BHARATHIAR UNIVERSITY

Coimbatore – 641046

DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. Mathematics with Computer Applications

(For the Candidates admitted during the academic year **2018-2019 onwards**)

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046

DEPARTMENT OF APPLIED MATHEMATICS (DAM)

M.SC., MATHEMATICS WITH COMPUTER APPLICATIONS

ELIGIBILITY CONDITIONS FOR STUDENTS

(For the Candidates admitted during the academic year **2018-2019 onwards**)

Eligibility Conditions for Admission to the Programme: M.Sc. Mathematics with Computer Applications

A candidate who has passed the Degree Examination **in B.Sc. (Mathematics) or B.Sc. Mathematics (CA)** of this University or an examination of some other University accepted by the Syndicate as equivalent there to shall be eligible for admission to the **Master Degree in Mathematics (CA)** of this University.

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046

DEPARTMENT OF APPLIED MATHEMATICS (DAM)

M.SC., MATHEMATICS WITH COMPUTER APPLICATIONS

VISION:

- To provide a quality education in Mathematics with Computer Applications to widen the horizon of knowledge and to encourage high level research.

MISSION:

- To impart with strong mathematical background, abstract understanding, analytical and computational skills, which enable to face the changing scenario and to handle any industrial and research problems.
- To develope knowledge and a passion for science towards the needs concern for the society.

PROGRAM EDUCATIONAL OBJECTIVES:

Master of Science in Mathematics (CA) curriculum for full-time is designed to engross the post graduates having attitude and knowledge to

1. cultivate a mathematical attitude and nurture the interests.
2. impart training with a view to create competent and motivated academicians.
3. equip with more technological skills and scientific computing techniques based on mathematical methods.

PROGRAMME OUTCOMES

The post graduates will have the ability to

A. understand the concepts of Analysis, Algebra, Differential equations, able to solve the problems using Numerical methods and also with C++.

B. identify and solve the problems in Partial differential equations, Mechanics and able to write programs using the software Matlab.

C. understand the concepts of Topology, Functional analysis and Fluid dynamics and their applications in the industrial areas.

D. self-learning and updating with advanced technological challenges of Computer Science and Mathematics at the local level and to remain globally competitive.

DEPARTMENT OF APPLIED MATHEMATICS (DAM)
M.Sc., MATHEMATICS WITH COMPUTER APPLICATIONS

Scheme of Examination

Sem	Code No.	Subject	Class Hours	University Examination			
				Internal (%)	External (%)	Total	Credit
I	MATBC1	Algebra	5	25	75	100	4
	MATBC2	Real Analysis	5	25	75	100	4
	MATBC3	Ordinary Differential Equations	5	25	75	100	4
	MATBC4	Programming in C++	3	12	38	50	2
	MATBC4P	Practical I: Programming in C++	3	12	38	50	2
		Elective – I	4	25	75	100	4
		Supportive – I	2	12	38	50	2
II	MATBC5	Complex Analysis	5	25	75	100	4
	MATBC6	Partial Differential Equations	5	25	75	100	4
	MATBC7	Mechanics	5	25	75	100	4
	MATBC8	Java Programming	3	12	38	50	2
	MATBC8P	Practical II : Java Programming	3	12	38	50	2
		Elective II	4	25	75	100	4
		Supportive – II	2	12	38	50	2
III	MATBC9	Topology	5	25	75	100	4
	MATBC10	Fluid Dynamics	5	25	75	100	4
	MATBC11	Operations Research	5	25	75	100	4
	MATBC12	Mathematical Softwares	3	12	38	50	2
	MATBC12P	Practical III :Mathematical Softwares	3	12	38	50	2
		Elective- III	4	25	75	100	4
		Supportive – III	2	12	38	50	2
IV	MATBC13	Functional Analysis	5	25	75	100	4
	MATBC14	Mathematical Methods	5	25	75	100	4
	MATBC15	Oracle	3	12	38	50	2
	MATBC15P	Practical IV: Oracle	3	12	38	50	2
		Elective- IV	4	25	75	100	4
	MATBP	Project, Viva-Voce	8	---	---	200	8
Total Marks: 2250			**Credits: 90**				

As per UGC (Credit Framework for Online Learning Courses through **SWAYAM**) Regulation 2016, it is encouraged the use of SWAYAM (Study Web of Active Learning by Young and Aspiring Minds) platform. Based on the availability of relevant courses on SWAYAM, students shall choose an online courses from **Course era, NPTEL, MOOC, Udacity**, etc. as extra credit (without marks) courses.
On submission of the valid course certificate before the completion of the programme, it can be added to the marksheets.

ELECTIVE AND SUPPORTIVE COURSES

Code No.	Subject	Class Hours	University Examination			
			Internal (%)	External (%)	Total	Credit
ELECTIVE COURSES						
MATBE1	Numerical Methods	4	25	75	100	4
MATBE2	Discrete Mathematics	4	25	75	100	4
MATBE3	Number theory and Cryptography	4	25	75	100	4
MATBE4	Fuzzy sets and Fuzzy logic	4	25	75	100	4
MATBE5	Stochastic Processes	4	25	75	100	4
MATBE6	Mathematical Statistics	4	25	75	100	4
MATBE7	Fundamentals of Actuarial Mathematics	4	25	75	100	4
MATBE8	Magneto hydrodynamics	4	25	75	100	4
SUPPORTIVE COURSES						
GS01	Numerical Methods	2	12	38	50	2
GS45	Differential Equations and Transforms	2	12	38	50	2

Title of the subject : **ALGEBRA** No. of Credits: **4**

Code No. : **MATBC1** No. of Teaching Hours: **5**

Course Objectives:

The student should be made to:

- introduce the general concepts in Algebra and related theorems.

UNIT I: GROUP THEORY

Permutation Groups – Another counting principle – Sylow's theorem.

UNIT II: RING THEORY

Euclidean rings – A particular Euclidean ring – Polynomial rings – Polynomials over the rational field.

UNIT III: FIELDS

Extension Fields – Roots of polynomials.

UNIT IV: FIELDS

Elements of Galois Theory.

UNIT V: LINEAR TRANSFORMATIONS

Characteristic roots – Trace and Transpose – Hermitian, unitary and normal Transformations.

TEXT BOOK:

- I.N.Herstein, "Topics in Algebra", II Edition.

REFERENCE BOOKS:

- J.B.Fraleigh, "A First Course in Abstract Algebra", Narosa Publishing House, New Delhi, 1988.
- M.Artin, "Algebra, Prentice-Hall", Englewood Cliff, 1991.
- T.W.Hungerford, "Algebra", Springer, New York, 1974.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 - understand concept of Cauchy's theorem, Sylow's theorem, Rings, fields, linear transformations, trace & transpose.

Course prepared by : Dr. S. Narayanamoorthy.

Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : **REAL ANALYSIS** No. of Credits: **4**

Code No. : **MATBC2** No. of Teaching Hours: **5**

Course Objectives:

The student should be made to:

- have a detailed study of continuity, uniform continuity, differentiability Riemann Stieltjes integral and the calculus on $\mathbb{R}_n$.
- know about convergence of sequences and Lebesgue Measure and Integration.

