ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f. 2014-15)

M.Sc., MATHEMATICS – PROGRAMME STRUCTURE

Sem	Course		Cr.	Hrs./ Week	Marks		Total
	Subject code	Name			Int.	Ext.	
I	4MMA1C1	**Core – I** – Algebra – I	5	6	25	75	100
	4MMA1C2	**Core – II** – Analysis – I	5	6	25	75	100
	4MMA1C3	**Core – III** – Differential Geometry	5	6	25	75	100
	4MMA1C4	**Core – IV** – Differential Equations	5	6	25	75	100
		Elective – I	4	6	25	75	100
	Total		**24**	**30**	**--**	**--**	**500**
II	4MMA2C1	**Core – V** – Algebra – II	5	6	25	75	100
	4MMA2C2	**Core – VI** – Analysis – II	5	6	25	75	100
	4MMA2C3	**Core – VII** – Probability and Statistics	5	6	25	75	100
		Elective – II	4	6	25	75	100
		Elective – III	4	6	25	75	100
	Total		**23**	**30**	**--**	**--**	**500**
III	4MMA3C1	**Core – VIII** – Complex Analysis	5	6	25	75	100
	4MMA3C2	**Core – IX** – Topology – I	5	6	25	75	100
	4MMA3C3	**Core – X** – Operations Research	5	6	25	75	100
	4MMA3C4	**Core – XI** – Number Theory	5	6	25	75	100
		Elective – IV	4	6	25	75	100
	Total		**24**	**30**	**--**	**--**	**500**
IV	4MMA4C1	**Core – XII** – Functional Analysis	5	8	25	75	100
	4MMA4C2	**Core – XIII** – Topology – II	5	8	25	75	100
	4MMA4C3	**Core – XIV** – Numerical Analysis	5	7	25	75	100
		Elective – V	4	7	25	75	100
	Total		**19**	**30**	**--**	**--**	**400**
	Grand Total		**90**	**120**	**--**	**--**	**1900**

Elective – I

1. Mechanics – 4MMA1E1
2. Programming in C++ – Theory & Practical – 4MMA1E2
3. Calculus of Variations and Special Functions – 4MMA1E3

Elective – II

1. Applied Algebra – 4MMA2E1
2. Graph Theory – 4MMA2E2
3. LATEX – 4MMA2E3

Elective – III

1. Discrete Mathematics – 4MMA2E4
2. Programming in JAVA – Theory and Practical – 4MMA2E5
3. Fluid Dynamics – 4MMA2E6

Elective – IV

1. Combinatorial Mathematics – 4MMA3E1
2. Stochastic Processes – 4MMA3E2
3. Fuzzy Mathematics – 4MMA3E3

Elective – V

1. Advanced Statistics – 4MMA4E1
2. Data Structures and Algorithms–Theory and Practical – 4MMA4E2
3. Automata Theory – 4MMA4E3

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I YEAR – I SEMESTER
COURSE CODE: 4MMA1C1

CORE COURSE I – ALGEBRA – I

Unit I

Group Theory: Definition of a group – Some examples of a groups – some preliminary Lemmas – Subgroups – a counting principle – Normal subgroups and Quotient groups – Homomorphisms – Automorphisms – Cayley's Theorem – Permutation groups.

Unit II

Another counting Principle – Sylow's Theorem – Direct products

Unit III

Ring Theory: Definition and examples of rings – some special classes of Rings – Homomorphisms.

Unit IV

Ideals and Quotient Rings – More ideals and Quotient Rings – The field of quotients of an Integral Domain

Unit V

Enclidean Rings – A Particular Euclidean Ring – Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings over commutative Rings.

Text Book

Topics in Algebra by Herstein I. N

Chapters: II & III

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I YEAR – I SEMESTER
COURSE CODE: 4MMA1C2

CORE COURSE II – ANALYSIS – I

Unit I

Basic Topology: Metric Spaces – Compact sets – Perfect sets – Connected sets.

Unit II

Numerical sequences and series; Convergent sequences, Subsequences, Cauchy sequences, Upper and Lower limits – Special sequences, Series , Series of non–negative terms.
The number e – The root and ratio tests.

Unit III

Power series – Summation by parts – Absolute convergence – Addition and Multiplication of series – Rearrangements

Unit IV

Continuity: Limits of functions – Continuous functions, Continuity and Compactness, Connectedness – Discontinuities – Monotonic functions – infinite limits and limits at infinity.

Unit V

Differentiation: The derivative of a real function – Mean value theorems – the continuity of derivatives – L'Hospital's rule – Derivatives of Higher order – Taylor's theorem Differentiation of vector – valued functions.

Text Book

Principles of Mathematical Analysis – Walter Rudin, III Edition (Relevant portions of chapters II, III, IV & V), McGRAW-Hill Book Company.

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I YEAR – I SEMESTER
COURSE CODE: 4MMA1C3

CORE COURSE III – DIFFERENTIAL GEOMETRY

Unit I

Arc length – Tangent – Normal – Binormal – Curvature – Torsion, Serret - Frenet Formulae– Curvature and torsion of a curve given as the intersection of two surfaces.

