HINDUSTHAN COLLEGE OF ARTS AND SCIENCE(AUTONOMOUS)
COIMBATORE - 641 028
M.Sc., MATHEMATICS
SCHEME OF EXAMINATIONS-CBCS PATTERN
(For the Students admitted from the Academic year 2016 - 2017 and onwards)

CODE NO	SUBJECT	LECTURE HRS/ WEEK	EXAM DURATION HRS	MAXIMUM MARKS			CREDIT POINTS
				IE	EE	TOTAL	
First Semester							
16MAP01	Advanced Algebra	6	3	25	75	100	5
16MAP02	Advanced Real Analysis	6	3	25	75	100	5
16MAP03	Ordinary Differential Equations	6	3	25	75	100	5
16MAP04	Numerical Analysis	6	3	25	75	100	4
16MAP05	Mathematical software-I (Theory)	4	3	25	75	100	2
16MAP06	Mathematical software -I (Lab)	2	3	40	60	100	2
Second Semester							
16MAP07	Advanced Complex Analysis	6	3	25	75	100	4
16MAP08	Partial Differential Equations	6	3	25	75	100	4
16MAP09	Mechanics	6	3	25	75	100	4
16MAP10	Optimization Techniques	6	3	25	75	100	4
16MAP11	Fuzzy logic and fuzzy set.	4	3	25	75	100	4
16GSP01	Skill based - Cyber security	2	-	100	-	100	2
Third Semester							
16MAP12	Topology	6	3	25	75	100	5
16MAP13	Advanced Topics in Fluid Dynamics	6	3	25	75	100	5
16MAP14	Probability theory and Mathematical statistics	6	3	25	75	100	4
16MAP15	**Elective - I** (a) Graph Theory (or) (b) Stochastic Differential Equations	6	3	25	75	100	4
16MAP16	Mathematical Software-II(Theory)	4	3	25	75	100	4
16MAP17	Mathematical software -II (Lab)	2	3	40	60	100	2
Fourth Semester							
16MAP18	Functional Analysis	7	3	25	75	100	4
16MAP19	Mathematical Methods	7	3	25	75	100	4
16MAP20	C++ Programming (Theory)	5	3	25	75	100	2
16MAP21	C++ Programming (Lab)	4	3	40	60	100	2
16MAP22	**Elective - II** (a)Magneto Hydro Dynamics (or) (b)Operator Theory	6	3	40	60	100	4
16MAP23	Project	1	-	50	150	200	5
							90

REGULATIONS FOR PG

1. Breakup Marks for IE (Theory papers)

One Test	- 5 Marks
Model Exam	- 10 Marks
Assignments	- 5 Marks
Seminar	- 5 Marks
Total	- 25 Marks

Question Paper Pattern for IE test I (for 50 Marks) (2 hours)

Section-A (18 Marks) — **3 x 6=18 Marks**
Answer **ALL** Questions
Either or Type
ALL questions carry EQUAL Marks

Section-B (32 Marks) — **2 x 16=32 Marks**
Answer any **TWO** Questions out of three questions.
ALL questions carry EQUAL Marks

Total 50 Marks

Question Paper Pattern for IE Model Exam (for 75 Marks) (3 hours)

Section-A (30 Marks) — **5 x 6= 30 Marks**
Answer **ALL** Questions
One Question from each unit with **Either or Type**
ALL questions carry EQUAL Marks

Section-B (45 Marks) — **3 x 15= 45 Marks**
Answer any **THREE** Questions out of five questions.
ALL questions carry EQUAL Marks

Total 75 Marks

2 a) Components for Practical I. E.

Components	Marks
Test –I	20
Test - II	20
Total	**40**

2 b) Components for Practical E.E.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	**60**

3. Institutional/ Industrial Training, Mini and Major Project Work

*[1]Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

Institutional / Industrial Training		**Mini Project**	**Project Work**		
Components	**Marks**		**Components**		**Marks**
I.E			*I. E*		
Work Diary	25	-	a) Attendance Marks	20	
Report	50	50	b) Review Marks	30	50
Viva –voce	25	50			
Examination					
Total	**100**	**100**			
			E.E[1]		
			a) Final Report Marks	120	
			b) Viva-voce Marks	30	150
				Total	**200**

4. Components for Cyber Security Paper

Components	Marks
Two Tests (2 x 40)	80
Two assignments (2 x 10)	20
Total	**100**

The question paper pattern is as follows:

i) Test I – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40Marks
j) Test II – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40 Marks

Total = 80 Marks

- The passing minimum for Cyber Security is 50
- In case the candidate fails to secure 50 marks which is the passing minimum, he/she may have to reappear for the same in the subsequent semesters.