UNIT I: RIEMANN STIELTJES INTEGRAL

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.

UNIT III: FUNCTIONS OF SEVERAL VARIABLES

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

UNIT IV: MEASURE ON THE REAL LINE

Introduction - Lebesgue outer measure - measurable sets - Borel sets - regular measure - Lebesgue measurable function – Borel measurable function.

UNIT V: INTEGRATION OF NON-NEGATIVE FUNCTIONS

Lebesgue integral- Fatou's lemma- Lebesgue monotone convergence theorem - Lebesgue Dominated convergence theorem – Riemann and Lebesgue integrals.

TEXT BOOKS:

- W.Rudin, "Principles of Mathematical Analysis", II Edition, McGraw Hill, New York, 1976.
- G.De.Barra, "Measure theory and Integration", E.Horwood Publishing company, 1981.

REFERENCE BOOK:

- H.L.Roydon, "Real Analysis", Third Edition, Macmillan Company, New York, 1988.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 - understand the concept of analysis which is the motivating tool in other area such as Applied Mathematics.

Course prepared by : Dr. S. Narayanamoorthy.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : **ORDINARY DIFFERENTIAL EQUATIONS** No. of Credits: **4**

Code No. : **MATBC3** No. of Teaching Hours: **5**

Course Objectives:

The student should be made to:

- introduce the basic theory of ordinary differential equations and apply to dynamical problems of practical interest.

UNIT I: LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS

The second order homogeneous equations – Initial value problems – Linear dependence and independence - A formula for the Wronskian – The non-homogeneous equation of order two.

UNIT II: HOMOGENEOUS AND NON-HOMOGENEOUS EQUATIONS OF ORDER 'n'

Initial value problems – A special method for solving the non–homogeneous equation – Algebra of constant coefficient operators.

UNIT III: LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS

Initial value problems for the homogeneous equation - Solutions of the homogeneous equation - The Wronskian and linear independence - Reduction of the order of a homogeneous equation - Homogeneous equation with analytic coefficients – The Legendre equation.

UNIT IV: LINEAR EQUATIONS 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 OREDER EQUATIONS

Equation with variables separated – Exact equations – The method of successive approximations – The Lipschitz condition – Convergence of the successive approximations.

TEXT BOOK:

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

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – gain knowledge about Second order linear equations, Legendre equation and Bessel equations etc., which provides the essential motivation in Applied Mathematics.

Course prepared by : Dr. S. Narayanamoorthy.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : **PROGRAMMING IN C++ (Theory)** No. of Credits: **2**

Code No. : **MATBC4** No. of Teaching Hours: **3**

Course Objectives:

The student should be made to:

- Provide an insight to theoretical computer science and to get across to the notion of effective computability using programming in C++.

UNIT I: PRINCIPLES OF OBJECT-ORIENTED PROGRAMMING

Software crisis – Software evolution – A look at procedure-oriented Programming – Object-oriented Programming Paradigm – Basic Concept of Object-Oriented Programming – Inheritance – Polymorphism – Benefits of OOP – Object-Oriented languages – Applications of OOP.

UNIT II: TOKENS, EXPRESSIONS AND CONTROL STRUCTURE

Introduction – Tokens – Keywords – Identifiers and constants – basic data types – User defined data types - Derived data types – Symbolic constants – Type compatibility – Declaration of variables – Dynamic insulation of variables – Reference variables – operations in C++ - Scope resolution operator – member Dereferencing operators – memory management operators – Manipulators – type cast operator – expressions and their types– Special assignment expressions – implicit conversions – operator overloading – operator precedence – Control structures.

UNIT III: FUNCTIONS IN C++

Introduction – The main function – Function prototyping – call by reference – return by reference inline functions – default arguments – constant arguments – function overloading – friend and virtual functions – Math library functions. Managing Console I/O operations: Introduction – C++ streams – C++ stream classes – Unformatted I/O operations – Formatted I/O operations – Managing output with manipulators.

UNIT IV: CLASSES AND OBJECTS

Introduction – C Structures Revisited – Specifying a class – Defining Member Functions – A C++ Program with class – Making an outside Function Inline – Nesting of Member Functions – Private Member Functions – Arrays within a class – Memory Allocation for Objects – Static Data Members – Static Member Functions – Arrays of Objects – Objects as Function Arguments-Friendly functions-Returning Objects-Constant Member Functions**.**

UNIT V: OPERATOR OVERLOADING AND TYPE CONVERSIONS

Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators Using Friends – manipulating of strings Using Operators – Rules of Overloading Operators. Inheritance and Extending Classes: Introduction – Defining Derived Classes – Single inheritance – Making a Private Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance.

TEXT BOOK:

- E. Balaguruswamy, “Object Oriented Programming with C++”, Tata McGraw-Hill Publishing Company limited, 1999.

REFERENCE BOOKS

- Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley, 1999.
- Herbert Schildt, "C++ – The Complete Reference", Tata McGraw Hill, 1998.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – understand the basic concepts of Oops.
CO 2 – know fundamentals of C++ programming language.

Course prepared by : Dr. S. Narayanamoorthy.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : **PRACTICAL I: PROGRAMMING IN C++** No. of Credits: **2**

Code No. : **MATBC4P** No. of Teaching Hours: **3**

Course Objectives:

The student should be made to:

- Provide an effective computability, using programming in C++.

Course Content:

1. Transpose of a Matrix
2. Obtaining Eigen value and Eigen vector of a matrix
3. Solving a Transcendental equation using Newton Raphson Method
4. Solving a set of Simultaneous Equations by Gauss Elimination Method
5. Solving a set of Simultaneous Equations by Gauss Jacobi Method
6. Integration using Trapezoidal Rule
7. Solving First order ODE using Second order Runge-Kutta Method

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – know fundamentals of C++ programming language with the means of writing efficient, maintainable and portable code in Numerical Problems.

Course prepared by : Dr. S. Narayanamoorthy.

Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : **COMPLEX ANALYSIS** No. of Credits: **4**

Code No. : **MATBC5** No. of Teaching Hours: **5**

Course Objectives:

The student should be made to:

- Understand the fundamental concepts of complex variable theory.
- Acquire the skill of contour integration to evaluate complicated real integrals by residue calculus.

UNIT I: ANALYTIC FUNCTION

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 conformal mappings: Elementary Riemann surfaces.

UNIT-II:FUNDAMENTAL THEOREMS

Line integrals rectifiable arcs – Line integrals as functions of arcs – Cauchy's theorem for a rectangle - Cauchy's theorem in a disk. 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

Definition and basic properties – The mean-value property –Poisson's formula.

UNIT-IV: POWER SERIES EXPANSIONS

Weierstrass theorem – The Taylor series – The Laurent series.

PARTIAL FRACTIONS AND FACTORIZATION

Partial fractions – Infinite products – Canonical products.

UNIT-V: MAPPING

The Riemann mapping theorem: Statement and proof – Boundary behavior – Use of the reflection principle – Analytic arcs – Conformal mapping of polygons: The behavior at an angle– The Schwarz – Christoffel formula – Mapping on a rectangle.