Unit II

Osculating circle – Osculating sphere – Locus of center of spherical curvature – Spherical indicatrices – Involutes and Evolutes indicatrices – Involutes and evolutes – tangent surfaces – Intrinsic Equations – Existence theorem – Uniqueness theorem – Helices.

Unit III

Surface – Class of a surface – Monge's form of the surface – curves on a surface Normal – surface of revolution – Helicoids – Metric – Direction coefficients – families of curves – Isometric correspondence – Intrinsic properties.

Unit IV

Geodesics – Canonical Geodesic equations – Normal property of Geodesics – Existence theorem – Geodesic parallels – Geodesic curvature Gauss – Bonnet theorem – Gaussian curvature.

Unit V

The Second Fundamental form – principal curvature – lines of curvature – Developables – Developables associated with space curves – Developables associated with curves on surfaces.

Text Book

An Introduction to Differential Geometry by T.G. Willmore Oxford University Press (1983)

Chapter I : (Sections 1.2 to 1.5)
Chapter II : (Sections 1.6 to 1.9)
Chapter III : (Section 2.1 to 2.9)
Chapter IV : (Section 2.10 to 2.17)
Chapter V : (Section 3.1 to 3.6)

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I YEAR – I SEMESTER
COURSE CODE: 4MMA1C4

CORE COURSE IV – DIFFERENTIAL EQUATIONS

Unit I

Linear Equations with variable Coefficients – Initial value problems for the homogeneous equations – solutions of the homogeneous equations – the Wronskian and linear dependence reduction of the order of a homogeneous equation – the homogeneous equation with analytic coefficients – the Legendre Equation.

Unit II

Linear Equations with regular singular points – The Euler Equation – Second order equations with regular singular points at infinity.

Unit III

Partial Differential equations of the first order – linear equation of the first order – integral surfaces passing through a given curve

Unit IV

Second order equations – linear partial equations with constant coefficient equations with variable coefficients – separation of variables.

Unit V

Laplace's Equations – Elementary solutions of Laplace's equation – Boundary value problems– Separation of variables – the Wave equation

Text Books

1. An Introduction to Ordinary Differential Equations by Earl A. Coddington Prentice Hall of India (1987)

   Chapter III : (Sections 3.1 to 3.8)
   Chapter IV : (Sections 4.1 to 4.4 and 4.6 to 4. 9)

2. Elements of Partial Differential Equations by Ian Snedden, McGRAW-Hill Book Company (1986)

   Chapter II : (Section 2.1 to 2.5, 2.7 to 2.13)
   Chapter III : (Sections 3.1, 3.2 3.4, 3.5, and 3. 9)
   Chapter IV, V : (Sections 4.2, 4.4, 4.5, 5.1 only).

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I YEAR – I SEMESTER
COURSE CODE: 4MMA1E1

ELECTIVE COURSE I (A) – MECHANICS

Unit I

D' Alembert's Principle and Lagrange's Equations

Unit II

Potentials, Dissipative function, Application of Lagrange formulation.

Unit III

Hamilton's Principle, Conservation theorems, Symmetry properties, the two body central force problem.

Unit IV

Classification of orbits, Virtual theorem, Bertrand's theorem

Unit V

Kepler problem, the Laplace – Runge – Lunz vector – Stress may be given for problems in the text.

Text Book

Classical Mechanics by H. Goldstein, Second Edition, Addison Wesley.
Chapters I, II and III (Sections 1 to 19 only)

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I YEAR – I SEMESTER
COURSE CODE: 4MMA1E2

ELECTIVE COURSE I (B) – PROGRAMMING IN C++ – THEORY & PRACTICAL

Unit I

Principles of Object Oriented Programming: Software Crisis – Evaluation – Basic concept and Benefits of OOP – Object oriented Language – Applications
Structure of C++ – Tokens, Expressions, operators, Manipulators and Control Structures.

Unit II

Functions in C++ – Call by reference – call by value – return by reference – Inline functions – Function overloading – Friend functions
Classes and Objects – Memory Allocation of objects – Static data members – Objects as Arguments – using Arrays.

Unit III

Constructors: Multiple constructor – Parameterized Constructors – Default, Copy and Dynamic Constructor – Destructors.
Operator Overloading: Overloading Unary and Binary Operators using Friend functions.

Unit IV

Inheritance: Defining Derived Classes – Single Inheritance – Multiple, Hybrid, Hierarchical Inheritance – Nesting of Classes – Abstract Classes.

Unit V

Streams formatted and unformatted I/O: Manipulators, File I/O – Reading and Writing – various functions.
Exception Handling: try, throw, catch statements.

Text Book

E.Balagurusamy "Object Oriented Programming with C++", TMH

Reference

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

PROGRAMMING IN C++ LAB

1. Program to read a Text from the keyboard and display the following information on the screen. (i) Number of Lines (ii) Number of Words (iii) Number of Characters
2. Program to find the largest of 3 numbers using INLINE function
3. Create Member Functions to create an array , Add two arrays, Multiply the arrays by a Scalar and Display the Array
4. Program to Link two Classes
5. Program to use Constructors and Destructors
6. Program to implement Operator overloading and Function overloading.
7. Program to implement Single, Multiple, Multi Level, Hybrid and Hierarchical Inheritance
8. Program to Implement Runtime Polymorphism
9. Program to us class and function Templates
10. Program to handle Exception.