5. Question Paper Pattern for EE Theory (for 75 Marks) (3 hours)

Section-A (30 Marks) — **5 x 6=30 Marks**
Answer **ALL** Questions
One Question from each unit with **Either or Type**
ALL questions carry EQUAL Marks

Section-B (45 Marks) — **3 x15=45 Marks**
Answer any **THREE** Questions out of five questions.
ALL questions carry EQUAL Marks

Total 75 Marks

(or)

Section-A (30 Marks) — **5 x 6=30 Marks**
Answer **ALL** Questions
One Question from each unit with **Either or Type**
ALL questions carry EQUAL Marks

Section-B (45 Marks) — **3 x15=45 Marks**
Question number 6 is compulsory
Answer any **TWO** Questions out of the remaining four questions.
ALL questions carry EQUAL Marks

Total 75 Marks

Code No	Subject	Semester No
16MAP01	ADVANCED ALGEBRA	I
Objective:	On successful completion of this course,the students should gain the knowledge about group theory and its properties.	
Unit No	Topics	Hours
Unit I	**Group Theory:** Permutation groups- Permutation groups and its product of its cycle- Another counting principle – Sub group-Cauchy theorem-Sylow's theorem –Second proof of sylow's theorem- third proof of sylow's theorem- Direct products **Chapter 2: Sections 2.11 – 2.13**	15
Unit II	**Ring Theory:** The field of quotients of an integral domain-Euclidean rings – A particular Euclidean ring -Polynomial rings - Polynomials over the rational field **Chapter 3: Sections 3.7 - 3.10**	15
Unit III	**Fields:** Extension Fields – Finite Extension-Algebraic of Degree n - Roots of polynomials –More about roots. **Chapter 5: Sections 5.3 and 5.5**	14
Unit IV	**Types of Fields:** T he elements of Galois theory –Fixed field-Finite Fields **Chapter 5: Sections 5.6 , Chapter 7: Sections 7.1**	14
Unit V	**Linear Transformations:** Canonical forms: Triangular form – Nilpotent transformations-Jordan form – Hermitian and unitary Transformations **Chapter 6: Sections 6.4, 6.8 and 6.10**	14

Text book:

1. Herstein.I.N.,Topics in Algebra (II Edition) Jan.2006

Reference Book:

1. Fraleigh.J.B., A First Course in Abstract Algebra. Narosa Publishing House, New Delhi, 1988.

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Code No	Subject	Semester No
16MAP02	ADVANCED REAL ANALYSIS	I
Objective:	On successful completion of this course,the students should gain the knowledge about Riemann-Stieltjes Integral, Sequences of Functions, Lebesgue Measure and integral.	
Unit No	**Topics**	**Hours**
Unit I	**Riemann stieltjes integral:** Definition and Existence of the Integral –properties of the integral –Integration and differentiation -Integration of vector valued function – **Chapter 6: Sections 6.1 - 6.25**	**15**
Unit II	**Sequence and Series of functions:** Uniform convergence and continuity – Uniform convergence and integration -uniform convergence and differentiation —The Stone Weirstrass theorem **Chapter 7: Sections 7.7,7.8, 7.26 - 7.27**	**15**
Unit III	**Functions of several variables:** Linear transformation –contraction principle –Inverse function theorem –Implicit function theorem. **Chapter 9: Sections 9.1 - 9.5, 9.22 - 9.25**	**14**
Unit IV	**Lebesgue measure:** Outer measure –Measurable sets and Lebesgue measure – Measurable functions and non measurable sets. **Chapter 3 : Sections 3.1 - 3.5**	**14**
Unit V	**Lebesgue integral:** The Lebesgue integral of bounded functions over a set of finite measure –integral of a non –negative function –General Lebesgue Integral – The integral comparision test –Lebesgue dominated convergence theorem. **Chapter 4: Sections 4.1 - 4.5**	**14**

Text book:

1. Rudin.W. Principles of Mathematical Analysis , McGraw Hill New York, 2013.

Unit I –III: Chapters 6, 7, 9.

Reference Book:

1. Roydon.H.L.. Real Analysis , Third Edition, MacmillanNew York, 1988.

Unit IV –V: Chapters 3 and 4.