TEXT BOOK:

*"*Complex Analysis*",* L.V. Ahlfors , Third Edition, McGraw-Hill, New York, 1979.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 - work with functions (polynomials, reciprocals, exponential, trigonometric, hyperbolic, etc) of single complex variable and describe mappings in the complex plane.

CO2 - examine the theory and illustrate the applications of the calculus of residues in the evaluation of integrals.

Course prepared by : Dr.M.MuthtamilSelvan.

Course verified by : Dr.P.Dhanalakshmi.

Title of the subject: **PARTIAL DIFFERENTIAL EQUATION** No. of Credits: **4**

Code No. : **MATBC6** No. of Teaching Hours: **5**

Course Objectives:

The student should be made to:

- Solve nonlinear Partial Differential equations by different methods.
- Understand some physical problems in Engineering that results in 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 –Characteristic curves of second–order equations-Characteristics of equations in three variables.

UNIT III: HYPERBOLIC EQUATION

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:

- I. N. Sneddon, *"Elements of Partial Differential Equations",* McGraw-Hill Book Company, Singapore, 1957.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 - solve linear partial differential equations, by using elementary methods.

CO2 – analyze and solve complex problems using partial differential equations as functional and analytical tools.

CO3 - apply problem-solving with partial differential equations to diverse situations in physics engineering and other mathematical contexts.

Course prepared by : Dr.M.MuthtamilSelvan.

Course verified by : Dr.P.Dhanalakshmi

Title of the subject : **MECHANICS** No. of Credits: **4**

Code No. : **MATBC7** No. of Teaching Hours: **5**

Course Objectives:

The student should be made to:

- Present the state of the area of mechanical system with its generalized coordinates and constraints.
- Analyze equations of Lagrange and Hamilton.

UNIT I: **INDRODUCTORY CONCEPTS**

The mechanical system – Generalized coordinates – Constraints – Virtual work – Energy and momentum.

UNIT II: **LAGRANGE'S EQUATIONS**

Derivations of Lagrange's equations- Examples –Integrals of the motion.

UNIT III: **HAMILTON'S EQUATIONS:**

Hamilton's principle – Hamilton's equations.

UNIT IV: **HAMILTON – JACOBI THEORY**

Hamilton's principal function –The Hamilton – Jacobi equation – Separability.

UNIT V: **CANONICAL TRANSFORMATIONS**

Differential forms and generating functions – Lagrange and Poisson brackets.

TEXT BOOK:

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

REFERENCE BOOK:

- H. Goldstein, C. Poole & J. Safko ,"*Classical Mechanics*" , Pearson Education, Inc., New Delhi, 2002.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO1 - understand the concepts of stress mechanical system and its generalized coordinates.

CO2 - know the analysis made on equations which are derived from the equation of continuity.

Course prepared by : Dr.M.MuthtamilSelvan.

Course verified by : Dr.P.Dhanalakshmi.

Title of the subject : **JAVA PROGRAMMING (Theory)** No. of Credits: **2**

Code No. : **MATBC8** No. of Teaching Hours: **3**

Course Objectives:

The student should be made to:

- Understand fundamentals of object oriented programming paradigm with thread and Applet concepts.

UNIT I: OBJECT ORIENTED PROGRAMMING

Basic concepts of object oriented programming – benefits & applications of OOP. JAVA evolution: Java features – Java and C – Java and C++ - Java and Internet.

OVERVIEW OF JAVA LANGUAGE:

Introduction - implementation of java program – creating, compiling, running the program, JVM.

UNIT II:

Data Types– operators and Expressions – Strings, Arrays– Branching: Decision making with if statement, if…else statement, nesting if…else statements, the else if ladder, switch statement. Looping: The while statement, do statement, for statement- additional features of for loop: nesting of for loops; jumps in loops – jumping out of a loop; skipping a part of loop; labeled loops

UNIT III: CLASSES AND OBJECTS

Introduction; adding variables, creating and adding methods, constructors, overloading; Inheritance – defining a subclass, multilevel inheritance, hierarchical inheritance, overriding methods, visibility control, rules of thumb.

UNIT IV: PACKAGES AND MULTITHREADED PROGRAMMING

Creating threads, extending the thread class- implementing the run() method, starting new thread stopping and blocking a thread- life cycle of a thread – new born state, running state, blocked state, dead state.

UNIT V:APPLET

Basics – Architecture – Passing parameters to Applets – Skeleton – simple Applet – AWT.

REFERENCE BOOKS:

- Ken Arnold, James Gosslings , “The JAVA Programming Language”.
- Matthew siple ,“The Complete Guide to JAVA Database Programming”, TMH.
- E.Balagurusamy ,“Programming with JAVA a Primer”, TMH.
- Koparkar ,“JAVA For you”, TMH.
- Herbert Schildt,“The Complete Reference - Java 2.0”, Fourth Edition, TATA McGraw Hill.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO1 – use the characteristic of an Oops.

CO1 – familiar with multithreaded programming and simple Applet.

Course prepared by : Dr.M.MuthtamilSelvan.

Course verified by : Dr.P.Dhanalakshmi.

Title of the subject : **PRACTICAL II: JAVA PROGRAMMING** No. of Credits: **2**

Code No. : **MATBC8P** No. of Teaching Hours: **3**

Course Objectives:
The student should be made to:

- enhance problem solving and programming skills in java with extensive programming projects

Course Content:

1. Mathematical Operations
2. Matrix Manipulation
3. Student Mark list using Multilevel Inheritance
4. Employee details using Multiple Inheritance
5. Packages
6. Constructors
7. Thread
8. Thread using runnable interface
9. Applet
10. Displaying different shapes using Applet

Course Outcomes:
On successful completion of the course, the students will be able to:

CO1 - use the characteristics of an object-oriented programming language.

CO2- program using Java features such as composition of objects, Operator overloading, inheritance, polymorphism etc.

Course prepared by : Dr.M.MuthtamilSelvan.

Course verified by : Dr.P.Dhanalakshmi.

Title of the subject : **TOPOLOGY** No. of Credits: **4**
Code No. : **MATBC9** No. of Teaching Hours: **5**

Course Objectives:

The student should be made to:

- Introduce the fundamental concepts of topology and investigate properties of topological spaces.

UNIT I: TOPOLOGICAL SPACES

Basis for a Topology – The Order Topology– The product Topology on X x Y- The Subspace Topology- Closed Sets and Limit Points.

UNIT II : CONTINUOUS FUNCTIONS

The Product Topology – The Metric Topology .

UNIT III : CONNECTEDNESS AND COMPACTNESS

Connected Spaces – Connected sets in R-Components and Path Components – Local Connectedness – Compact Spaces – Limit Point Compactness– Local Compactness.

UNIT IV: COUNTABILITY AND SEPARATION AXIOMS

Countability Axioms–Separation Axioms-Urysohn's Lemma–Urysohn Metrization Theorem.

THE TYCHONOFF THEOREM:

The Tychonoff Theorem – Completely Regular spaces – The Stone-Cech Compactification.

UNIT V: COMPLETE METRIC SPACES

Compactness in Metric Spaces- A space-Filling Curve – Pointwise and Compact Convergence –The Compact –Open Topology .