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I YEAR – I SEMESTER
COURSE CODE: 4MMA1E3

ELECTIVE COURSE I (C) – CALCULUS OF VARIATIONS AND SPECIAL FUNCTIONS

Unit I

Functional – The fundamental lemma – Euler's equations minimum surface of revolution – Brachistochrone problem – Problems on geodesics – isoperimetric problems.

Unit II

Several dependent variables – Functional dependent on higher order derivative – Functionals dependent variables – variational problems – parametric form

Unit III

Hamiltous' Principle – Lagrange's equations – problems on vibrations – Direct methods in variational problems – Euler's finite difference method – Ritz method and Kantorovich's method problems.

Unit IV

Legendre functions – Legendre Polynomials – Recurrence formula – Rodrigue's formula – properties – Bessel functions – Gamma function – recurrence formula – generating function – properties of Bessel functions.

Unit V

Hermite, Legendre and chebyshev functions and polynomials – Generating functions – Properties.

Text Books

1) Differential equations and calculus of variations by L.Elsgolts, Mir publishers.
2) Advanced Mathematics for Engineering and Science by M.K. Venkataraman, National Publishing Co.
3) Methods of Applied Mathematics by F.B.Hildebrand, PHI.
4) Differential equations with applications and historical notes by G.F.Simmons,Tata McGRAW Hill.
5) Advanced Engineering Mathematics by Erwin Kreyzig,Wiley Eastern.
6) Differential equatons with Special Functions by Sharma and Gupta,Krishna Prakasan Mandir.
7) Higher Engineering Mathematics by B.S.Grewal,Kanna Publishers.

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2C1

CORE COURSE V – ALGEBRA – II

Unit I

Vector Space: Elementary basic concepts – Linear Independence and Basis.

Unit II

Dual spaces – Inner product spaces.

Unit III

Field: Extension fields – Roots of polynomials – More about roots.

Unit IV

The elements of Galois theory.

Unit V

Linear Transformations: The Algebra of linear transformations – Characteristic roots – Matrices – Canonical forms Triangular Form – Hermitian, Unitary, and Normal transformations.

Text Book

Topics in Algebra by Herstein I.N

Chapter IV	:	(Sections 4.1 to 4.4)
Chapter V	:	(Sections 5.1, 5.3, 5.5, 5.6)
Chapter VI	:	(Sections 6.1, 6.2, 6.3, 6.4, and 6.10)

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2C2

CORE COURSE VI – ANALYSIS – II

Unit I

Riemann-Stieltjes Integral: Definition and Existence of the integral, Integration and Differentiation , Integration of vector – valued functions – Rectifiable curves.

Unit II

Sequences and series of functions: Discussion of main problem, Uniform convergence – continuity- Integration and Differentiation, Equicontinuous families of functions – the Stone Weierstrass theorem.

Unit III

Some special functions: Power series, the Exponential, Logarithmic and Trigonometric functions – the algebraic completeness of the complex field – Fourier series – Gamma functions.

Unit IV

Lebesgue measure: Algebra of sets – Measurable space – Lebesgue outer measure – Lebesgue measure and Lebesgue measurable sets – non-measurable sets – Lebesgue measurable functions – Little wood's three principles.

Unit V

Lebesgue Integral: Riemann integral – Lebesgue Integral of a bounded function over a set of finite measure – Lebesgue Integral of nonnegative measurable function – general Lebesgue integral – Convergence theorems on measurable functions.

Text Book

1. Principles of Mathematical Analysis by walter Rudin (3rd Edition) McGraw Hill 1976 (For Analysis part chapters VI, VII and VIII)

2. Real Analysis by Royden (For Measure Theory chapters III& IV)

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2C3

CORE COURSE VII – PROBABILITY AND STATISTICS

Unit I

Probability and Distribution: Introduction – Set theory – The probability set function – Conditional probability and independence – Random variables of the discrete type – Random variables of the continuous type – properties of the distribution function – expectation of random variable – some special expectations – Chebyshev's Inequadity.

Unit II

Multivariate Distributions: Distributions of two random variables – conditional distributions and expectations – the correlation coefficient – Independent random variables – extension to several random variables.

Unit III

Some special Distributions: The Binomial and related distributions – The Poisson distribution– The Gamma and Chi-square distributions – The Normal distributions – The Bivariate Normal distribution.

Unit IV

Distributions of functions of Random variables: Sampling theory – transformations of variables of the discrete type – transformations of variables of the continuous type – the Beta, t and F distributions – extensions of the change – of – variable technique – the distributions of order statistics – the moment generating – function, Techniques the distributions of $\bar{X}$ and ns^2/σ^2 – expectations of functions of random variables

Unit V

Limiting Distribution: Convergence in distribution – convergence in probability – Limiting Moment Generating functions – the Central Limit theorem – Some theorems on Limiting Distributions.