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Code No	Subject	Semester No
16MAP03	**ORDINARY DIFFEENTIAL EQUATIONS**	I
Objective:	End of this course, the students gain the knowledge about the method of solving Ordinary Differential Equations. It also exposes Ordinary Differential Equation as a powerful tool in solving problems in Physical and Social sciences.	
Unit No	**Topics**	**Hours**
Unit I	**Second order linear equations with ordinary points :** Uniform convergence and Legendre equation and Legendre polynomials –Second order equations with regular singular points – properties of Bessel functions **Sections 3.1 - 3.5**	**15**
Unit II	**Systems of first order equations:** Model for Arms competition between two nations- Existence and uniqueness theorem – Fundamental matrix. **Sections 4.1 - 4.5**	**15**
Unit III	**Nonhomogeneous linear systems :** Linear systems with constant coefficients –linear systems with periodic co-efficients- Miscellaneous Exercises. **Sections 4.6 – 4.8**	**14**
Unit IV	**Successive approximation:** Picard's theorem -Non-uniqueness of solution–Continuation and dependence on initial conditions, Existence of solutions in the large-Existence and uniqueness of solutions of systems-Fixed point method. **Sections 5.1 – 5.9**	**14**
Unit V	**Fundamental results** Sturm's comparison theorem –Elementary linear oscillations. Comparison theorem of Hille-Winter –oscillations of $x''+a\,t(x) = 0$. **Sections 8.1 – 8.9**	**14**

Text book:

1. Deo.S.G. and Raghavendra.V – "Ordinary Differential Equations and Stability Theory "– 3rd edition 2015

Reference Book:

1. Coddington. E.A. and Levinson.N , – "Theory of Ordinary Differential Equations", McGraw Hill. New York, 1955.

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Code No	Subject	Semester No
16MAP04	NUMERICAL ANALYSIS	I
Objective:	End of this course, the students gain the knowledge about the method of solving Romberg integration, Relaxation method, Milne's method, Crank Nicolson method	
Unit No	Topics	Hours
Unit I	**Solution of nonlinear equations:** Bisection method- Regula Falsi method-Newton's method – Convergence of Newton's method ,Horners method **Chapter 3: Sections 3.1,3.3,3.4,3.5** **Numerical differentiation and integration:** Derivatives from Differences tables –Higher order derivatives – Divided difference, Central-Difference formulas –Composite formula of Trapezoidal rule –Romberg integration **Chapter 9: Sections 9.1-9.4,9.6-9.14**	15
Unit II	**Solution of system of equations:** Gauss Elimination method – Gauss Jordan methods –LU Decomposition method –Matrix inversion by Gauss-Jordan method –Methods of Iteration –Jacobi and Gauss Seidal Iteration **Chapter 4: Sections 4.1-4.9**	15
Unit III	**Solution of ordinary differential equations:** Taylor series method –Euler and Modified Euler methods – Rungekutta methods (4^{th} order & 6^{th} order)–Milne's method – Adams Moulton method. **Chapter 11: Sections 11.5-11.7,11.9-11.18**	14
Unit IV	**Characteristic value problems**: Eigen values of a matrix by Iteration –The power method Derivative boundary conditions, Jacobi method for finding Eigen values **Chapter 9: Sections 9.1-9.4,9.6-9.14**	14
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 . **Chapter 12: Sections 12.1 - 12.10**	14

Text book :

1.Kandasamy. P. Thilagavathi. K and Gunavathi. K – "Numerical methods" , S. Chand and Company Ltd. New Delhi – Revised Edition 2007.

Reference Book:

1. Chapra .S.C. and Raymond. P.C. – "Numerical Methods for Engineers", tata McGraw Hill. New Delhi. (2000)2..L. Burden and J. Douglas Faires: Numerical Analysis, P.W.S.Kent Publishing Company. Boston (1989), Fourth Edition.

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Code No	Subject	Semester No
16MAP05	MATHEMATICAL SOFTWARE-I	I
Objective:	End of this course, the students are expected to gain the knowledge about mathematical software and their applications in decision making.	
Unit No	Topics	Hours
Unit I	**Basis of a Latex file:** Special Characters, Document layout and organization – Document class, Page style, Parts of the document, Centering and indenting, Lists, Theorem–like declarations, Boxes, Tables. **Chapter2:Section2.5,Chapter3:Sections3.1– 3.3, Chapter 4:4.2,4.3,4.5,4.7,4.8**	10
UnitII	**Footnotes and marginal notes:** Mathematical formulas – Mathematical environments, Main elements of math mode, Mathematical symbols, Additional elements, Fine–tuning mathematics, Drawing pictures with LATEX. **Chapter 4: Sections 4.10, Chapter 5: Section 5.1 - 5.5, Chapter 6:Section 6.1**	10
Unit III	**MATLAB Windows:** Online help – Matrices and Vectors – Matrix and Array Operations – Inline functions – using Built-in Functions and on –line help-saving and loading data-plotting simple graphs. **Chapter 1: Sections 1.6.1,1.6.2,Chapter 3: Section 3.1, 3.2,3.5.1,3.6-3.8**	10
Unit IV	**Programming in MATLAB:** Script files - Functions and function files-Language specific Features-Advanced data objects. **Chapter 4: Sections 4.1 - 4.4**	9
Unit V	**Loops :** Linear Algebra – Data Analysis and Statistics – OrdinaryDifferentialEquations–Nonlinear Algebraic Equations – Basic 2D and 3D Plot (Syntax only). **Chapter4:Sections4.3.4,Chapter5:Section 5.1, 5.3,5.5,5.6 Chapter 6:Sections 6.1,6.3**	9