TEXT BOOK:

- James R.Munkres, "Topology A First Course", Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

REFERENCE BOOKS:

- J.Dugundji, Allyn and Bacon,"Topology",Prentice Hall of India Pvt. Ltd. 1966.
- George F. Simmons," Introduction to Topology and Modern Analysis", McGraw-Hill Book Company,1963.
- , by
- J.L.Kelley and Van Nostrand," General Topology", Reinhold Co.,New York,1995.
- L.Steen and J.Seebach, Holt,Rinehart and Winston, "Counter examples in Topology", New York,1970.
- R.Engelking, "General Topology", Polish Scientific Publishers,Warszawa,1977.
- Sze – Tsen Hu, "Elements of General Topology", Holden – Day,Inc.1965.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 –know the various topological properties of sets

CO 2 – know the properties of continuous functions on different topological spaces

CO 3 –connected and compact topological spaces and its properties

CO 4 –various theorems on normal spaces and complete metric spaces

Course prepared by : Dr.N.Sakthivel.
Course verified by : Dr.P.Dhanalakshmi.

Title of the Subject : **FLUID DYNAMICS** No.of Credits **: 4**

Code No. **: MATBC10** No. of Teaching hours**: 5**

Course Objectives:

The student should be made to:

- introduce fundamental aspects of fluid flow behavior.

UNIT I : BERNOULL'S EQUATION

Introductory Notions – Velocity- Stream Lines and Path Lines- Stream Tubesand 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: EQUATIONS OF MOTION

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 Potential Functions- Complex Basic singularities-Source-Sink-Vortex-Doublet-past a circle theorem-Flow 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:

- L.M.MilneThomson,"Theoretical Hydrodynamics" , MacmillanCompany, V Edition (1968).
- N.Curle and H.J.Davies,"Modern Fluid Dynamics", Vol-I, DVanNostrand Company Ltd., London (1968).
- S.W.Yuan, "Foundations of Fluid Mechanics", Prentice -Hall (1976).

REFERENCE BOOKS:

- Frank Chorlton, "Fluid Dynamics", CBS Publishers & Distributors, 2004.
- E.Karuse, "Fluid Mechanics with Problems and Solutions", Springer, 2005.
- R.W.Fox and A.T.McDonald, "Introduction to Fluid Mechanics", Wiley, 1985.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO1 - identify how properties of fluids change with temperature and their effect on pressure and fluid flow.

CO2-use the general energy equation to calculate changes in fluid flow for circular and non-circular pipes for in-compressible fluids.

Course prepared by :N.Sakthivel.
Course verified by :Dr.P.Dhanalakshmi.

Title of the Subject: **OPERATIONS RESEARCH** No.of Credits **: 4**
Code No. **: MATBC11** No. of Teaching hours **:5**

Course Objectives:

The student should be made to:

- impart the mathematical modelling skills through different methods of optimization.

UNIT I : THE SIMPLEX METHOD AND SENSITIVITY ANALYSIS

Introduction to L.P. – Graphical L.P. Solution – Sensitivity analysis – Simplex Method –L.P. solution space in equation form – Transition from graphical to Algebra solution – The simplex method – artificial starting solution – Special cases in Simplex method applications.
DUALITY: Primal and Dual – relationships – additional simplex algorithm for L.P.

UNIT II: ADVANCED LINEAR PROGRAMMING

Generalized simplex Tableau in matrix form –Decomposition algorithm – Matrix definition of dual problem – optimal dual solution.

UNIT III :INTEGER LINEAR PROGRAMMING AND DETERMINISTIC DYNAMIC PROGRAMMING

Integer Programming – Integer Programming algorithm – Gomory cutting plane algorithm – Branch and Bound algorithm - Solution of the Traveling salesperson problem Deterministic Dynamic programming – Recursive nature of computation in D.P. – Forward and Backward recursion.

UNIT IV: CLASSICAL OPTIMIZATION THEORY

Unconstraint problems – Necessary and sufficient conditions – The Newton-Raphson method – constraint problems – Equality constraints (Jacobi method and Lagrangian method).

UNIT V: NONLINEAR PROGRAMMING ALGORITHMS

Non-linear programming – unconstrained algorithms - Direct search method – Gradient method – constraint algorithms – Separable programming – Quadratic programming.

TEXT BOOK

- Hamdy A Taha,"Operations Research" (Seventh Edition),Prentice Hall of India Private Limited, New Delhi (2004).

REFERENCE BOOKS

- J.K Sharma, "Operations Research: Theory and Application", six edition, Laxmi publication Pvt.Ltd,New Delhi 2016.
- KantiSwarup, "Operations Research", Man Mohan and P.K Gupta,Sultan Chand and Sons, New Delhi 2004.

Course Outcomes:

On successful completion of the course, the students will become:

CO 1 - proficient in solving mathematical models through different optimization techniques.

CO 2 - capable in solving LPP and ILPP.

CO 3 - competent in solving constraints and unconstraints optimization problems.

Course prepared by : Dr.N.Sakthivel.
Course verified by : Dr.P.Dhanalakshmi

Title of the Subject :**MATHEMATICAL SOFTWARE** No.of Credits **: 2**

Code No. **: MATBC12** No. of Teaching hours**: 3**

Course Objectives:

The student should be made to:

- prepare document with high-quality typesetting by using Latex.
- understand for numerical computations by Mathematica.
- solve the linear system by using MATLAB.

UNIT I:COMMANDS AND ENVIRONMENTS

Command names and arguments-Environments-Declarations-Special Characters, Document layout and organization – Document class, Page style, Parts of the document.

DISPLAYED TEXT

Changing font- Centering and indenting, Lists, Theorem–like declarations, Boxes, Tables, footnotes and marginal notes.

UNIT II:MATHEMATICAL FORMULAS

Mathematical environments, Main elements of math mode, Mathematical symbols, Additional elements, Fine–tuning mathematics, Drawing pictures with LATEX.

UNIT III: INTRODUCTION TO MATHEMATICA

Running Mathematica - Numerical calculations – Building up calculations – Using the Mathematica system – Algebraic calculations - Symbolic mathematics - Numerical mathematics.

UNIT IV:PROGRAMMING IN MATLAB

Scripts and Functions – Script files – Functions files-Language specific features – Advanced Data objects.

UNIT V:APPLICATIONS

Linear Algebra - Solving a linear system – Finding Eigen values and Eigen vectors – Matrix Factorizations.

TEXT BOOKS

- H. Kopka and P.W. Daly ,"A Guide to LATEX", Third Edition, Addison – Wesley, London, 1999.
- S. Wolfram ,"The Mathematica Book" , Fourth Edition, Cambridge University Press, Cambridge, 1999.
- RudraPratap, "Getting Started with MATLAB-A Quick Introduction for Scientists and Engineers", Oxford University Press, 2003.

REFERENCE BOOKS

- William John Palm, "Introduction to Matlab 7 for Engineers", McGraw-Hill Professional, 2005.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – typeset the journal articles, technical reports, thesis, books, and slide presentations.
CO 2 – use the Mathematica system.
CO 3 – understand the applications of MATLAB in Linear Algebra.

Course prepared by : Dr.N.Sakthivel.
Course verified by : Dr.P.Dhanalakshmi.

