Annexure No.	**17 C**
SCAA Dated	**29.02.2008**

BHARATHIAR UNIVERSITY: COIMBATORE
DEPARTMENT OF MATHEMATICS - M.Sc. BRANCH I (a) – MATHEMATICS
With Compulsory Diploma in Mathematical Software
(The Curriculum is offered by the University Department under CBCS)

Eligibility for Admission to the Course
A candidate who has passed the Degree Examination **in B.Sc. (Mathematics) or B. Sc. (Mathematics with Computer Applications)** of this University or an examination of some other University accepted by the syndicate as equivalent thereto shall be eligible for admission to the Master Degree of this University.

Title of Core Papers	**L/T**	**P**	**Credits**
1. Algebra	**4**		**4**
2. Real Analysis	**4**		**4**
3. Ordinary Differential Equations	**4**		**4**
4. Complex Analysis	**4**		**4**
5. Partial Differential Equations	**4**		**4**
6. Mechanics	**4**		**4**
7. Topology & Functional Analysis	**4**		**4**
8. Fluid Dynamics	**4**		**4**
9. Mathematical Methods	**4**		**4**
10. Non-Linear Differential Equations	**4**		**4**
11. Control Theory	**4**		**4**
Title of Elective Papers			
12. Numerical Methods	**4**		**4**
13. Computer Programming and Lab I	**2**	**4**	**4**
14.Computer Programming and Lab II	**2**	**4**	**4**
Project			**10**
Supportive			**6**

Total Credits			**72**

L/T—Lecture/Theory; P-Practical

Supportive Courses for Other Department Students:

1.Applied Mathematics-I (Odd Semester)
2.Applied Mathematics-II (Even Semester)

Scheme of Examinations

Semester		Subject	Credit	Marks
Semester I				
	Core 1	**Algebra**	**4**	**100**
	Core 2	**Real Analysis**	**4**	**100**
	Core 3	**Ordinary Differential Equations**	**4**	**100**
	Elective 1	**Numerical Methods**	**4**	**100**
	Supportive 1		**2**	**50**
Semester II				
	Core 4	**Complex Analysis**	**4**	**100**
	Core 5	**Partial Differential Equations**	**4**	**100**
	Core 6	**Mechanics**	**4**	**100**
	Elective 2	**Computer Programming and Lab I (Theory and Practical)**	**4**	**100 ***
	Supportive 2		**2**	**50**
Semester III				
	Core 7	**Topology & Functional Analysis**	**4**	**100**
	Core 8	**Fluid Dynamics**	**4**	**100**
	Core 9	**Mathematical Methods**	**4**	**100**
	Elective 3	**Computer Programming and Lab II (Theory and Practical)**	**4**	**100***
	Supportive 3		**2**	**50**
Semester IV				
	Core 10	**Nonlinear Differential Equations**	**4**	**100**
	Core 11	**Control Theory**	**4**	**100**
	Project		**10**	**250**
Total Marks				**1800**

* - Computer papers have Theory and Practical examinations :
Theory - 50 marks; Practical - 50 marks

MATAC01 – ALGEBRA

UNIT-I:

Group Theory: Direct products- Group Action on a Set: Isotropy Subgroups- Orbits- Counting Theorems- p-Groups- The Sylow Theorems

UNIT-II:

Applications of the Sylow Theory: Applications to p-Groups and the Class Equation- Further Applications

Ring Theory: Ring of Polynomials: Polynomials in an Inderterminate- The Equation Homomorphisms- Factorization of Polynomials over a Field

UNIT-III:

Field Theory: Extension Fields-Algebraic and Transcendental Elements-Irreducible polynomial over F-Simple Extension- Algebraic Extensions: Finite Extensions- Structure of Finite Fields

UNIT-IV:

Automorphisms of Fields- Conjugation Isomorphisms- Automorphisms and Fixed Fields- The Frobenius Automorphism- Splitting Fields.

UNIT-V:

Separable Extensions- Galois Theory: Normal Extensions- The Main Theorem- Illustrations of Galois Theory: Symmetric Functions

Text book: "A First Course in Abstract Algebra" by J.B.Fraleigh, Fifth Edition, Addition Wesly Longman, Inc, Reading Massachusetts, 1999.