Text book:

1. Kopka. H and Daly. P.W. – "A Guide to LATEX", Fourth Edition, Addison – Wesley, London,2004 for Unit I and II

Reference Book:

1. RudraPratap – "Getting Started with MATLAB" –Indian Edition,Oxford UniversityPress for 2010 Unit III ToUnit V

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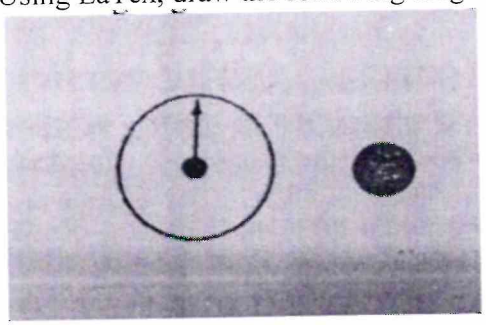
Code No	Subject	Semester No
16MAP06	PRACTICAL I MATHEMATICAL SOFTWARE-I	I
Objective:	End of this course, the students are expected to gain the knowledge about mathematical software and their applications in decision making.	

1. Using LaTex, type the following paragraph, to including the 9.5in text height, 6.30in text width, 0.10in left margin, 0.120in right margin, -0.6in top margin, 1.5in line space and foot notes.
2. Using LaTex, type the following formula

$$a_0+\cfrac{1}{a_1+\cfrac{1}{a_2+\cfrac{1}{a_3+\cfrac{1}{a_4}}}}+\begin{pmatrix} a & b \\ c & d \end{pmatrix}+\sum_{\alpha=0}^{\infty}(\beta^{\alpha}+\Gamma^{\alpha})$$

3. Using LaTex, draw the following diagram:



4. Create the following table using LaTex: S.No. Register Number Name of the Student Percentage of Marks Rank

S.No.	Register Number	Name of the Student	Percentage of Marks	Rank
1	XXXXXX	XXXXXX	XXXXX	XXXX
2	XXXXXX	XXXXXXX	XXXX	XXXX
3	XXXXXX	XXXXXX	XXXX	XXXXX

5. By using MATLAB, Plotting a function.
6. By using MATLAB, Polar plot.
7. By using MATLAB, Addition of two matrices.
8. By using MATLAB, Finding the determinant of a matrix.
9. By using MATLAB, Write the MATLAB program to generate Fibonacci series.
10. Using MATLAB, Solve the following system of equations by matrix method 2x+y13, x-3y = -18.
11. Using MATLAB, solve the following first order linear differential equation using Euler method: $dy/dx = -y$, $y(0)=1$. Draw the graph and compare the exact solution.
12. Calculate mean, median, standard deviation, variance, maximum value, minimum value, range, skewness and kurtosis for the following data: 40 41 45 49 50 51 55

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Code No	Subject	Semester No
16MAP07	ADVANCED COMPLEX ANALYSIS	II
Objective:	On successful completion of this course, the students are expected to gain knowledge about complex functions and mappings.	
Unit No	Topics	Hours
Unit I	**Introduction to the concept of analytic function**: Limits and continuity –Analytic functions, Polynomials – Conformality:Arcs and closed curves –Analytic functions in regions –Conformal Mapping –Length and Area **Chapter 2: Sections 1.1 - 1.3 Chapter 3: Sections 2.1 - 2.4**	15
UnitII	**Complex Integration**: Line Integrals Rectifiable Arcs –Line Integrals as Functions of Arcs –Cauchy's theorem for a rectangle -Cauchy's theorem in a disk, Cauchy's Integral formula: The Index of a point with respect to a closed curve –Removable singularity- Taylor's Theorem –Zeros and Poles –The Local Mapping **Chapter 4: Sections 1.1 - 1.4 ,2.1,3.1-3.3**	15
Unit III	**The Calculus of Residues:** The Residue theorem –The Argument principle –Evaluation of definite integrals. Harmonic functions: The Definitions and basic Properties –Mean value property –Poisson's Formula. **Chapter 4: Sections 5.1 - 5.3,6.1-6.3**	14
Unit IV	**Series and Product Developments:** Weierstrass Theorem–The Taylor Series The Laurent Series–Partial fractions and Factorization: Partial Fractions-Infinite Products **Chapter 5: Sections 1.1 - 1.3,2.1,2.2**	14
Unit V	**The Riemann Mapping Theorem** The Riemann Mapping Theorem –Use of the reflection principle – Analytic arcs –Conformal mapping of Polygons: The Behaviour at an angle –The Schwarz –Christoffel Formula –Mapping on a rectangle **Chapter 6: Sections 1.1 ,1.3,1.4,2.1-2.3**	14