Title of the Subject: PRACTICAL **III: MATHEMATICAL SOFTWARES** No.of Credits**: 2**

Code No. **: MATBC12P** No. of Teaching hours**:3**

Course Objectives:

The student should be made to:

- learn the features of LaTeX, MATLAB and Mathematica as a continuation of previous course.

LATEX

Test the basic operations of running the LaTex program

1. To display the text
2. Theorem-like declarations
3. Constructing tables
4. To display Mathematical formulas
5. To display matrices
6. To create single picture and diagrams.

MATHEMATICA

1. Numerical Calculations
2. Mathematical Functions
3. Algebraic Calculations
4. Symbolic Mathematics
5. Symbolic Mathematics – Solving Equations
6. Numerical Mathematics
7. Functions
8. Lists
9. Graphics-Two Dimensional Plots
10. Graphics – Three Dimensional Plots
11. Input and Output in Notebooks
12. Input and Output forms.

MATLAB

1. Plotting a function.
2. Polar plot.
3. Addition of two matrices.
4. Finding the determinant of a matrix.
5. Finding Eigen values and Eigen vectors of a matrix.
6. Straight line fit.
7. Exponential curve fitting.
8. Solving a first-order linear ODE.
9. Solving a second-order nonlinear ODE.
10. Solving nonlinear algebra equations.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1– typesetting of complex mathematical formulae.
CO 2 – compute Mathematical functions using Mathematica.
CO 3 –plot a Mathematical function using MATLAB.

Course prepared by : Dr.N.Sakthivel.
Course verified by : Dr.P.Dhanalakshmi

Title of the subject **: FUNCTIONAL ANALYSIS** No. of Credits **: 4**

Code No. **: MATBC13** No. of Teaching Hours**: 5**

Course Objectives:

The student should be made to:

- Introduce the basic concepts and theorems of functional analysis and its applications.

UNIT I: ALGEBRAIC SYSTEMS

Linear spaces and dimension of spaces, linear transformations and linear operators, algebras, normed linear spaces, definition of Banach spaces with examples.

UNIT II: BANACH SPACES

Continuous linear transformations, The Hahn-Banach theorem, The natural imbedding of space N into space N**, open mapping theorem, closed graph theorem, conjugate of an operator, BanachSteinhaus's uniform boundedness theorem.

UNIT III: HILBERT SPACES

Inner product spaces, definition and properties, Schwarz inequality and theorems, orthogonal complements, orthonormal sets, Bessel's inequality, complete orthonormal sets, conjugate space H***.**

UNIT IV: OPERATORS ON HILBERT SPACES

Adjoint of an operator, self-adjoint operators, normal and unitary operators, projections.

UNIT V: FINITE DIMENSIONAL SPECTRAL THEORY

Matrices ,determinants and the spectrum of an operator, the spectral theorem.

TEXT BOOK:

- G. F. Simmons, "Introduction to Topology and Modern Analysis", Tata McGraw -Hill Publishing Company, New Delhi, 2004

REFERENCE BOOKS:

- M. T. Nair, "Functional Analysis: A First Course", PHI-Learning (Formerly: Prentice-Hall of India), New Delhi, 2002G.
- Bachman and L. Narici, *"*Functional Analysis*",* Academic Press, New York, 1966.
- H.C. Goffman and G. Fedrick,"First Course in Functional Analysis", Prentice Hall of India, New Delhi, 1987.
- E.Kreyszig,"Introductory Functional Analysis with Applications", John Wiley & Sons, New York, 1978.
- E.S.Suhubi,"Functional Analysis", Springer International Edition, India, 2009.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – familiar with continuous linear transformations and related theorems.
CO 2 – know about the Banach and Hilbert spaces and their properties.
CO 3 –describe the spectral theorem

Course prepared by : Dr. P. Dhanalakshmi.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject **: MATHEMATICAL METHODS** No. of Credits**: 4**
Code No. **: MATBC14** No. of Teaching Hours**: 5**

Course Objectives:

The student should be made to:

- introduce the basic concepts and theorems on transforms.
- know about types of integral equations and its applications.
- study about calculus of variations.

UNIT I:FOURIER TRANSFORMS

Fourier Transforms- Define 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.

UNIT II: LAPLACE TRANSFORMS

Laplace's equation in Half plane - Laplace's equations in an infinite strip - The Linear diffusion equation on a semi-infinite line – The two- dimensional diffusion equation.

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:APPLICATIONS

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:

- R.P.Kanwal, "Linear Integral Equations Theory and Technique", Academic press, New York, 1971.
- L.Elsgolts, "Differential Equations and Calculus of Variations", Mir publishers, Moscow, 1970.
- I.N.Sneddon, "The Use of Integral Transforms", Tata Mc Graw Hill, New delhi, 1974.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1- know about Fourier and Laplace's transforms.
CO 2- familiar with Volterra and Fredholm integral equations .
CO 3-describe the functionals of the integral forms.

Course prepared by : Dr. P. Dhanalakshmi.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject **: ORACLE** No. of Credits**: 2**
Code No. **: MATBC15** No. of Teaching Hours**: 3**

Course Objectives:

The student should be made to:

- enhance the knowledge and understanding of Database analysis and design.
- solve Database problems using SQL and PL/SQL. This will include the use of Procedures, Functions, Packages, and Triggers.

UNIT I: INTRODUCTION

ORACLE 8.0 – Data types – Basic parts of SQL, DDL, DML, and TCL.

UNIT II: FUNCTIONS

String functions – Group value functions – Single value functions – Data functions and views.

UNIT III: QUERIES

Indexes – Sequences – Sub queries – Reports in SQL PLUS.

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UNIT IV: PL/SQL CONCEPTS

PL/SQL – PL/SQL Block – Exception handling.

UNIT V: PL/SQL CONSTRUCTS

Triggers – Procedures – Cursors.

TEXT BOOK

- George Koch Kevin Loney ,*"* ORACLE 8The Complete Reference*"*, TATA McGraw Hill.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – design, develop, and maintain Oracle Database Objects, stored procedures, and triggers.

Course prepared by : Dr. P. Dhanalakshmi.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject **: PRACTICAL IV: ORACLE** No. of Credits**: 2**
Code No. **: MATBC15P** No. of Teaching Hours**: 3**

Course Objectives:

The student should be made to:

- enhance the knowledge of the processes of Database Development using SQL and PL/SQL

Course Content:

1. DML Commands
2. Group Functions
3. String Functions
4. Date Functions
5. Queries for using Simple Conditions
6. Conditional Control
7. Cursors
8. Explicit Cursors
9. Exception Handling
10. PL / SQL Trigger to Check a Condition

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – know fundamentals of Programming and technical skills using SQL and PL/SQL.

Course prepared by : Dr. P. Dhanalakshmi.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : **NUMERICAL METHODS** No. of Credits: **4**

Code No. : **MATBE1** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Understand the basic concepts to solve the Numerical problems.

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 and Relaxation method – Systems of Nonlinear equations.

UNIT III: SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Taylor series method – Euler and Modified Euler methods – RungeKutta methods (Second and Fourth order) – 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:

- C.F.Gerald, P.O.Wheatly, "Applied Numerical Analysis", Fifth Edition, Addison Wesley, 1998.