UNIT-I: Chapter 2, Section: 2.4 (Direct Product only)
Chapter 3, Sections: 3.6, 3.7
UNIT-II: Chapter 4, Section: 4.3, Chapter 5, Sections: 5.5, 5.6
UNIT-III: Chapter 8, Sections: 8.1, 8.3 (Finite Extensions Only), 8.5
UNIT-IV: Chapter 9, Sections: 9.1, 9.3
UNIT-V: Chapter 9, Sections: 9.4, 9.6, 9.7 (Symmetric Functions only)

References:

1. I.N.Herstein, Topics in Algebra, Blaisdell, New York, 1964
2. M.Artin, Algebra, Prentice-Hall of India, New Delhi, 1991

MATAC02 : REAL ANALYSIS

RIEMANN STILTJES INTEGRAL:

Unit-I.

Definition and Existence of the Integral – properties of the integral – Integration and differentiation – Integration of vector valued function – rectifiable curves

Unit-II.

Uniform convergence and continuity – uniform convergence and integration - uniform convergence and differentiation – equicontinuous families of functions – The Stone Weirstrass theorem

FUNCTIONS OF SEVERAL VARIABLES

Unit-III.

Linear transformation – contraction principle – Inverse function theorem – Implicit function theorem – determinants – derivatives of higher order – differentiation of integrals

LEBESGUE MEASURE:

Unit-IV.

Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Littlewood's Theorem

Unit-V.

The Lebesgue integral of bounded functions over a set of finite measure – integral of a non – negative function – General Lebesgue Integral – convergence in measure

Text Book:

For Unit-I to III relevant chapters from : Principles of Mathematical Analysis by W. Rudin, McGraw Hill, New York, 1976

For Unit-IV and V relevant chapters from : Real Analysis by H.L. Roydon, Third Edition, Macmillan, New York, 1988.

MATAC03: ORDINARY DIFFERENTIAL EQUATIONS

Unit-I.

Linear Equations with constant coefficients – Second order Homogeneous equations – Initial value problems – Linear dependence and independence Wronskian and a formula for Wronskian – Non Homogeneous equation of order two.

Unit-II.

Homogeneous and Non – Homogeneous Equations of order n – Initial value problems – annihilator Method to solve a non – homogeneous equation – Algebra of constant coefficients operators.

Unit-III.

Linear Equations with variable coefficients - Initial value problems – Existence and Uniqueness Theorems – Solutions to a non – homogeneous equation – Wronskian and Linear dependence – reduction of the order of a homogeneous equation - Homogeneous equation with analytic coefficients – The Legendre equation.

Unit-IV.

Linear Equation with regular singular points – Euler Equation - Second order equations with regular singular points – Exceptional cases – Bessel equation.

Unit-V.

Existence and Uniqueness of solutions to first order equations – Equation with variables separated – Exact Equations – Method of successive approximations – The Lipschitz condition – convergence of the successive approximations and the existence theorem.

Text Book:

An Introduction to Ordinary Differential Equations by E.A. Coddington, Prentice Hall of India Ltd., New Delhi, 1957

MATAC04: COMPLEX ANALYSIS

Unit–I:

Introduction to the concept of analytic function: Limits and continuity – Analytic functions – Polynomials – Rational functions – Conformality: Arcs and closed curves – Analytic functions in regions – Conformal Mapping – Length and Area – Linear Transformations: The Linear group – The Cross ratio – Elementary Riemann Surfaces.

Unit-II:

Complex Integration: Line Integrals Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's theorem for a rectangle - Cauchy's theorem in a disk, Cauchy's Integral formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives Removable singularities, Taylor's Theorem – Zeros and Poles – The Local Mapping – The Maximum principle – chains and cycles.

Unit-III:

The Calculus of Residues The Residue theorem – The Argument principle – Evaluation of definite integrals. Harmonic functions: The Definitions and basic Properties – Mean value property – Poisson's Formula.