Text Book

Introduction to Mathematical Statistics, (Fifth edition) by Robert V.Hogg and AllenT. Craig Pearson Education Asia.
Chapters I, II, III, IV (Omit 4.10) & V.

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2E1

ELECTIVE COURSE II (A) – APPLIED ALGEBRA

Unit I

Finite State Machines: Introduction – Binary Devices and States – Finite state Machines – Covering and equivalence – Equivalent States – A minimization procedures – Turing machines – Incompletely specified machines – Relations between states – a minimization procedure.

Unit II

Programming Languages: Introduction – Arithmetic expressions – Identifies: assignment statements – Arrays – FOR statements – Block structures in ALGOL – The ALGOL grammer– Evaluating arithmetic statements – compiling arithmetic expressions.

Unit III

Boolean Algebras: Introduction – Order – Boolean polynomials – Block diagrams for gating networks – connections with logic – logical capabilities of ALGOL – Boolean Applications – Boolean subalgebras – Disjunctive normal form – Direct Products; morphisms.

Unit IV

Optimization and computer Design: Introduction – optimization – Computerizing optimization – Logic design – NAND gates and NOR gates – The minimization problem – procedure for deriving prime implicants – consensus taking – Flip – Flops – Sequential machine design.

Unit V

Binary Group Codes: Introduction – Encoding and Decoding – Block codes Matrix encoding techniques – Group codes – Decoding tables – Hamming codes.

Text Book

Modern Applied Algebra by Garret Birkhoff and Thomas C.Bartee, McGRAW Hill International Student Edition.

Chapters : III, IV, V, VI & VIII

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2E2

ELECTIVE COURSE II (B) – GRAPH THEORY

Unit I

Graphs – Subgraphs – Trees.

Unit II

Connectivity – Euler Tours and Hamiltonian cycles.

Unit III

Matchings – Edge colouring.

Unit IV

Independent sets and cliques – vertex colourings.

Unit V

Planar graphs.

Text Book

Graph Theory with application by A. Bondy and U.S.R Murty, Macmillan Press Ltd.

Chapter I	:	(Sections 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7)
Chapter II	:	(Sections 2.1, 2.2, 2.3, 2.4)
Chapter III	:	(Sections 3.1, 3.2)
Chapter IV	:	(Sections 4.1, 4.2)
Chapter V	:	(Sections 5.1, 5.2)
Chapter VI	:	(Sections 6.1, 6.2)
Chapter VII	:	(Sections 7.1, 7.2)
Chapter VIII	:	(Sections 8.1, 8.2)
Chapter IX	:	(Sections 9.1, 9.2, 9.3, 9.4 & 9.6)

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2E3

ELECTIVE COURSE II (C) – 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.

Text Book

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.

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2E4

ELECTIVE COURSE III (A) – DISCRETE MATHEMATICS

Unit I

Algebraic Systems: Binary operations – Algebraic Systems – Semigroups and Monoids – Homomorphism and Isomorphism of Semigroups and Monoids – Properties of Homomorphisms – Subsemigroups and Submonoids.

Unit II

Logic: Introduction – TF-Statements – Connectives – Atomic and Compound Statements – Well formed (Statement) Formulae – Truth Table of a Formulae – Tautology – Tautological Implications and Equivalence of Formulae – Replacement Process – Functionally Complete Sets of Connectives and Duality Law – Normal Forms – Principal Normal Forms.

Unit III

Logic: Theory of Inference – Open Statements – Quantifiers – Valid Formulae and Equivalence – Theory of Inference for Predicate Calculus – Statements involving more than one Quantifier.

Unit IV

Lattices: Lattices – Some properties of Lattices – New Lattices – Modular and Distributive Lattices.

Unit V

Boolean Algebra: Boolean Algebras – Boolean Polynomials – Karnaugh Map – Switching Circuits.

Text Book

Discrete Mathematics by Dr.M.K.Venkataraman, Dr.N.Sridharan and Dr.N.Chandrasekaran, The National Publishing Company.

Chapters: VII (Sections 7.1 to 7.6), IX & X .

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I YEAR – II SEMESTER
COURSE CODE: 4MMA2E5

ELECTIVE COURSE III (B) – PROGRAMMING IN JAVA – THEORY AND PRACTICAL

Unit I

Introduction: Introduction to java – java and Internet – Byte codes – Features of Java – java development Environment – Java character set – operators – control statements – simple programs.

Unit II

Object Orientation in Java: Classes – Methods – Inheritance – packages – interfaces – programming examples.

Exception Handling: Fundamentals – Exception types – Try catch block – throw, throw clause – finally – user defined Exceptions.

Unit III

Threads: Thread model – thread priorities – Runnable interface – creating a thread, multiple threads – Synchronization – interthread communication – suspending, Resuming and stopping threads.

Unit IV

Input / Output: String handling – Exploring java io. Package.