Text book :

1. Ahlfors. L.V., Complex Analysis,McGraw Hill, New York, 1999.

Reference Book:

1.Gamelin.T.W. ,complex analysis

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Code No	Subject	Semester No
16MAP08	PARTIAL DIFFERENTIAL EQUATIONS	II
Objective:	End of this course, the students are expected to gain the knowledge about the method of solving Partial Differential Equations.	
Unit No	Topics	Hours
Unit I	**Mathematical Models:** The Classical equation –The vibrating string –The vibrating membrane–Conduction of Heat in solids –Cannonical forms– equations with constant coefficients –general solution **Chapter 2:Sections 2.2, 2.3, 2.5 Chapter3: Sections 3.1 – 3.4**	15
Unit II	**The Cauchy problem:** Cauchy–Kowlalewsky theorem –Homogeneous wave equation – Initial –Boundary value problems–Non-homogeneous boundary conditions –Nonhomogeneous wave equation, Riemann Method. **Chapter 6: Sections 6.1 - 6.25**	15
Unit III	**Methods of separation of variables:** Separation of variables –The vibrating string problem –Existence and Uniqueness of solution of the vibrating string problem. The heat conduction problem –existence and uniqueness of solution of the heat conduction problem. **Chapter 6: Sections 6.2 - 6.6**	14
Unit IV	**Boundary value problems:** Maximum and minimum principles –Uniqueness and continuity theorems –Dirichlet problems for a circle –Neumann problem for a circle Drirchlet problem for a rectangle –Neumann problem for a rectangle. **Chapter 8: Sections 8.1 – 8.7, 8.9**	14
Unit V	**Green's function:** The delta function –Green's function –method of Green's function –Dirichlet problem for the Laplace operator–method of images– method of eigen functions. **Chapter 10: Sections 10.1 – 10.4, 10.6 – 10.7**	14

Text book:

1. TynMyint. U with LokenathDebnath,Partial Differential Equations for Scientists and Engineers, 4th Edition.. 2011

ReferenceBook:

1. Sneddon. I.N., Elements of Partial Differential Equations, McGraw Hill, London, 1957.

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Code No	Subject	Semester No
16MAP09	MECHANICS	II
Objective:	On successful completion of this course, the students should gain knowledge about Hamilton's Equations, Hamilton-Jacobi Theory, Canonical Transformations and Introduction to Relativity	
Unit No	Topics	Hours
Unit I	**Indroductory concepts:** Mechanical system –Generalized Coordinates – Coplanar Motion –Constraints –Virtual Work –Energy and Momentum. **Sections 1.1 - 1.5**	15
Unit II	**lagrange's equations:** Introduction to Lagranges equations- Derivations of Lagrange's Equations –Examples –Integrals of Motion. **Sections 2.1 - 2.3**	15
Unit III	**Hamiton's equations:** Introduction to Hamilton's equations-Hamilton's methods-Action and Hamilton's Principle –Hamilton's Equations. **Sections 4.1 - 4.2**	14
Unit IV	**Hamilton –Jacobi theory:** Hamilton's Principle function –Hamilton –Jacobi Equation and waves of constant action –Separability. **Sections 5.1 - 5.3**	14
Unit V	**Canonical transformations:** Differential forms and Generating Functions – Lagrange and Poisson Brackets-Theory of Dimensions. **Sections 6.1 - 6.4**	14

Text book :

1. Greenwood. D.T. –Classical Dynamics, Dover Publication, New York, 2nd edition 1997

Reference Book:

1. Gantmacher. F, Lectures in Analytic Mechanics, MIR Publishers. Moscow, 1975.

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Code No	Subject	Semester No
16MAP10	**OPTIMIZATION TECHNIQUES**	II
Objective:	On successful completion of this course.the students should gain knowledge about optimal use of resources.	
Unit No	**Topics**	**Hours**
Unit I	**Simplex method:** What is operation research?–Modeling with Linear Programming – Simplex method –Artificial starting solution –Special cases in the Simplex method - Revised simplex method. **Chapter 1, Chapter 2: Sections 2.1,2.2.1,2.2.2, Chapter 3: Sections 3.1.1,3.1.2,3.3.1,3.3.2,3.4.1,3.4.2,3.5.1-3.5.4**	**15**
Unit II	**Duality:** Definition –Primal –Dual relationship –Dual simplex method – Transportation model –Assignment model. **Chapter 4 : Sections 4.1,4.2.1-4.2.4,4.4.1 Chapter 5: Sections 5.1, 5.2, 5.3.1-5.3.2,5.4.1-5.4.2**	**15**
Unit III	**Network models:** Minimal spanning tree algorithm –Shortest root algorithm (Dijkstra's algorithm only) – CPM - PERT. **Chapter 6 : Sections 6.1,6.2,6.3.1,6.3.3,6.5.1-6.5.5**	**14**
Unit IV	**Inventory control:** Types of inventories – Inventory cost – EOQ with no shortages – EOQ with shortages – EOQ with price breaks. **Chapter 7 : Sections 7.1.1,7.1.2,7.2.1,7.2.2**	**14**
Unit V	**Simulation modeling:** Monte Carlo simulation –Types of simulation –Elements of discrete event simulation –Generation of random numbers. **Chapter 16 : Sections 16.1,16.2,16.3.1,16.3.2,16.4**	**14**

Text book :

1. Taha. H.A.,Operations Research: An Introduction, Eighth Edition, Prentice Hall of India Private Limited, NewDelhi (2006).

ReferenceBook:

1. Dantzig. G, Linear Programming and Extension, Princeton University Press, Princeton , 1963.

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Code No	Subject	Semester No
16MAP11	FUZZY LOGIC AND FUZZY SET	II
Objective:	On successful completion of this course ,the students should gain knowledge about techniques and applications of fuzzy sets and fuzzy logic in decision making.	
Unit No	Topics	Hours
Unit I	**FUZZY SETS:** Basic types – Basic concepts – α-cuts – Additional properties of α- cuts – Representation of fuzzy sets– Decompositions theorems –Extension principle for Fuzzy sets. **Chapter 1: Sections 1.3 - 1.5,Chapter 2: Sections 2.1 - 2.3**	10
Unit II	**OPERATIONS ON FUZZY SETS:** Types of operations – Fuzzy complements – Fuzzy Intersections: t-Norms – Fuzzy Unions: t-conorms – Combinations of operations. **Chapter 3: Sections 3.1 - 3.5**	10
Unit III	**FUZZY ARITHMETIC:** Fuzzy numbers –Linguistic variables– Arithmetic operations on intervals – Arithmetic operations on Fuzzy numbers. **Chapter 4: Sections 4.1 - 4.4**	10
Unit IV	**FUZZY RELATIONS:** Crisp and fuzzy relations – Binary fuzzy relations – Binary relations on a single set-Fuzzy equivalence relations–Fuzzy compatibility relations –Fuzzy ordering relations–Fuzzy morphism–Sup-i compositions of binary fuzzy relations – Inf-ωi compositions of fuzzy relations. **Chapter 5: Sections 5.1 – 5.10**	9
Unit V	**APPLICATIONS:** Natural, life and Social Sciences - Engineering - Medicine - Management and decision making **Chapter 6: Sections 6.2 - 6.5**	9

Text book :

1. George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, 1995For Unit I to IV

Reference book:

1. George J. Klir and Tina A. Folger, "Fuzzy Sets, Uncertainty and Information", Prentice-Hall of India Private Limited-Fourth printing-2005 For Unit V

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Code No	Subject	Semester No
16MAP12	TOPOLOGY	III
Objective:	To gain knowledge about the concept of compactness, connectedness and separation axioms.	
Unit No	Topics	Hours
Unit I	**Topological spaces:** Basis for a Topology-The Order Topology -Product Topology - Subspace Topology - Closed sets and Limit Points -Continuous Functions -Metric Topology. **Chapter 2: Sections 12 – 20**	15
Unit II	**Connectedness and Compactness:** Connected Spaces -Connected sets in R -Components and path components -Local connectedness -Compact Spaces -Limit Point Compactness. **Chapter 3: Sections 23 – 28**	15
Unit III	**Countability and Separation Axioms:** UrysohnMetrization Theorem-Countability Axioms -Separation Axioms Urysohn'sLemma . **Chapter 4: Sections 30 – 35**	14
Unit IV	**Completely regular spaces:** The Tychonoff Theorem -The Stone-CechCompactification. **Chapter 5: Sections 37 - 38**	14
Unit V	**Complete Metric Spaces :** Compactness in Metric Spaces -Pointwise and Compact Convergences - The Compact-Open Topology . **Chapter 7: Sections 45 - 46**	14

Text book:

1. James R.Munkres, Topology;A First Course;Prentice Hall of India PNew Delhi. 2nd edition 2000.

Reference Book:

1.Dugundji.J, Topology, Allyn and Bacon, 1966 (Reprinted in India by Prentice Hall of India Private Limited.).