Unit-IV:

Series and Product Developments: Weierstrass Theorem – The Taylor Series – The Laurent Series – Partial fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products.

Unit-V:

The Riemann Mapping Theorem – Statement and Proff – Boundary Behaviour – Use of the reflection principle – Analytic arcs – Conformal mapping of Polygons: The Behaviour at an angle – The Schwarz – Christoffel Formula – Mapping on a rectangle.

Text Book:

Complex Analysis by L.V. Ahlfors, Mc Graw Hill, New ork, 1979.

MATAC05: PARTIAL DIFFERENTIAL EQUATIONS

Unit I:

Nonlinear Partial Differential Equations of the first order – Cauchy's method of characteristics – Compatible systems of first order equations – Charpit's method- Special types of First order equations – Jacobi's method.

Unit II:

Partial Differential Equations of Second order – The origin of Second-order Equations – Linear Partial Differential Equations with constant coefficients – Equations with variable coefficients – Characteristics curves of second –order equations- Characteristics of equations in three variables.

Unit III:

The Solution of Linear Hyperbolic Equations – Separation of variables – The Method of Integral Transforms – Nonlinear Equations of the second order.

Unit IV:

Laplace's Equation – The occurrence of Laplace's Equation in Physics- Elementary solution of Laplace's Equation – Families of Equipotential surfaces Boundary value problems – Separation of variables- Problems with axial symmetry.

Unit V:

The wave equation – The occurrence of wave equation in Physics – Elementary solutions of the one-dimensional wave equation – Vibrating Membranes: Applications of the calculus of variations – Three dimensional problems.

The Diffusion Equations: Elementary solutions of the Diffusion Equation – Separation of variables- The use of Integral transforms.

Text Book:

Elements of Partial Differential Equations by IAN N. SNEDDON, McGraw- Hill Book Company

Unit-I: Chapter 2: Section 7,8,9,10,11 and 13
Unit-II: Chapter 3: Section 1,4, 5, 6 and 7
Unit-III: Chapter 3: Sections 8,9,10 and 11
Unit-IV: Chapter 4: Sections 1,2,3,4,5 and 6
Unit-V: Chapter 5: Sections: 1,2,4 and 5, Chapter 3: Sections 3,4 and 5

MATAC06: MECHANICS

Unit-I:

INDRODUCTORY CONCEPTS: Mechanical system – Generalized Coordinates – Constraints – Virtual Work – Energy and Momentum.

Unit-II:

LAGRANGE'S EQUATIONS: Derivations of Lagrange's Equations: Derivations of Lagrange's Equations – Examples – Integrals of Motion.

Unit-III:

HAMITON'S EQUATIONS: Hamilton's Principle – Hamilton's Equations.

Unit-IV:

HAMILTON – JACOBI THEORY: Hamilton's Principle function – Hamilton – Jacobi Equation – Separability.

Unit-V:

CANONICAL TRANSFORMATIONS: Differential forms and Generating Functions – Lagrange and Poisson Brackets.

Text Book:.

Classical Dynamics by D.T.Greenwood, Prentice Hall of India Pvt.Ltd, New Delhi, 1979.

MATAC07- TOPOLOGY AND FUNCTIONAL ANALYSIS

TOPOLOGY:

Unit-I:

Spaces and Maps.

Unit-II:

Separability Axioms and Compactness.

Unit-III:

Connectedness – Pathwise connectedness – Imbedding and Extension theorems.

FUNCTIONAL ANALYSIS

Unit-IV:

Banach spaces – Definition and Examples – continuous linear transformations – Hahn Banach theorem – Natural Imbedding – open mapping theorem – conjugate of an operator.

Unit-V:

Hilbert spaces – Definition and simple properties – Orthogonal Complements – Orthonormal basis – conjugate space.

Text Book:

For Unit I-III: Introduction to Topology by S.T.Hu, Tata – McGraw Hill. New Delhi, 1979.

For Unit IV and V: Introduction to Topology and Modern Analysis by G.F.Simmons, Mc Graw Hill, New York, 1963.