Applets: Applet basics – AWT classes – window fundamentals – working with frame windows – graphics – AWT controls – Swing – Layout Managers – Menus – Event Handling.

Unit V

Java Networking: Basics – Socket overview – TCP/IP client sockets, TCP/IP server sockets– URL – Datagram sockets.

Concepts of Advanced Java Programming: JAVA SCRIPTS – servlets – JDBC – EJB – JSP.

Text Book

1. Patrick aughton, Herbert Schildt, "JAVA2- The complete reference" Tata McGraw Hill Fifth Edition, New Delhi 2002

Reference Books

1. Deitel H M and Deiltel P J "JAVA – How to Program" Pearson Education, New Delhi 2003
2. Hubbard John R, "Schaum's Outline of Theory and Problems of Programming with Java" Tata Mcgraw Hill, Second Edition, New Delhi 2004
3. Chitra A "Internet and Java Programming" ISTE 2002.

JAVA PROGRAMMING LAB

Java script

1. Write a java script to create a window by using the confirm message?
2. Write a java script to create a order form to select the house articles?
3. Write a java script to create Color Palette and display the background in the color chosen from the palette

VB script

1. Write a VB Script to do the following: a) Check the given Password b) Change the Existing Password
2. Write a VB Script to do the following a) Display the current date b) Find the difference between the dates c) Find the age of a person by providing date of birth
3. Write a VB Script to create a Calendar for given month and year.

JDBC

1. By using database connectivity display the records in a table.
2. By using database connectivity insert and delete a record from a table.

APPLETS

1. Write a java program using applet to display any 3 image when 3 buttons in the Border Layout are clicked. The image should be displayed at the center
2. Write a Java Program using Applet to display the dialogue and menu
3. Write a Java Program using Applet to create the Frames and its Controls
4. Write a Java Program using Applet to display the different colos and fonts.

HTML

1. Using atleast 20 HTML Tags, Create a screen with a string “WEB Design”?
2. Create Web Page in the format of front page of a new paper using Text Links
3. Align the Text with colors
4. Develop a picture gallery having atleast 3 pages. Each of them is having several pictures
5. Develop a web page for recruitment agency in an IT industry
6. Design and Publish a Web Page for a College.

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I YEAR – II SEMESTER

COURSE CODE: 4MMA2E6

ELECTIVE COURSE III (C) – FLUID DYNAMICS

Unit I: Kinematics of fluids in motion

Real fluids and Ideal fluids - Velocity of a fluid at a point - Stream lines and path lines - Steady and Unsteady flows – The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change – The equation of Continuity - Worked Examples - Acceleration of a Fluid.

Unit II: Equations of Motion of a Fluid

Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation - Worked Examples - Discussion of the case of steady motion under Conservative Body Forces -Some flows involving axial symmetry.

Unit III: Some Three-Dimensional Flows

Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axisymmetric flows - Stoke's Stream Function.

Unit IV: Some Two-Dimensional Flows

The Stream Function - The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow - Complex Velocity Potentials for Standard Two-Dimensional Flows - Some Worked Examples - Two Dimensional Image Systems - The Milne-Thomson Circle Theorem.

Unit V: Viscous Fluid

Stress components in a real fluid - Relation between Cartesian Components of Stress - Translational motion of fluid element - The Coefficient of Viscosity and Laminar flow - The Navier-Stokes equation of a viscous fluid - Some solvable problems in viscous flow - Steady motion between parallel planes only.

Text Book

Textbook of Fluid Dynamics, **Frank Chorlton**, CBS Publishers & Distributors, 2004.
Chapter 2: Sections 2. - 2.9
Chapter 3: Sections 3.1, 3.2, 3.4 - 3.7, 3.9
Chapter 4: Sections 4.1 - 4.5
Chapter 5: Sections 5.3-5.8
Chapter 8: Sections 8.1-8.3, 8.8, 8.9, 8.10.1

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II YEAR – III SEMESTER

COURSE CODE: 4MMA3C1

CORE COURSE VIII – COMPLEX ANALYSIS

Unit I

Concept of analytic function – Elementary theory of power series – Conformability – Linear transformations.

Unit II

Complex integration – Cauchy integral formula.

Unit III

Local properties of analytic functions.

Unit IV

Calculus of residues.

Unit V

Power series expansions – canonical products – Jensen's formula.

Text Book

Complex Analysis by Lars V.Ahlfors, McGRAW Hill Book Co.

Chapter II : (Sections 1, 2)
Chapter III : (Sections 2, 3)
Chapter IV : (Sections 1, 2, 3, & 5)
Chapter V : (Sections 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.3).

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II YEAR – III SEMESTER
COURSE CODE: 4MMA3C2

CORE COURSE IX – TOPOLOGY – I

Unit I

Topological Spaces – Basis of a topology – the order topology – the product topology on XxY– the subspace topology – closed sets and limit points.

Unit II

Continuous functions – the product topology – the metric topology – the quotient topology.

Unit III

Connected spaces – connected sets in the real line – components and path components – local connectedness.

Unit IV

Compact spaces – compact sets in the real line – limit point compactness.

