ISBN: 9788177584141.
4. MATLAB Guide by D.J. Higham and N.J. Higham, 2nd edn, 2000, Siam, ISBN: 9780898715163.

II. GENERAL MATHEMATICS

Marks: 100

Unit-1: Basic concept of Real and Complex Analysis

Marks: 20

Limits, continuity, uniform continuity, Differentiability, Riemann Integral, Metric space, sequence and series, Algebra of complex numbers, Analytic function, power series, Taylor's and Laurent's Series, conformal mapping.

Unit-2: Basic concept of Linear Algebra

Marks: 20

Vector space, subspace, Linear dependence, linear transformation, algebra of matrices, rank of matrix, determinants, linear equations, Eigen values and Eigen vectors, quadratic forms.

Unit-3: Differential equations

Marks: 20

First order ODE, singular solutions, initial value problem of first order ODE, general theory of homogeneous and non homogeneous linear ODE, variation of parameters.

Unit 4: Fluid Dynamics

Marks: 20

Lagrangian and Euler methods of description, governing equations of fluid motion, velocity and circulation, equation of continuity equation of energy, motion in two dimension. Viscous fluid, Stokes and Navier equation, steady motion of viscous fluid between two parallel planes, cylindrical pipes.

Unit 5: Differential Geometry

Marks: 20

Space curve, arc length, tangent vectors and vector fields on a curve, curvature and torsion, Serret-Frenet formulae, Osculating plane, osculating circle, osculation sphere, tangent and normal vectors fields on a surface, first, second and third fundamental forms of a surface at a point.

Recommended Books:

1. A first course in Differential Geometry by Chuan-Chih Hsiung, International Press, 2013, ISBN: 9781571462800.
2. Linear Algebra Done Right by Sheldon Axler, 3rd edn., Springer Nature, ISBN: 9783319110790.
3. Ideal and Incompressible Fluid Dynamics by M.E.O'Neill and F Chorlton, 1986, Prentice Hall, ISBN: 9780134540832.
4. Complex variables and Applications by J.W Brown & R.V. Churchill, 6th edn., 1996, McGraw Hill, ISBN: 9780071140652.
5. Elementary Differential Equations by W.T. Martin and Eric Relssner, 3rd edn., Holden-Day, 1958, ISBN: 9780816254354.
6. Differential Geometry of Three Dimensions by Weatherburn, 2017, Andesite Press, ISBN: 9781376188677.

III. ADVANCED FLUID DYNAMICS:

Marks: 100

Unit-1: Dimensional Analysis

Marks: 25

Similitude, Geometrical, Kinematic and Dynamical similarity; Dimensionless numbers: Reynolds number, Prandtl number, Eckert number, Grashof number, Nusselt number, Schmidt number, etc; Techniques of dimensional analysis, Rayleigh technique and Buckingham Pi-theorem.

Unit-2: Heat and Mass Transfer

Marks:15+15=30

Heat transfer, the energy equation-conservation of energy, temperature distribution in (i) Couette flow, (ii) Poiseuille flow (iii) Hagen-Poiseuille flow, thermal boundary layer, thermal boundary layer equation in two dimensional flow, free convection and forced convection.

Mass transfer, diffusion and convection, Frick's law, concentration boundary layer equation.

Unit-3: Finite Difference Method

Marks: 15

Two dimensional parabolic equations- Alternating direction implicit method, the parabolic equation in cylindrical and in spherical polar coordinates, solution of non-linear parabolic equations- A three time level method.

Unit-4: Finite Volume Method

Marks: 15

Introduction, Differential and integral forms of the general transport equations, the central differencing scheme, properties of discretization schemes, finite volume method for one, two and three dimensional steady state diffusion problem, the power law scheme.

Unit-5: Perturbation Method

Marks: 15

Perturbation techniques for solving differential equation, homotopy perturbation method.

Recommended Books:

1. Boundary-Layer Theory by H. Schlichting, 2014, 7th edn, McGraw Hill, ISBN: 9789332902824.
2. Heat and Mass Transfer by H.D. Baehr and K. Stephan, 2011, 3rd edn, Springer, ISBN: 9783642200205.
3. Perturbation Methods in Fluid Mechanics by Milton-Von Dyke, 1975, Parabolic Press, ISBN: 9780915760015.
4. Viscous Fluid Dynamics by J.L. Bansal, 2nd edn, Oxford & IBH, 2003, ISBN: 9788120415942.
5. Convection Heat Transfer by A. Bejan, 4th edn, John Wiley, 2013, ISBN: 9780470900376.
6. Numerical Solutions of Partial Differential Equations: Finite Difference Methods by G.D. Smith, 3rd edn, 1985, Oxford Univ. Press, ISBN: 9780198596509.
7. An Introduction to Computational Fluid Dynamics: The Finite Volume Method by H. K. Versteeg & W. Malasekera, 2007, PHI, ISBN: 9780131274983.

IV. PROJECT WORK AND SEMINARS**Marks 100**
