BHARATHIAR UNIVERSITY, COIMBATORE.
M. Sc MATHEMATICS DEGREE COURSE (AFFILIATED COLLEGES)
(Effective from the academic Year 2010-2011)
SCHEME OF EXAMINATIONS – CBCS PATTERN

Sem.	Study Components	Course title	Ins. hrs/ week	Dur.Hrs	CIA	Marks	Total Marks	Credit
I	Paper 1	Algebra	7	3	25	75	100	4
	Paper 2	Real Analysis	7	3	25	75	100	4
	Paper 3	Ordinary Differential Equations	6	3	25	75	100	4
	Paper 4	Numerical Methods	6	3	25	75	100	4
	Elect. Paper I		4	3	25	75	100	4
II	Paper 5	Complex Analysis	6	3	25	75	100	4
	Paper 6	Partial Differential Equations	7	3	25	75	100	4
	Paper 7	Mechanics	7	3	25	75	100	4
	Paper 8	Operations Research	6	3	25	75	100	4
	Elect. Paper II		4	3	25	75	100	4
III	Paper 9	Topology	7	3	25	75	100	4
	Paper 10	Fluid Dynamics	7	3	25	75	100	4
	Paper 11	Mathematical Statistics	6	3	25	75	100	4
	Paper 12	Graph Theory	6	3	25	75	100	4
	Elect. Paper III		4	3	25	75	100	4
IV	Paper 13	Functional Analysis	7	3	25	75	100	4
	Paper 14	Mathematical Methods	7	3	25	75	100	4
	Paper 15	Computer Programming (C++ Theory)	4	3	25	75	100	4
	Practical	Computer Programming (C++ Practical)	2	3	40	60	100	4
	Paper 16	Number Theory	6	3	25	75	100	4
	Elect. Paper IV		4	3	25	75	100	4
	Project						150*	6
		Total					2250	90

* For Project report – 120 marks, Viva-voce – 30 marks.

LIST OF ELECTIVES

1.Latex
2.Matlab
3. Mathematica
4.Magnetohydro Dynamics
5.Control Theory
6.Differential Geometry
7.Fuzzy Logic and Fuzzy Sets
8.Cryptography
9. Neural Networks
10.Stochastic Differential Equations

Note :

The syllabus for the above papers (except Number theory and Elective papers) be the same as prescribed for the academic year 2009-10. The Syllabus for the Number theory and Elective papers are furnished below:

NUMBER THEORY

Unit I:

Introduction, Divisibility, Primes.

Unit II:

Congruences, solutions of congruences, Congruences of Degree 1. The functions $\phi(n)$, congruences of higher degree, Prime power moduli, Prime modulus.

Unit III:

Congruences degree 2, prime modulus, POWER Residues, Number theory from an algebraic view point , Multiplicative groups, Rings and fields, quadratic residues.

Unit IV:

Quadratic reciprocity – The Jacobi Symbol – Greatest integer function.

Unit V:

Arithmetic functions – The Moebius Inversion formula – The multiplication of arithmetic functions – Recurrence functions.

Treatment as in:

1.   An Introduction to Theory of Numbers by Ivan Nivan and Herberts Zucherman. Third Edition, 1972, Wiley Eastern Limited, New Delhi.

Unit-I:	Chapter I:	Sections 1.1 – 1.3
Unit-II:	Chapter II:	Sections: 2.1 – 2.7
Unit-III:	Chapter II:	Sections: 2.8 – 2.11
	Chapter III:	Section: 3.1
Unit-IV:	Chapter III:	Sections: 3.2, 3.3
	Chapter IV:	Section: 4.1
Unit-V:	Chapter IV:	Sections: 4.2 – 4.5

Reference:

1. T.M. Apostol, Introduction to Analytic Number Theory, Springer Verlag, 1976.
2. Kennath and Rosan, Elementary Number Theory and its Applications, Addison Wesley Pulishing Company, 1968.
3. George E. Andrews, Number Theory, Hindustan Publishing, New Delhi, 1989.

ELECTIVE PAPERS

ELECTIVE 1. LATEX

Unit I:
Text formatting, TEX and its offspring, What's different in LATEX 2ϵ, Distinguishing LATEX 2ϵ , Basics of a LATEX file.