Unit V

The countability axioms – the separation axioms – the Urysohn's lemma – the Uryshon's metrization theorem.

Text Book

Topology a first course by James R. Munkres Prentice Hall of India, New Delhi (1987)

Chapter II : (Sections 2.1 to 2.10)
Chapter III : (Sections 3.1 to 3.4)
Chapter IV : (Sections 3.5 to 3.7)
Chapter V : (Sections 4.1 to 4.4)

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II YEAR – III SEMESTER
COURSE CODE: 4MMA3C3

CORE COURSE X – OPERATIONS RESEARCH

Unit I

Network Models: Scope and definition of network models – Minimal spanning tree algorithm– Shortest – Route Problem: Examples of the shortest route applications, Shortest route algorithms, linear programming formulation of the shortest route problem – maximal flow model – Enumeration of cuts, maximal flow algorithm, linear programming formulation of maximal flow mode – CPM and PERT: Network representation, CPM Computations, construction of the time schedule, Linear programming formulation of CPM, PERT calculations.

Unit II

Deterministic inventory Models: General inventory Model – role of demand in the development of inventory models – static Economic – Order – Quantity models – classic EOQ models, EOQ with price breaks, multi item EOQ with storage limitation – Dynamic EOQ models: No step Model, Setup Model.

Unit III

Queing systems: Elements of a queuing model – Role of exponential distribution – Pure birth and Death Models (relationship between the Exponential and Poisson distributions) Pure birth Model, Pure death model.

Unit IV

Generalized poisson queuing model Specialized poisson Queues: Steady State measures of performance, Single Server Models, multiple server models, Machine Servicing Model (M/M/R): (GD/K/K), R>K – (M/G/1): (GD/∞/∞) – Pollaczek – Khintchine (P-K) formula – other queuing Models.

Unit V

Non Linear Programming Algorithms: Unconstrained algorithms: Direct search Method, Gradient Method – Constrained Algorithms separable programming.

Text Book

Operations Research VIII Edition by Hamdy A. Taha, Prentice-Hall of India Pvt.Ltd.
Chapters: VI, XI, XV and XIX

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II YEAR – III SEMESTER
COURSE CODE: 4MMA3C4

CORE COURSE XI – NUMBER THEORY

Unit I

The fundamental Theorem of Arithmetic: Introduction – divisibility – greatest common divisor – Prime Numbers – The Fundamental theorem of arithmetic – The series of reciprocals of the primes the Euclidean Algorithm – the greatest common divisors of more than two numbers.

Unit II

Arithmetical functions and Dirichlet Multiplication: Introduction; the Mobius function $\mu(n)$ – θ and μ – product formula for $\theta(n)$ the Dirichlet product of arithmetical functions Dirichlet inverses and the mobiles inversion formula the Mangoldt function (n) – Multiplicative functions – Multiplicative functions; and Dirichlet multiplication – the inverse of a Completely multiplicative function – Liouville's fn λ (n) – the division functions $\sigma\alpha$ (n) – Gneralized Convolutions – Formal Power Series – the Bell series of an arithmetical function Bell series and Dirichlet Multiplication – Derivatives of arithmetical functions the selberg identity.

Unit III

Averages of Arithmetical Functions: Introduction The big on notation Asymptotic equality of functions – euler's summation formula some elementary asymptotic formulas – the average order of d (n) – the average order of the division functions $\sigma\alpha(n)$ – the average order of θ (n) an application to the distribution of lattice points. Visible from the origin the average order μ (n) and of Λ (n) the partial sums of a Dirichlet product – Applications to $\mu(n)$ and Λ (n) Another identity for the partial sums of a Dirichlet product.

Unit IV

Congruences: Definition and Basic properties of congruences Residue classes and complete residue systems linear congruences – reduced residue systems and the Euler – Fermat theorem– Polynomial congruences modulo Lagrange's theorem – Applications of Lagrange's theorem Simultaneous linear congruences the Chinese remainder theorem – Application of the Chinese remainder theorem – polynomial congruences with prime power moduli the principle of cross classification a decomposition property of reduced residue systems.

Unit V

Quatratic residuces and the Quadratic Reciprocity Law: Lagrange's symbol and its properties– evaluation of (-1/p) and (2/P) – Gauss's Lemma – the quadratic reciprocity law applications of the reciprocity law the Jacobi symbol applications to Diphantine eqns

Text Book

Introduction to Analytic Number theory by Tom M. Apostal, Springer Verlag
Chapters : I, II, III, V & IX (upto Diphantine equations)

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II YEAR – III SEMESTER
COURSE CODE: 4MMA3E1

ELECTIVE COURSE IV (A) – COMBINATORIAL MATHEMATICS

Unit I

Generating function.

Unit II

Recurrence relation.

Unit III

The principle of inclusion and exclusion.

Unit IV

Polya theory of counting.

Unit V

Block Designs.

Text Book

Introduction to Combinatorial Mathematics by CL. Liu, McGRAW Hill.

Chapters : II III, IV, V & XIV.