REFERNCE BOOKS:

- S.C.Gupta, P.C.Raymond, "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi, 2000.
- R.L.Burden, J.Douglas Faires, "Numerical Analysis", P.W.S.Kent Publishing Company, Boston, 1989, Fourth Edition.
- S.S.Sastry, "Introductory methods of Numerical Analysis", Prentice Hall of India, New Delhi, 1998.
- P.Kandasamy, "Numerical Methods", S. Chand & Company Ltd., New Delhi 2003.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 – know the basics of numerical methods to solve nonlinear equations, system of equations, Ordinary differential equations and Partial differential equations.

Course prepared by : Dr. S. Narayanamoorthy.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : **DISCRETE MATHEMATICS** No. of Credits: **4**

Code No. : **MATBE2** No. of Teaching Hours: **4**

Course Objectives:
The student should be made to:

- simplify and evaluate basic logic statements including compound statements, implications, inverses, converses and contrapositives using truth tables and the properties of logic.
- apply the operations of sets by using Venn diagrams.
- solve problems using the principle of inclusion-exclusion.

UNIT I:LOGIC
Propositions – Logical Connectives - Compound statements – Conditional and Biconditional Propositions – Truth tables – Tautologies and Contradictions – Logical equivalence and implications – Demorgan's Law – Normal forms – PDNF and PCNF – Predicate Calculus – Free and bound variables – Quantifiers – Universe of discourse – Theory of inference– Rules of universal specification and generalization – Arguments – Validity of Arguments.

UNIT II: SET THEORY
Basic concepts – Notations –Algebra of sets – The power sets – Ordered pairs and Cartesian products–Relation and its types – Properties –Relational Matrix and the graph of relation – Partitions– Equivalence relations – Poset-Hasse diagram – Lattices and their properties – Sublattice – Boolean Algebra – Homomorphism.

UNIT III: FUNCTIONS Definitions of functions and its Classification – Types –Examples – Composition of functions – Inverse functions – Binary and unary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

UNIT IV: GRAPH THEORY
Graph Introduction – Basic terminology – Representation of graphs –connectivity – Eulerian and Hamiltonian graphs – Planar graphs- Directed graphs-Application of Graphs. Binary tree – traversals of a binary tree – Expansion trees.

UNIT V: GRAMMARS AND LANGUAGES
Definitions – Types of Grammars – Productions – Regular Grammar and Languages– Finite state Automata (FSA) – Deterministic and Non-Deterministic FSA – Conversion of NDFSA to DFSA.

TEXT BOOK:

- Trembley J.P and Manohar.R, "Discrete Mathematical Structures With applications to Computer Science", Tata Mc Graw- Hill Pub.Co. Ltd., New Delhi, 2003.

REFERNCE BOOKS:

- Ralph.P.Grimmaldi, "Discrete and Combinatorial Mathematics - An Introduction", Fourth edition, Perarson Education, Asia, Delhi, 2002.
- HopgRalph.P.Grimmaldi, "Discrete and Combinatorial Mathematics - An Introduction", Fourth edition, Perarson Education, Asia, Delhi, 2002.
- Hopgaff and Ullman, Introduction to Automata Theory, "Languages and Computation", Pearson Edition, Asia, Delhi.
- Doerr Alar and Levasseur Kenneth, Applied discrete structures for Computer Science", Gal Gotia publications Pvt. Ltd. (2002).

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 - express a logic sentence in terms of predicates, quantifiers, and logical connectives.

CO2 – apply the rules of inference.

CO 3 - use tree and graph algorithms to solve problems.

Course prepared by : Dr.M.Muthtamilselvan.
Course verified by : Dr. P. Dhanalakshmi.

Title of the Subject : **Number Theory and Cryptography** No.of Credits **: 4**

Code No. **: MATBE3** No. of Teaching hours**: 4**

Course Objectives:
The student should be made to:

- provide an introduction to basic number theory.
- know about Computational aspects in cryptography.

UNIT I : DIVISIBILITY AND CONGRUENCE

Divisibility – Primes - Congruence's – Solutions of Congruence's – Congruence's of Degree one.

UNIT II: SOME FUNCTIONS OF NUMBER THEORY

Arithmetic functions –The Mobius inverse formula – The multiplication of arithmetic functions.

UNIT III: SOME DIAPHANTINE EQUATIONS

The equation ax + by= c – positive solutions – Other linear equations – The equation $x^2 + y^2 = z^2$ - The equation $x^4 + y^4 = z^4$ Sums of four and five squares – Waring's problem – Sum of fourth powers – Sum of Two squares.

UNIT-VI: CRYPTOGRAPHY

Some simple crypto systems - Enciphering matrices

UNIT-V: PUBLIC KEY CRYPTOGRAPHY

The idea of public key cryptography - RSA - Discrete log - Knapsack

TEXT BOOKS:

- Ivan Niven and H.S Zuckerman, "An Introduction to the Theory of Numbers", Third edition, Wiley Eastern Ltd., New Delhi, 1989.
- NealKoblitz, "A Course in Number Theory and Cryptography", Second Edition, Springer-Verlag, New York, 2002,.

REFERENCE BOOKS:

- D.M. Burton, "Elementary Number Theory", Universal Book Stall, New Delhi 2001.
- K.Ireland and M.Rosen, "A Classical Introduction to Modern Number Theory", Springer Verlag, New York, 1972.

- T.M Apostol, "Introduction to Analytic Number Theory", Narosa Publication,House, Chennai,1980.
- Neal Koblitz, "A Course in Number Theory and Cryptography", Springer-Verlag, New
- York,1987
- Stallings, W., "Cryptography and Network Security, 5th Edition". Pearson, 2010.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 - Apply mathematical concepts and principles to perform numerical and symbolic computations.

CO 2 - Use technology appropriately to investigate and solve mathematical and statistical problems.

Course prepared by : Dr.N.Sakthivel.
Course verified by : Dr.P.Dhanalakshmi.

Title of the subject **: FUZZY SETS AND FUZZY LOGIC** No. of Credits**: 4**

Code No. **: MATBE4** No. of Teaching Hours**: 4**

Course Objectives:

The student should be made to:

- understand the basic knowledge of fuzzy sets and fuzzy logic.
- to gain knowledge in fuzzy relations and fuzzy measures.
- be exposed to basic fuzzy system Applications.

Unit I : CRISP SETS AND FUZZY SETS

Crisp Sets, Fuzzy Sets (basic types), Fuzzy Sets (basic concepts); Representation of fuzzy sets; Decompositions theorems; Extension principle for fuzzy sets. Operations on fuzzy sets (Fuzzy compliment, Intersection and union); Combinations of operations.

Unit II: FUZZY RELATIONS

Crisp and fuzzy relations- Projections; Binary fuzzy relations; Binary relations on a single set, Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy ordering relations, Fuzzymorphism, Sup-i compositions of binary fuzzy relations, Inf-w_i compositions of fuzzy relations.

Unit III: FUZZY MEASURES

Possibility theory, Fuzzy measure, Evidence theory, possibility theory, Fuzzy sets and possibility theory.