MATAC08: FLUID DYNAMICS

Unit-I:

Introductory Notions- Velocity- Stream Lines and Path Lines- Stream Tubes and Filaments- Fluid Body- Density- Pressure. Differentiation following the Fluid- Equation of continuity- Boundary conditions- Kinematical and physical- Rate of change of linear momentum- Equation of motion of an inviscid fluid.

Unit-II:

Euler's momentum Theorem- Conservative forces- Bernoulli's theorem in steady motion- energy equation for inviscid fluid- circulation- Kelvin's theorem- vortex motion- Helmholtz equation.

Unit-III:

Two Dimensional Motion- Two Dimensional Functions- Complex Potential Basic singularities- source- sink- Vortex- doublet- Circle theorem. Flow past a Circular cylinder with circulation- Blasius Theorem- Lift force. (Magnus effect)

Unit-IV:

Viscous flows- Navier – stokes equations- some exact solutions of Navier Stokes equations- Flow between parallel flat plates- Couette flow- Plane Poiseuille flow- Steady flow in pipes: Flow through a pipe- The Hagen Poiseuille flow.

Unit-V:

Laminar Boundary Layer in incompressible flow: Boundary Layer concept- Boundary Layer equations- Boundary Layer along a flat plate- The Blasius solution- Shearing stress and boundary layer thickness- Displacement thickness, momentum thickness- Momentum integral theorem for the boundary layer- The Von Karman Integral relation, The Von Karman Integral relation by momentum law.

Text Books:

For Unit I and II: Theoretical Hydrodynamics' by L.M.Milne Thomson, Macmillan Company, V Edition (1968).

For Unit III-IV: Modern Fluid Dynamics' Vol-I by N.Curle and H.J.Davies, D Van Nostrand Company Ltd., London (1968).

For Unit V: Foundations of Fluid Mechanics' by S.W.Yuan, Prentice- Hall (1976).

MATAC09: MATHEMATICAL METHODS

Unit-I: FOURIER TRANSFORMS: Fourier Transforms – Defn. Inversion theorem – Fourier cosine transforms - Fourier sine transforms – Fourier transforms of derivatives - Fourier transforms of some simple functions - Fourier transforms of rational functions – The convolution integral – convolution theorem – Parseval's relation for Fourier transforms – solution of PDE by Fourier transform.
Laplace's Equation in Half plane
Laplace's Equation in an infinite strip
The Linear diffusion equation on a semi-infinite line
The two-dimensional diffusion equation.

Unit-II: HANKEL TRANSFORMS: Definition – Elementary properties of Hankel Transforms - Hankel Transforms of Derivatives of functions - Hankel Transforms of some elementary functions - The Parseval relation for Hankel transforms – Relation between Fourier and Hankel transforms – Application to PDE.
Axisymmetric Dirichlet problem for a half – space.
Axisymmetric Dirichlet problem for a thick plate

Unit-III: INTEGRAL EQUATIONS: Types of Integral equations – Equation with separable kernel - Fredholm Alternative Approximate method – Volterra integral equations – Classical Fredholm theory – Fredholm's First, Second, Third theorems.

Unit-IV: Application of Integral equation to ordinary differential equation – initial value problems – Boundary value problems – singular integral equations – Abel Integral equation

Unit-V: CALCULUS OF VARIATIONS: Variation and its properties – Euler's equation – Functionals of the integral forms Functional dependent on higher order derivatives – functionals dependent on the functions of several independent variables – variational problems in parametric form.

Text Books:

For Unit I and II: The Use of Integral Transforms by I.N.Sneddon, Tata Mc Graw Hill, New Delhi, 1974.
For Unit III and IV: Linear Integral Equations Theory and Technique by R.P.Kanwal, Academic Press, New York, 1971.
For Unit V: Differential Equations and Calculus of Variations – by L.Elsgolts, Mir Publishers, Moscow, 1970.

MATAC10 - NON LINEAR DIFFERENTIAL EQUATIONS

Unit-I:

First order systems in two variables and linearization: The general phase plane-some population models – Linear approximation at equilibrium points – Linear systems in matrix form.