Unit II:
Commands and Environments–Command names and arguments, Environments, Declarations, Lengths, Special Characters, Fragile Commands, Exercises.

Unit III:
Document Layout and Organization – Document class, Page style, Parts of the document, Table of contents, Fine – Tuning text, Word division.

Displayed Text - Changing font, Centering and indenting, Lists, Generalized lists, Theorem–like declarations, Tabulator stops, Boxes.

Unit IV:
Tables, Printing literal text, Footnotes and marginal notes. Drawing pictures with LATEX.

Unit V:
Mathematical Formulas – Mathematical environments, Main elements of math mode, Mathematical symbols, Additional elements, Fine–tuning mathematics.

Treatment as in:
A Guide to LATEX by H. Kopka and P.W. Daly, Third Edition, Addison – Wesley, London, 1999.

Unit   I : Chapter 1 : Sections : 1.1-1.3, 1.4.1, 1.5.
Unit II : Chapter 2 : Sections : 2.1-2.7.
Unit III : Chapter 3 : Sections : 3.1-3.6, 4.1-4.7
Unit IV : Chapter 4 : Sections : 4.8-4.10, 6.1.
Unit V : Chapter 5: Sections : 5.1-5.5.

ELECTIVE 2. MATLAB

Unit – I

Introduction - Basics of MATLAB, Input – Output, File trypes – Platform dependence – General commands.

Unit – II

Interactive Computation: Matrices and Vectors – Matrix and Array operations – Creating and Using *Inline* functions – Using Built-in Functions and On-line Help – Saving and loading data – Plotting simple graphs.

Unit – III

Programming in MATLAB: Scripts and Functions – Script files – Functions files- Language specific features – Advanced Data objects.

Unit – IV

Applications – Linear Algebra – Curve fitting and Interpolation – Data analysis and Statistics – Numerical Integration – Ordinary differential equations – Nonlinear Algebraic Equations.

Unit – V

Graphics: Basic 2-D Plots – Using subplot to Layout multiple graphs - 3 – D Plots – Handle Graphics – Saving and printing Graphs – Errors.

Treatment as in:

RUDRA PRATAP, Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers, Oxford University Press, 2003.

Reference Books:

1. William John Palm, Introduction to Matlab 7 for Engineers, McGraw-Hill Professional, 2005.
2. Dolores M. Etter, David C. Kuncicky , Introduction to MATLAB 7, Prentice Hall, 2004

ELECTIVE 3 : MATHEMATICA

Unit – I: Introduction to *Mathematica*

Running *Mathematica* - Numerical Calculations – Building Up calculations – Using the Mathematica system – Algebraic calculations - Symbolic Mathematics - Numerical Mathematics.

Unit – II

Functions and Programs – Lists – Graphics – Input and Output in Notebooks – The structure of Graphics.

Unit – III: Advanced Mathematics in *Mathematica*

Mathematical Functions – Algebraic Manipulation – Manipulating Equations - Calculus.

Unit - IV

Series, Limits and Residues - Linear Algebra – Constructing matrices – Getting pieces of matrices – Scalars, Vectors and Matrices – Operations on scalars, vectors and matrices – Multiplying Vectors and matrices – Matrix inversion – Basic matrix operations – Solving linear systems – Eigen values and Eigen vectors.

Unit – V

Numerical operations on data – Curve fitting – Approximate functions and Interpolation – Fourier Transforms.

Numerical operations on functions – Numerical Integration – Numerical evaluation of sums and products – Numerical Solution of Polynomial equations – Numerical root finding – Numerical solution of Differential equations -

Treatment as in:

Stephen Wolfram, **The Mathematica Book**, Fifth Edition, Cambridge University Press, 2003

ELECTIVE 4. MAGNETOHYDRO DYNAMICS

Unit I:
   Electromagnetism – Fundamental Laws – Electrostatic Energy – Electrodynamics – Ampere's Law – Lorentz force on a moving charge – Magnetostatic Energy – Faraday's Law of Induction – Poynting stresses.