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Code No	Subject	Semester No
16MAP13	**ADVANCED TOPICS IN FLUID DYNAMICS**	**III**
Objective:	To gain knowledge about the concept of conservative forces,two dimensional functions, viscous flows and the importance of Navier-stokes equations	
Unit No	**Topics**	**Hours**
Unit I	**Introductory notions:** velocity-stream lines, path lines-Stream Tubes and Filaments-fluid body-density-pressure Differentiation following the fluid-Equation of continuity-Boundary conditions-kinematical and physical- Rate of change of linear momentum-Equation of motion of an inviscid fluid. **Chapter I : Sections 1.0-1.3,3.10-3.41(omit 3.32)**	**15**
Unit II	**Conservative forces:** Euler's momentum theorem--Bernoulli's theorem in steady motion- Energy equation for inviscid fluid-circulation-Kelvin's theorem-vortex motion-Helmholtz equation. **Chapter III : Sections 3.42-3.53(omit 3.44)**	**15**
Unit III	**Two Dimensional Motion:** Two Dimensional Functions-Complex potential- Basic singularities-source-sink- vortex-doublet-Circle theorem. Flow past a circular cylinder with circulation-conformaltransformation-Blasius theorem-lift force. **Chapter III : Sections 3.1-3.7.5(omit 3.3.4,3.4,3.5.2,3.6)**	**14**
Unit IV	**Viscous flows:** Viscous flows- Navier – stokes equations- some exact solutions of Navier Stokes equations- Flow between parallel flat plates- Coutte flow- Plane Poiseuille flow- Steady flow in pipes: Flow through a pipe- The Hagen Poiseuille flow. **Chapter V : Sections 5.1-5.3.3**	**14**
Unit V	**Laminar Boundary Layer in incompressible flow:** Boundary Layer concept – Boundary Layer equations-Displacement thickness, Momentum thickness- Kinetic energy thickness – integral equation of boundary layer- flow parallel to semi-infinite flat plate. **Chapter VI : Sections 6.1-6.3,1(omit 6.2.2,6.2.5)**	**14**

Text book :

1. Milne Thomson. L.M., – Theoretical Hydrodynamics Fifth Edition (Revised and Enlarged).Dover Publications, Inc. NewYork and

Reference Book:

1. Raisinghania M.D. – Fluid Dynamics (Hydro Dymamics) (S.CHAND & CO LTD 2002)

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Code No	Subject	Semester No
16MAP14	PROBABILITY THEORY AND MATHEMATICAL STATISTICS	III
Objective	To gain knowledge about Mathematical Statistics which will be very much useful in day to day life.	

Unit No	Topics	Hours
Unit I	**Random Events:** Preliminary remarks –random events and operations performed on them –System of axiom of the theory of Probability,Conditional probability,Bayes theorem. Independent Events –Parameters of the distribution of a random variable-expected values,moments, Chebyshev inequality –absolute moments. **Chapter 1: Sections 1.1 - 1.7, Chapter 3: Sections 3.1 - 3.4**	15
Unit II	**Characteristic Functions:** Properties of characteristic functions - the characteristic function and moments –semi-invariants –the characteristic function of the sum of independent random variables –Determination of the distribution function of multidimensional random vectors – probability –generating functions. **Chapter 4: Sections 4.1 - 4.4,4.6-4.7**	15
Unit III	**Some Probability distributions:** The uniform distribution -the normal distribution –the gamma distribution –The Cauchy and Laplacedistributions –Limit theorems –preliminary remarks –Stochastic convergence –the convergence of a sequence of distribution functions –the Levy-Cramer theorem – The De Moivre Laplace theorem -the Lindeberg-Levy theorem **Chapter 5: Sections 5.6 - 5.8,5.10,Chapter 6: Sections 6.1 ,6.2,6.4,6.6-6.8**	14
Unit IV	**Sample moments and their functions:** The notion of a sample –the notion of a Statistic –the distribution of the arithmetic mean of independent normally distributed random variables –the chi squaredistribution –the distribution of the statistic (X,S) –student's t-distribution – Fisher's Z-distribution **Chapter 9: Sections 9.1 – 9.7**	14
Unit V	**The Theory of Estimation**: Preliminary notions –Consistent estimates –unbiased estimates – the sufficiency of an estimate –the efficiency of an estimates – Asymptotically most efficient estimates –methods of finding estimates –confidence intervals **Chapter 13: Sections 13.1 - 13.8**	14