Unit-II:

Averaging Methods: An energy balance method for limit cycles – Amplitude and frequency estimates – slowly varying amplitudes – nearly periodic solutions - periodic solutions: harmony balance – Equivalent linear equation by harmonic balance – Accuracy of a period estimate.

Unit-III:

Perturbation Methods: Outline of the direct method – Forced Oscillations far from resonance - Forced Oscillations near resonance with Weak excitation – Amplitude equation for undamped pendulum – Amplitude Perturbation for the pendulum equation – Lindstedt's Method – Forced oscillation of a self – excited equation – The Perturbation Method and Fourier series.

Unit-IV:

Linear Systems: Time Varying Systems – Constant coefficient System – Periodic Coefficients – Floquet Theory – Wronskian.

Unit-V:

Stability: Poincare stability – solutions, paths and norms – Liapunov stability Stability of linear systems – Comparison theorem for the zero solutions of nearly – linear systems.

Text Book:

Nonlinear Ordinary Differential Equations By D.W.Jordan, & P.Smith, Clarendon Press, Oxford, 1977.

References:

1.Differential Equations by G.F.Simmons, Tata McGraw Hill, NewDelhi (1979)

2.Ordinary Differential Equations and Stability Theory By D.A.Sanchez, Freeman (1968).

3.Notes on Nonlinear Systems by J.K.Aggarwal, Van Nostrand, 1972.

MATAC11: 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 - Linear time varying systems – Perturbed linear systems – Nonlinear systems

Unit-IV:

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

Unit-V:

OPTIMAL CONTROL: Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Nonlinear Systems

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.

MATAE01: NUMERICAL METHODS

Unit-I:

SOLUTION OF NONLINEAR EQUATIONS: Newton's method – Convergence of Newton's method – Bairstow"s Method for quadratic factors NUMERICAL DIFFERENTIATION AND INTEGRATION: Derivatives from Differences tables – Higher order derivatives – Divided difference, Central-Difference formulas – Composite formula of Trapezoidal rule – Romberg integration – Simpson's rules.

Unit-II:

SOLUTION OF SYSTEM OF EQUATIONS: The Elimination method – Gauss and Gauss Jordan methods – LU Decomposition method – Matrix inversion by Gauss-Jordan method – Methods of Iteration – Jacobi and Gauss Seidal Iteration – Relaxation method – Systems of Nonlinear equations.

Unit-III:

SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Taylor series method – Euler and Modified Euler methods – Rungekutta methods – Multistep methods – Milne's method – Adams Moulton method.

Unit-IV:

BOUNDARY VALUE PROBLEMS AND CHARACTERISTIC VALUE PROBLEMS: The shooting method – solution through a set of equations – Derivative boundary conditions – Characteristic value problems – Eigen values of a matrix by Iteration – The power method.

Unit-V:

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: (Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations) Representation as a difference equation – Laplace's equation on a rectangular region – Iterative methods for Laplace equation – The Poisson equation – Derivative boundary conditions – Solving the equation for time-dependent heat flow (i) The Explicit method (ii) The Crank Nicolson method – solving the wave equation by Finite Differences.

Text Book:

APPLIED NUMERICAL ANALYSIS' by C.F.Gerald and P.O.Wheatley, Fifth Edition, Addison Wesley, (1998).

MATAE02: COMPUTER PROGRAMMING AND LAB I

THEORY(50 Marks)

Unit-I:
Fortran 77 – Representation of Integer and Real constants – Variable names – Arithmetic operators and modes for Expression – Integer Expressions. Real Expressions – Hierarchy of Operations in Expressions – Arithmetic statement – Defining Variables – Mixed Mode Expressions – Special Functions – Input Output statements.

Unit-II:
Format description for Read statement – Format description for print statement – multi record formats – Hollerith field declaration – specifications in a Format – Generalized input / output statements – Logical constants, variables and Logic Expressions.

Unit-III:
Control statements – Relational Operator – Logical IF statement – GO TO Statements – Nested Logical IF statement – Arithmetic IF statement – computed GOTO statement.