Unit II:
   Electromagnetic Equations with respect to moving axes – boundary conditions of electric and magnetic fields. Kinematics of fluid motion – equation of continuity – Stress tensor – Navier-stokes equations – boundary condition – Velocity Magneto fluid dynamic equations.

Unit III:
   MHD approximation – equation of Magnetic diffusion in a moving conducting medium – Magnetic Reynolds number.

Unit IV:
   Alfven's theorem Law of isorotation - Magneto hydrostatics – Force-free field – Alfven waves in incompressible MHD.

Unit V:
   Incompressible viscous flows in the presence of magnetic field – Hartmann Flow – unsteady Hartmann flow – Magnetofluid dynamic pipe flow.

   Books:
   1. Crammer K.R. and Pai S.I, Magneto Fluid Dynamics for Engineers and Applied Physicists, McGraw Hill, 1973.
   2. Ferraro, VCA and Plumpton: Introduction to Magneto Fluid Dynamics, Oxford, 1966.

ELECTIVE 5. CONTROL THEORY

Unit I:
OBSERVABILITY:
   Linear Systems – Observability Grammian – Constant coefficient systems – Reconstruction kernel – Nonlinear Systems

Unit II:
CONTROLLABILITY:
   Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems

Unit III:
STABILITY:
   Stability – Uniform Stability – Asymptotic Stability of Linear Systems.

Unit IV:
        Linear time varying systems – Perturbed linear systems – Nonlinear systems

Unit V:
STABILIZABILITY:
        Stabilization via linear feedback control – Bass method – Controllable subspace – Stabilization with restricted feedback

Text Book:
Elements of Control Theory by K.Balachandran and J.P.Dauer, Narosa, New Delhi, 1999.

References:
1. Linear Differential Equations and Control by R.Conti, Academic Press, London, 1976.
2. Functional Analysis and Modern Applied Mathematics by R.F.Curtain and A.J.Pritchard, Academic Press, New York, 1977.
3. Controllability of Dynamical Systems by J.Klamka, Kluwer Academic Publisher, Dordrecht, 1991.
4. Mathematics of Finite Dimensional Control Systems by D.L.Russell, Marcel Dekker, New York, 1979.
5. E.B. Lee and L. Markus, Foundations of optimal Control Theory, John Wiley, New York, 1967

ELECTIVE 6. DIFFERENTIAL GEOMETRY

Unit I:
        Curves: Analytic representation - Arc Length – Osculation plane.

Unit II:
        Curvature torsion – Formulas of Frenet - Contact – Natural equations – Helices – General solutions of Natural equations.

Unit III:
        Evolutes and Involutes - Elementary theory of surface: Analytic representation.

Unit IV:
        First fundamental form – Normal, Tangent plane – Developable surfaces - Second fundamental form.

Unit V:
        Meusnier's theorem – Euler's Theorem – Dupin's indicatrix – Some surfaces.

Text Book: D. Struik, Lectures on Classical Differential Geometry, Addison Wesley Publishing Company, 1961.

ELECTIVE 7. FUZZY LOGIC AND FUZZY SETS

UNIT-1: CRISP SETS AND FUZZY SETS:

The Notion of Fuzzy Sets-basic concepts of Fuzzy sets –Fuzzy complement-Fuzzy Union-Fuzzy intersection – Combination of operations – general aggregation of operations.

UNIT-2: FUZZY RELATIONS:

Crisp and Fuzzy relations – Binary relations – Binary relations on a single set –

Equivalence and similarity relations – Compatibility on Tolerance Relations-Orderings –

Morphism – Fuzzy relations Equations.

UNIT-3: FUZZY MEASURES:

Belief and plausibility Measures –Probability measures – Possibility and Necessity measures.

UNIT-4: UNCERTAINTY AND INFORMATION:

Types of Uncertainty – Measures of Fuzziness-Classical Measures of Uncertainty-Hartley information – Shannon entropy– Measures of Dissonance- Measures of Non-Specificity.

UNIT-5: APPLICATIONS:

Natural, life and Social Sciences - Engineering - Medicine - Management and decision making.