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II YEAR – III SEMESTER
COURSE CODE: 4MMA3E2

ELECTIVE COURSE IV (B) – STOCHASTIC PROCESSES

Unit I

Stochastic Processes: Basic concepts – Markov chains.

Unit II

Definition, Transition Matrix, order of Markov chain, Higher Transition probabilities – classifications of states and chains, Determinations of Higher transition probabilities.

Unit III

Stability of a Markov chain, Limiting behaviour Markov process and related distributions.

Unit IV

Generalizations of Poisson process. Birth and death process, Markov processes.

Unit V

Renewal processes: Renewal Equations, Renewal Theorems, delayed and equilibrium renewal processes, residual and excess life times.

Text Book

Stochastic Processes by J. Medhi, Wiley Eastern, June 1987

Chapter II	:	Full
Chapter III	:	(Sections 3.1, 3.2, 3.3, 3.4, 3.5)
Chapter IV	:	(Sections 4.1, 4.2, 4.3, 4.4, 4.5)
Chapter VI	:	(Sections 6.1, 6.2, 6.3, 6.4, 6.5)

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II YEAR – III SEMESTER
COURSE CODE: 4MMA3E3

ELECTIVE COURSE IV (C) – FUZZY MATHEMATICS

Unit I

Crisp sets and fuzzy sets.

Unit II

Operation on fuzzy sets.

Unit III

Fuzzy relations.

Unit IV

Fuzzy measures.

Unit V

Decision making in Fuzzy environments.

Text Books

1. Fuzzy sets – Uncertainity and information by George J.Klir and Tina A.Folger, Prentice – Hall of India Pvt. (2006). Chapters: I, II, III & IV.

2. Fuzzy set theory and its applications – H.J.Zimmermann – Springer – Fourth Edition (2001). Chapter XIV.

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II YEAR – IV SEMESTER
COURSE CODE: 4MMA4C1

CORE COURSE XII – FUNCTIONAL ANALYSIS

Unit I

Normed spaces, continuity of linear Maps.

Unit II

Hahn – Banach theorems, Banach limits, Banach spaces.

Unit III

Uniform boundedness Principle – Closed graph and open mapping theorems

Unit IV

Duals and Transposes, Duals of L^p ([a, b]) and C ([a, b]) (excluding moment sequences)

Unit V

Inner product spaces, orthonormal sets, projection and Reisz Representation theorems.

Text Book

Functional Analysis by B.V Limaye, Second Edition, New Age International Pvt. Ltd., Publishers.

Chapter II	:	(Section 5, 6, 7, 8)
Chapter III	:	Section 9 (Subsections 9.1, 9.2, & 9.3 only) & Sections 10
Chapter IV	:	(Sections 13, 14) (excluding Moment Sequences Subsections 14.6 & 14.7)
Chapter VI	:	(Sections 21, 22, and 24.1, 24.2, 24.3 & 24.4)

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II YEAR – IV SEMESTER
COURSE CODE: 4MMA4C2

CORE COURSE XIII – TOPOLOGY – II

Unit I

Connectedness and Compactness: Local Compactness – The Tychonoff Theorem: The Tychonoff theorem.

Unit II

Completely Regular Spaces , The Stone – Cech Compactification.

Unit III

Metrization theorems and Paracompactness: Local Finiteness, The Nagata – Smirnov Metrization Theorem (Sufficiency) – The Nagata – Smirnov Theorem (necessity).

Unit IV

Complete Metric Spaces and Function Spaces: Complete metric spaces – A Space – Filling Curve – Compactness in Metric spaces – Point wise and compact convergence.

Unit V

The Compact – Open Topology – Ascoli's theorem – Baire Spaces – A Nowhere differentiable functions.

Text Book

Topology, A First Course by James R Munkres, Prentice Hall of India.

Chapter III : (Section 3.8)
Chapter V : (Sections 5.1, 5.2, 5.3)
Chapter VI : (Sections 6.1, 6.2, 6.3)
Chapter VII : (Sections 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8)

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II YEAR – IV SEMESTER
COURSE CODE: 4MMA4C3

CORE COURSE XIV – NUMERICAL ANALYSIS

Unit I

Systems of Equations and unconstrained optimization: optimization and Steepest descent – Newton's method – fixed point Iteration and Relaxation method.

Unit II

Approximation: Uniform approximation by polynomials – Data fitting – orthogonal polynomials – Least square approximation by polynomials.

Unit III

Differentiation and Integration: Numerical integration – some basic rules – Gaussian rules – composite rules.

Unit IV

The solutions of differential Equations: Mathematical preliminaries – simple difference equations – Numerical integration by Taylor's series – Error estimates and convergence of Euler's method.

Unit V

Multistep formulas – Predictor – Corrector methods. Bountary value problems – finite difference methods – shooting methods.