Unit-IV:
The DO Statement – Rules to be followed in Utilizing Do Loops – RRPEAT WHILE structure – Subscripted Variables – Subscript Expressions – Dimension statement – DO loops with subscripts.

Unit-V:
Functions and subroutines – Function subprograms – Subroutines – Common declaration – Implicit declaration – Equivalence declaration.

Text Book:

Computer Programming in Fortran 77 by V.Rajaraman, 3rd Edition, Prentice Hall (1988).

COMPUTER PROGRAMMING AND LAB -I
PRACTICALS (50 Marks)
LIST OF PRACTICALS

(Big questions – marked with * marks and small questions – without * marks)

Obtaining the root of a transcendental equation by Newton-Raphson Method.
*Solving a system of linear equations by Cramer's rule.

*Solving a system of linear equations by Gauss – elimination

*Obtaining the matrix inversion by Gauss Jordan method
*Solving a set of simultaneous linear equations by Jacobi Iteration Method.

*Solving a set of simultaneous linear equations by Gauss Seidal Iteration Method.

*Finding the eigenvalues and eigenvectors of a matrix.

*Interpolation using Newton forward difference formula.

*Interpolation using Newton backward difference formula.

Single Integration by Trapezoidal rule.

Single Integration by Simpson's 1/3 rule.

Single Integration by Simpson's 3/8 rule.

Solving ODE by Euler's Method.

Solving ODE by Second order Runge-Kutta Method.

Solving ODE by fourth order Runge-Kutta Method.

Solving ODE by Predictor-Corrector method.

Multiplication of two matrices.

Obtaining the trace of a matrix.

Pattern:
One question may be asked from the above list which are marked with asterisk(*) Marks.
OR
Two questions can be asked from the above list of questions without asterisk(*) Marks.

BOOKS FOR REFERENCE:

1. Computer and Computing with Fortran 77 by S.S. Alam & S.K.Sen. Oxford and IBH Publishing Pvt.Ltd., New Delhi (1988).
2. Numerical Algorithms – Computations in Science and Engineering – by E.V.Krishnamurthy & S.K.Sen, Affiliated East-West Press Pvt.Ltd., (1986)
3. Applied Numerical Analysis – By C.F.Gerald & P.O.Wheatley, Fifth Edition, Addison- Wesley Publishing Co., 1998.

MATAE03 - COMPUTER PROGRAMMING AND LAB II

THEORY(50 Marks)

Unit-I:
Overview of C – Constants. Variables and Data Types – Character set – C tokens – Keywords & Identifiers – constants – variables – Data types – Declaration of variables – Assigning values to variables – Defining symbolic constants.

Unit-II:
Arithmetic of operators – Relational operators – Logical operators – Assignment operator – Increment and decrement operators – conditional operator – Bitwise operators – special operators – Arithmetic Expressions – Evaluation of Expressions – Precedence of arithmetic operators – Type conversions in Expressions – Operator Precedence and Associativity – Mathematical Functions.

Unit-III:
Managing Input and Output operators – Reading a character – Writing a character – formatted input - formatted output – Decision making IF statement – IF – ELSE – statement – Nesting of IF ELSE statements – The Switch statement – The GO TO statement.

Unit-IV:
The WHILE statement DO statement – FOR statement –Jumps in Loops – One-dimensional Array – Two dimensional Arrays – Initializing two dimensional arrays - Multidimensional arrays.

Unit-V:
Need for User defined functions – A multi-function program – the form of C Functions – Return Values and their Types calling a function – Category of functions – Arguments but no return values - Arguments with return values In file management in C – Defining and with return values - In file management in C – Defining and opening a file – closing a file- Input / Output operations on files.

Text Book:

Programming in ANSI C – by E. Balagurusamy, 2nd Edition, Tata Mc Graw Hill (1992).

COMPUTER PROGRAMMING AND LAB II
PRACTICALS (50 Marks)
LIST OF PRACTICALS

(Big Questions – marked with * marks & small questions without * marks)
Program for reversing an integer
Program for generating Fibonocci numbers

* Solving a quadratic equation for all types of roots

Obtaining the root of an equation by bisection method

Obtaining the root of an equation by False – position method

* Obtaining the root of a transcendental equation by Newton – Raphson method

Obtaining the Transpose of a matrix

Finding the determinant of a matrix

Program for multiplication of two matrices of type mxn and nxp

*Determining the Eigenvalues & Eigenvectors of a symmetric matrix.