Unit IV: FUZZY LOGIC AND UNCERTAINITY

Fuzzy logic, Classical logic, Multivalued logic, Fuzzy propositions, Fuzzy quantifiers, inference from conditional fuzzy propositions, Uncertainity based Information: Information and Uncertainty, Non specificity of Crisp sets, Non specificity of Fuzzy sets.

UNIT V: APPLICATIONS

Natural, life and Social Sciences - Engineering - Medicine - Management and decision making – Computer Sciences-System Science-Other Applications.

TEXT BOOKS:

- George J. Klir and Bo Yuan,**"**Fuzzy Sets and Fuzzy Logic**"**, Prentice Hall of India, 1988.
- George J. Klir and Tina A. Folger, "Fuzzy Sets, Uncertainty and Information", Prentice-Hall of India Private Limited-Fourth printing-June 1995.

REFERENCE BOOKS:

- H.J. Zimmerman, "Fuzzy Set Theory and Its Applications", Kluwer Academic publishers.
- D. DuBois and H. M. Prade, "Fuzzy Sets and Systems: Theory and Applications*"*, Academic Press, 1994.
- T. J. Ross, "Fuzzy Logic with Engineering Applications*"*, McGraw Hill, International Editions, 2010.

- J. J. Buckley and E. Eslami, "An Introduction to Fuzzy Logic and Fuzzy Sets", Springer-Verlag Heidelberg, 2002.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1- know about fuzzy sets and operations.
CO 2- familiar with fuzzy relations and the properties of these relations.
CO 3- apply a new thinking methodology to real life problems including engineering ones.

Course prepared by : Dr. P. Dhanalakshmi.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject **: STOCHASTIC PROCESSES** No. of Credits**: 4**
Code No. **: MATBE5** No. of Teaching Hours**:4**

Course Objectives

- This course covers Markov processes, Renewal processes and branching processes with an emphasis on model building

UNIT I: MARKOV AND STATIONARY PROCESSES
Specification of Stochastic Processes – Stationary Processes – Poisson Process Generalizations – Birth and Death Processes – Markov Chain – Erlang Process

UNIT II:RENEWAL PROCESSES
Renewal processes in discrete and continuous time – Renewal equation – Stopping time – Wald's equation – Renewal theorems – Delayed and Equilibrium renewal– processes Residual and excess life times – Renewal reward process – Alternating renewal process – Regenerative stochastic process

UNIT III: MARKOV RENEWAL AND SEMI – MARKOV PROCESSES
Definition and preliminary results – Markov renewal equation – Limiting behaviour -First passage time.

UNIT IV: BRANCHING PROCESSES
Generating functions of branching processes – Probability of extinction – Distribution of total number of progeny – Generalization of classical Galton – Watson process – Continuous time Markov branching process – Age dependent branching process –Bellman - Harris process

UNIT V: MARKOV PROCESSES WITH CONTINUOUS STATE SPACE
Brownian motion – Weiner process – Kolmogorov equations - First passage time distribution for Weiner process – Ornstein – Uhlenbeck process

TEXT BOOK :
1. J. Medhi, "Stochastic Processes", New Age International (P) Ltd., New Delhi, 2nd Edition, 2001.

REFERENCES:
- U.N. Bhat, "Elements of Applied Stochastic Processes", John Wiley and Sons Limited, 2nd Edition, 1984.
- D.R. Cox and H.D. Miller,"The theory of Stochastic Process", Methuen, London, 1965.
- S. M. Ross,"Stochastic Processes", Wiley, New York, 2nd Edition, 1996.
- S. Karlin and H.M. Taylor, "A First Course in Stochastic Processes", 2nd Edition, Academic press, New York, 1975.

Course Outcomes:
On successful completion of the course, the students will be able to:
CO 1 – know the basics knowledge about stochastic process.
CO 2 - acquire more detailed knowledge about Markov Process with discrete and continuous state space.

Course prepared by: **Dr.N.Sakthivel**
Course verified by: **Dr.P.Dhanalakshmi**

Title of the subject **: MATHEMATICAL STATISTICS** No. of Credits**: 4**

Code No. **: MATBE6** No. of Teaching Hours**:4**

Course Objectives:

The student should be made to:

- Understand knowledge of probability and the standard statistical distributions.

UNIT I: SAMPLING DISTRIBUTIONS AND ESTIMATION THEORY

Sampling distributions – Characteristics of good estimators – Method of Moments – Maximum Likelihood Estimation – Interval estimates for mean, variance and proportions.

UNIT II: TESTING OF HYPOTHESIS

Type I and Type II errors - Tests based on Normal, t, □2 and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT III: CORRELATION AND REGRESSION

Method of Least Squares - Linear Regression – Normal Regression Analysis – Normal Correlation Analysis – Partial and Multiple Correlation - Multiple Linear Regression.

UNIT IV: DESIGN OF EXPERIMENTS

Analysis of Variance – One-way and two-way Classifications – Completely Randomized Design – Randomized Block Design – Latin Square Design.

UNIT V: MULTIVARIATE ANALYSIS

Covariance matrix – Correlation Matrix – Normal density function –Principal components – Sample variation by principal components – Principal components by graphing.

TEXT BOOKS:

- J.E. Freund,"Mathematical Statistics", Prentice Hall of India, 5th Edition, 2001.
- R.A. Johnson and D.W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Education Asia, 5th Edition, 2002.

REFERENCE:

- Gupta S.C. and Kapoor V.K.,"Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 11th Edition, 2003.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1 - solve mathematical and statistical problems.

CO 2- explain the concepts of sampling distributions.

CO 3- understand the concept of testing of hypothesis and derives the likelihood and associated functions of interest for simple models.

Course prepared by : **Dr.N.Sakthivel**

Course verified by : **Dr.P.Dhanalakshmi**

Title of the subject**: FUNDAMENTALS OF ACTUARIAL MATHEMATICS** No. of Credits**: 4**

Code No. **: MATBE7** No. of Teaching Hours**:4**

Course Objectives:

The student should be made to:

- define and use standard actuarial functions involving several lives
- experience in life insurance premiums

UNIT I: ANNUITIES

Certain- present Values- Amounts - Deferred Annuities –Perpetuities - Present Value of an Immediate Annuity Certain – Accumulated Value of Annuity – Relation between Sn and an – Present Value of Deferred Annuity Certain – Accumulated Value of a term of n-years – Perpetuity – Present Value of an Immediate Perpetuity of 1p.a. – Present Value of a Perpetuity due of 1 p.a. – Deferred Perpetuity with Deferment Period of m years – Mortality Table – The Probabilities of Survival and Death.

UNIT II: LIFE INSURANCE PREMIUMS

General considerations - Assurance Benefits – Pure Endowment Assurance – Endowment Assurance – Temporary Assurance or Term Assurance - Whole Life Assurance – Pure Endowment Assurance – Endowment Assurance – Double Endowment Assurance – Increasing Temporary Assurance – Increasing Whole Life Assurance – Commutation Functions Dx, Cx, Mx and Rx – Expressions for Present Values of Assurance Benefits in terms of Commutation Functions – Fixed Term (Marriage) Endowment – Educational Annuity Plan.