Text Book:

1. George J. Klir and Tina A. Folger, Fuzzy Sets, Uncertainty and Information,

Prentice-Hall of India Private Limited-Fourth printing-June 1995

Unit:1   Chapter 1,2 Sec 1.3,1.4,2.2-2.6

Unit:2   Chapter 3   Sec 3.1-3.8

Unit:3   Chapter 4   Sec 4.2-4.5

Unit:4   Chapter 5   Sec 5.1-5.4, 5.6

Unit:5   Chapter 6   Sec 6.2-6.5

Reference Book:

1. George J. Klir and Boyuan**,** Fuzzy Sets and Fuzzy Logic-Theory and

Applications, Prentice-Hall of India Private Limited.

ELECTIVE 8. CRYPTOGRAPHY

Unit I:
Introduction – Encryption and Secrecy – The objective of Cryptography - Number Theory – Introduction – Modular Arithmetic.

Unit II:
Integer factorization problem – Pollard's rho factoring – Elliptic curve factoring – Discreate logarithm problem

Unit III:
Finite fields – Basic properties – Arithmetic of polynomials –Factoring polynomials over finite fields – Square free factorization

Unit IV:
Symmetric key encryption – Stream ciphers – Block Ciphers – DES

Unit V:
Public key cryptography – Concepts of public key cryptography – Modular arithmetic – RSA – Discrete logarithm – Elliptic curve cryptography

Reference Books:
1. Hans Delfs, Helmut Knebl, Introduction to Cryptography, Springer Verlag, 2002
2. Alfred J. Menezes, Paul C. Van Oorschot, Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2000
3. William Stallings, Cryptography and Network Security, Prentice Hall of India, 2000

ELECTIVE 9. NEURAL NETWORKS

UNIT I:
　　Mathematical Neuron Model- Network Architectures- Perceptron-Hamming Network-Hopfield Network-Learning Rules.

UNIT II:
　　Perceptron Architectures and Learning Rule with Proof of Convergence. Supervised Hebbian Learning-Linear Associator.

UNIT III:
　　The Hebb Rule-Pseudo inverse Rule-Variations of Hebbian Learning-Back Propagation-Multilayer Perceptrons.

UNIT IV:
　　Back propagation Algorithm-Convergence and Generalization - Performances Surfaces and Optimum Points-Taylor series.

UNIT V:

Directional Derivatives - Minima-Necessary Conditions for Optimality-Quadratic Functions-Performance Optimizations-Steepest Descent-Newton's Method-Conjugate Gradient.

Text Book: Martin T.Hagan, Howard B. Demuth and Mark Beale, Neural Network Design, Vikas Publishing House, New Delhi,2002.

Reference Books:
1. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications and Programming Techniques, Pearson Education, 2003.
2. Robert J. Schalkoff, Artificial Neural Network, McGraw-Hill International Edition, 1997.

ELECTIVE 10. STOCHASTIC DIFFERENTIAL EQUATIONS

Unit I

Introduction: Stochastic Analogs of Classical Differential Equations, Filtering Problems, Stochastic Approach to Deterministic Boundary Value Problems, Optimal Stopping, Stochastic Control and Mathematical Finance. Some mathematical preliminaries: Probalitity Spaces, Random Variables and Stochastic Processes and an Important Example: Brownian Motion.

Unit II

Ito Integrals: Construction of the Ito integral , Some Properties of the Ito Integral and Extensions of the Ito Integral.

Unit III

The Ito formula and the Martingale Representation Theorem: The 1- dimentional Ito Formula, the Multi dimensional Ito Formula and the Martingale Reprsentation Theorem.

Unit IV

Stochastic Differential Equations: Examples and Some Solution Methods, An Existence and Uniqueness Result and Weak and Strong Solutions.

Unit V

The Filtering problem: Introduction, The 1- dimentional Linear Filtering Problem and the Multi- dimentional Linear Filtering Problem.

Text Book:
"Stochastic Differential Equations - An Introduction with Applications", by **Bernt Oksendal**, (Sixth Edition), Springer-Verlag, Heidelberg, 2003.
Unit I : Chapter 1 and 2
Unit II : Chapter 3
Unit III: Chapter 4
Unit V : Chapter 5
Unit IV: Chapter 6