Programming for polynomial Interpolation

*Single Integration by Trapezoidal rule.

*Single Integration by Simpson's 1/3 rule.

*Solving ODE using second order Runge-Kutta Method.

*Solving ODE using fourth order Runge-Kutta Method.

*Solving set of simultaneous linear equations by Jacobi Iteration Method.

*Solving set of simultaneous linear equations by Gauss elimination Method.

One question may be asked from the above list which are marked with asterisk (*) Marks.
OR
Two questions can be asked from the above list of questions without asterisk (*) Marks.

References:

1. Computer Programming in C – by V.Rajaraman, Eastern Economy Edition, Second Printing (1995).
2. Programming in ANSI C – by E. Balagurusamy, 2nd Edition, Twentieth Reprint, Tata McGraw Hill Publishing Co., Ltd., New Delhi (1998).
3. Applied Numerical Analysis – by C.F. Gerald & P.O. Wheatley, Fifth Edition – Addition Wesley Publishing Co., (1994)

Compulsory Diploma in Mathematical Software

Paper 1	**Latex**	**100**
Paper 2	**Matlab**	**100**
Paper 3	**Mathematica**	**100**
Paper 4	**Practicals**	**100**

PAPER – I
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.

PAPER – II

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

PAPER – III

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

PAPER IV

PRACTICALS

Implementing the Algorithms of any one of the software in Papers I to III above.

SUPPORTIVE: APPLIED MATHEMATICS – I

UNIT I: ORDINARY DIFFERENTIAL EQUATIONS

Second and higher order linear ODE – Homogeneous linear equations with constant and variable coefficients – Nonhomogeneous equations – Solutions by variation of parameters.

UNIT II: FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives – Total differential – Taylor's expansions – Maxima and Minima of functions – Differentiation under integral sign.

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS

Formation of PDE by elimination of arbitrary constants and functions – Solutions – General and singular solution- Lagrange's Linear equation – Linear PDE of second and higher order with constant coefficients.

UNIT IV: FOURIER SERIES

Dirichlet's conditions – General Fourier series – Half range Sine and Cosine series – Parseval's identity – Harmonic Analysis.

UNIT V: BOUNDARY VALUE PROBLEMS

Classifications of PDE – Solutions by separation of variables - One dimensional heat and wave equation.

Reference books:

1. Kreyszig, E., "Advanced Engineering Mathematics" (8^{th} Edition), John Wiley and Sons, (Asia) Pte Ltd., Singapore, 2000.
2. Grewal, B.S., Higher Engineering Mathematics, Thirty Eighth Edition, Khanna Publishers, Delhi 2004.

SUPPORTIVE: APPLIED MATHEMATICS - II

UNIT I: LAPLACE TRANSFORM

Transform of elementary functions – Transforms of derivatives and integrals – Initial and final value theorems – Inverse Laplace transform – Convolution theorem – Solutions of linear ODE with constant coefficients.

UNIT II: FOURIER TRANSFORMS

Fourier integral theorem – Fourier transform pairs– Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III: MULTIPLE INTEGRALS

Double integration – Cartesian and polar co-ordinates – Change of order of integration – Area as a double integral – Triple integration – Volume as a triple integral.

UNIT IV: VECTOR CALCULUS

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem, Gauss divergence theorem and Stoke's theorem.

UNIT-V: NUMERICAL SOLUTIONS OF ODEs

Solution by Taylor's series Method - Euler's Method – Modified Euler Method, Runge-Kutta Method – Solving simultaneous equations.

Reference books:

1. Kreyszig, E., "Advanced Engineering Mathematics" (8^{th} Edition), John Wiley and Sons, (Asia) Pte Ltd., Singapore, 2000.
2. Grewal, B.S., Higher Engineering Mathematics, Thirty Eighth Edition, Khanna Publishers, Delhi 2004.