Text Book

Elementary Numerical Analysis – An algorithimic Approach by S.D.Conte and Carl De Boor, Mcgraw Hill (1981) Third Edition

Chapter V : (Sections 5.1, 5.2, 5.3)
Chapter VI : (Sections 6.1, 6.2, 6.3, 6.4)
Chapter VII : (Sections 7.1, 7.2, 7.3, 7.4)
Chapter VIII : (Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.7, 8.8)
Chapter IX : (Sections 9.1, 9.2)

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II YEAR – IV SEMESTER
COURSE CODE: 4MMA4E1

ELECTIVE COURSE V (A) – ADVANCED STATISTICS

Unit I

Introduction to statistical Inference: Point estimation – confidence intervals for means – confidence intervals for differences of means – test of statistical hypothesis – Additional comments about statistical tests – Chi-Square tests.

Unit II

Sufficient Statistics: Measures of Quality of Estimators – a sufficient statistic for a parameter– properties of a sufficient statistic – completiness and uniqueness the exponential class of probability density – functions of a parameter.

Unit III

More about estimation: Bayesian Estimation – Fisher Information and the Rao – Cramer inequality Limiting Distributions of Maximum Likelihood estimators.

Unit IV

Theory of statistical tests: Certain Best tests – Uniformly most powerful tests – Likelihood Ratio Tests – the sequential probability Ratio Test.

Unit V

Inferences about Normal Models: The distributions of certain Quadratic forms – A test of the equality of several means – Noncentral χ^2 and noncentral F – multiple comparisons – The analysis of variance – A regression problem – A test of independence.

Text Book

Introduction to Mathematical Statistics (Fifth Edition) by Robert V. Hogg and Allen T.Craig, Pearson Education Asia.

Chapter : VI
Chapter : VII (Omit 7.7, 7.8 and 7.9)
Chapter : VIII (Omit 8.4)
Chapter : IX (Omit 9.5)
Chapter : X (Omit 10.8 and 10.9)

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II YEAR – IV SEMESTER
COURSE CODE: 4MMA4E2

ELECTIVE COURSE V (B) – DATA STRUCTURES AND ALGORITHMS – THEORY AND PRACTICAL

Unit I

Preliminaries in C++**:** Functions and Parameters Dynamic Memory Allocation – Classes – Testing and Debugging
Programming Performances**:** Space Complexity – Time Complexity – Asymptotic Notation (O,Ω, θ, o) Practical Complexity – Performance Measurements.

Unit II

Data Representation**:** Linear Lists – Formula based representation – Linked representation – Indirect Addressing – Simulating Pointers – Applications.

Arrays Matrices**:** Arrays – Matrices – Special Matrices – Sparse Matrices.
Stacks and Queues: The Abstract Data Type – Derived Classes and Inheritance – Formula based Representation – Linked Representation – Applications – Hashing.

Unit III

Binary and other Trees**:** Trees – Binary Trees – Properties of binary trees – Representation of Binary Trees – Common Binary tree operations – Binary Tree traversal – The ADT Binary tree – Applications – Priority Queues: Linear Lists – Hash – Leftist Trees – Applications – Search Trees – AVL Trees – B-Trees – Applications – Graphs.

Unit IV

The Greedy Method**:** Optimization Problems – Greedy Method – Applications
Divide and Conquer**:** The Method – Applications – Lower Bounds on Complexity.

Unit V

Dynamic Programming**:** The Method – Applications – Backtracking – The Method – Applications – Branch and Bound: The Method – Applications.

Text Book

SAHNI, Data structures, Algorithms and Applications in C++ – International Edition 1998, Tata McGraw Hill.

DATA STRUCTURES AND ALGORITHMS IN C++ LAB

1. Stack implementation using Arrays and Linked List
2. Queue implementation using Arrays and Linked List
3. Binary Search Tree
4. Single Linked List, Doubly Linked and Circular Linked List
5. Different Types of Sorting (Quick, Bubble, Merge etc)
6. String Operations
7. Number Generation (Prime Number, Fibonacci, Armstrong, Perfect Numbers)
8. Searching (Linear and Binary)
9. SPARSE Matrix
10. Polynomial Addition
11. Tree Traversal
12. Sum of Alternate Digits
13. Student File (Mark Processing)
14. Matrix Multiplication
15. Employee Details

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II YEAR – IV SEMESTER
COURSE CODE: 4MMA4E3

ELECTIVE COURSE V (C) – AUTOMATA THEORY

Unit I

Definition of automata – transition system – acceptability of a string by finite automation –Non – deterministic finite state machines – the equivalence of DFA and NDFA.

Unit II

Formal languages – Chomsky classification of languages – Languages and their relations.

Unit III

Recursive and Recursively Enumerable sets – Operation on languages – Languages and Automata.

Unit IV

Regular expressions – finite Automata and regular expansions – Pumping Lemma for regular sub–closure properties of regular sets.

Unit V

Context – Free languages – simplication of context free Grammar – Normal forms for context free languages.

Text Book

Theory of Computer Science (Automata, Languages and Computation) III Edition by KLP Mishra and N. Chandrasekaran, Prentice Hall of India (2007).

Chapter III : (Sections 3.1 to 3.7)
Chapter IV : (Sections 4.1 to 4.6)
Chapter V : (Sections 5.1 to 5.5)
Chapter VI : (Sections 6.1 to 6.4)

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