UNIT III: LIFE ANNUITIES AND TEMPORARY ANNUITIES

Commutation Functions Nx – To Find the Present Value of an Annuity Due of Re.1 p.a. for Life – Temporary Immediate Life Annuity – Expression for ax: n – Deferred Temporary Life Annuity – Variable Life Annuity – Increasing Life Annuity – Commutation Function Sx – Increasing Temporary Life Annuity – Tables of Life Annuity and Temporary Life Annuity – Variations in the Present Values of Annuities – Life Annuities Payable at Frequent Intervals.

UNIT IV: NET PREMIUMS FOR ASSURANCE PLANS

Natural Premiums – Level Annual Premium – Symbols for Level Annual Premium under Various Assurance Plans – Mathematical Expressions for level Annual Premium under Level Annual Premium under Various Plans for Sum Assure of Re. 1 – Net Premiums – Consequences of charging level Premium – Consequences of withdrawals – Net Premiums for Annuity Plans – Immediate Annuities – Deferred Annuities.

UNIT V: PREMIUM CONVERSION TABLES

Single Premium Conversion tables – Annual Premium Conversion Tables – Policy Values – Two kinds of Policy values – Policy value in symbols – Calculation of Policy Value for Unit Sum Assure – Numerical Example : Retrospective Method and Comparison with Prospective Value – Derivative of Theoretical Expressions for Policy Value, tVx by the Retrospective Method and Prospective Method – Other Expressions for Policy Value – Surrender Values – Paid up Policies – Alteration of Policy Contracts.

TEXT BOOK:

- "Mathematical Basis of Life Insurance" , Insurance Institute of India.

REFERENCE BOOKS

- Newton L. Bowers, Hans U. Gerber, James C. Hickman, Donald A. Jones, Cecil J. Nesbitt,

"Actuarial Mathematics".(1997)
- Promislow S.D, "Fundamentals of Actuarial Mathematics".

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1-know the basic knowledge about stochastic processes.

CO 2- acquire more detected knowledge about Markov Processes with discrete and continuous state space.

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Course prepared by : Dr. P. Dhanalakshmi.
Course verified by : Dr. P. Dhanalakshmi.

Title of the subject : MAGNETO HYDRODYNAMICS **No. of Credits: 4**
Code No. : MATBE8 **No. of Teaching Hours:4**

Course Objectives: MHD is an extension of hydrodynamics to electrodynamics.

The student should be made to:

- introduce the Definition of electromagnetism, MHD basis, one and two fluid equations, equilibrium and stability; equations of kinetic theory; derivation of fluid equations and stabilities.

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 – Electromagnetic Equations with respect to moving axes – boundary conditions of electric and magnetic fields

Unit II: KINEMATICS OF FLUID MOTION

Equation of continuity – Stress tensor – Navier stokes equations – boundary condition – Velocity Magneto fluid dynamic equations – MHD approximation – equation of Magnetic diffusion in a moving conducting medium – Magnetic Reynolds number

Unit III: MAGNETO HYDROSTATICS

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

Unit IV: INCOMPRESSIBLE VISCOUS FLOWS IN THE PRESENCE OF MAGNETIC FIELD

Hartmann Flow– Unsteady Hartmann flow – Magnetofluid dynamic pipe flow

Unit V: STABILITY

Instability of linear pinch – Sausage and flute types –Method of small oscillations – gravitational instability

TEXTBOOKS

- **Crammer K.R.** and **Pai S.I**, **"**Magneto Fluid Dynamics for

Engineers and Applied Physicists", McGraw Hill, 1973.

- **Ferraro, VCA** and **Plumpton**: **"**Introduction to Magneto Fluid Dynamics**",** Oxford, 1966.

REFERENCE:

- J. P. Freidberg,Ideal Magnetohydrodynamics, Plenum Press, New York (1987).

Course Outcomes:

On successful completion of the course, the students will be able to:

CO1- describe and explain the domains of validity of one-fluid MHD
CO2- demonstrate the basic properties of MHD
CO3- apply the instability.

Course prepared by: D**r.N.Sakthivel**
Course verified by: **Dr.P.Dhanalakshmi**

Title of the Subject **: NUMERICAL METHODS** No. of Credits **: 2**

Code No. **: GS01** No. of Teaching hours**: 2**

Course Objectives:

The student should be made to:

- solve the non-linear equations.
- Understand the concepts of interpolation, differentiation and integration.

UNIT I SOLUTION OF NUMERICAL ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

The Bisection Method – Method of Successive approximation -Regula falsi Method-Newton's Raphson Method - Convergence of Newton's Method and rate of Convergence.

UNIT II SOLUTION OF SIMULTANEOUS LINEAR ALGEBRAIC EQUATION

Gauss elimination method-Gauss Jordan method – Jacobi Iterative method - Gauss Seidal method - Comparison of Gauss elimination and Gauss Seidal Iteration Method.

TEXT BOOKS:

- M.K.Venkataraman, "Numerical Methods in Science and Engineering",The National publishing company, 1990.
- P. Kandasamy ,K.Thilagavathy, K.Gunavathi, "Numerical Methods", S. Chand &Company Ltd., New Delhi (2003).

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1- Describe and implement common methods for root-finding.
CO 2 - Demonstrate techniques for the solution of linear simultaneous equations.

Course prepared by : Dr.N.Sakthivel.
Course verified by : Dr. P. Dhanalakshmi.

Title of the Subject :**DIFFERENTIAL EQUATIONS AND TRANSFORMS** No.of Credits **: 2**

Code No. **: GS45** No. of Teaching hours**: 2**

Course Objectives:
The student should be made to:

- learn to solve first-order differential equations.
- learn to use Laplace transform methods to solve differential equations.
- understand how the Fourier series is extended to a periodic signals in the form of Fourier transform

UNIT I: LAPLACE TRANSFORM

Laplace transform-conditions for existence-Transforms of elementary functions-Basic properties-Transform of derivatives and Integrals. Statement of Fourier integral theorem -Fourier transform pair-Sine and Cosine transforms-Properties. Z-Transform-Elementary properties.

UNIT II: DIFFERENTIAL EQUATION

Definition of Differential Equations – degree – order - Solutions of Differential equation – Exact Differential equations: Sufficient Condition - Practical rule for solving an exact differential equation - rules for finding integrating factors – Equations of the first order, but of higher degree- equations solvable for y - equations solvable for x - Clairaut's form.

TEXT BOOKS:

- S. Narayanan and T.K. Manicavachagam pillay, "Calculus-Volume II"', S.Viswanathan Printers and publishers pvt.Ltd, 1996.
- G.Balaji, "Engineering Mathematics –II", G.Balaji Publishers, 2011.
- Dr.A.Singaravelu, "Transforms and Partial Differential Equations",Meenakshi Agency,2015.

Course Outcomes:

On successful completion of the course, the students will be able to:

CO 1- Solve basic application problems described by first order differential equations.
CO 2- Find the Laplace transform of a function using the definition.
CO 3- Calculate the Fourier transform of elementary functions from the definition.

Course prepared by : Dr. N.Sakthivel.

Course verified by : Dr. P. Dhanalakshmi.