Text book :

1. MarekFisz,John Wiley, Probability Theory and Mathematical Statistics., Third Edition, New York, 2006.

Reference Book:

1. Feller W. " An Introduction to Probability Theory and its Applications", Vol. 1, John Wiley, Third Edition, 1968.

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Code No	Subject	Semester No
16MAP15	ELECTIVE I: (a) GRAPH THEORY	III
Objective:	To gain knowledge about the concept of different types of graphs, their properties, relationship and their applications.	
Unit No	Topics	Hours
Unit I	**Graphs, Subgraphs :** Graphs, Subgraphs: Graphs and simple graphs – Graph Isomorphism- The Incidence and Adjacency Matrices – Subgraphs spanning and induced subgraphs - vertex Degrees –Paths and Connection -Cycles – Cayley's formula. **Chapter 1 : Sections 1.1 – 1.7 ,Chapter 2: 2.1 – 2.4**	15
Unit II	**Trees, Connectivity, Euler tours and Hamilton cycles:** Trees: Trees – Cut edges and Bonds – Cut vertices .Connectivity – Blocks.Euler tours and Hamilton Cycles : Euler tours – Hamilton Cycles. **Chapter 3 : Sections 3.1 – 3.2, Chapter 4 : 4.1 – 4.2**	15
Unit III	**Matching and Edge colorings:** Matching – Matching coverings in Bipartite Graphs - Perfect Matching.Edge colorings: Edge chromatic number – Vizing's theorem. **Chapter 5 : Sections 5.1 – 5.3, Chapter 6: 6.1 – 6.2**	14
Unit IV	**Independent sets Cliques and Vertex Colorings:** Independent sets - Ramsey's theorem.Vertex Colorings: Chromatic Number – Brook's theorem – Hajos Conjecture. **Chapter 7 : Sections 7.1 – 7.2 , Chapter 8: 8.1 – 8.5**	14
Unit V	**Planar graphs and Directed Graphs :** Plane and planar Graphs – Dual Graphs – Euler's formula – Bridges – Kuratowski's Theorem (proof omitted) – the five color theorem – Four colour conjecture. **Chapter 9 : Sections 9.1 – 9.7**	14

Text book :

*1. Bondy.J.A. and Murty. U.S.R., Graph Theory with applications, American Elsevier Publishing Co.,Newyork.*2011

Reference Book:

1.NarsinghDeo.Graph theory with applications to engineering and computer science.Prentice Hall India.-19th printing May 2000

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Code No	Subject	Semester No
16MAP15	ELECTIVE I: (b) STOCHASTIC DIFFERENTIAL EQUATIONS	III
Objective:	To gain knowledge about Stochastic Approach to Deterministic BoundaryValue Problems, Martingale Representation Theorem and Dynkin Formula.	
Unit No	**Topics**	**Hours**
Unit I	**Introduction** Stochastic Analogs of Classical Differential Equations, Filtering Problems, Stochastic Approach to Deterministic Boundary Value Problems, Optimal Stopping, Stochastic Control and Mathematical Finance. Some mathematical preliminaries:Probalitity Spaces, Random Variables andStochastic Processes and anImportantExample: Brownian Motion	**15**
Unit II	**Ito Integrals:** Construction of the Ito integral . Some Properties of the Ito Integral and Extensions of the Ito Integral	**15**
Unit III	**The Ito formula and the Martingale Representation Theorem:** The 1-dimentional Ito Formula. the Multi dimensional Ito Formula and the Martingale Reprsentation Theorem. Stochastic Differential Equations: Examples and Some Solution Methods, An Existence and Uniqueness ResultandWeakandStrong Solutions	**14**
Unit IV	**The Filtering problem:** Introduction, The 1-dimentionalLinear Filtering Problem and the Multi-dimentional Linear Filtering Problem.	**14**
Unit V	**Diffusions:** Basic Properties: The Markov Property, the Strong Markov Property, the Generator of an Ito Diffusion, the Dynkin Formula, the Characteristic Operator	**14**

Text book :

1. BerntOksendal "Stochastic Differential Equations -An Introduction with Applications", (Sixth Edition), Springer-Verlag, Heidelberg, 2003.

Reference book:

1. Berntoksendal, Stochastic Differential Equations -An Introduction with Applications".

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Code No	Subject	Semester No
16MAP16	MATHEMATICAL SOFTWARE-II	III
Objective:	To gain knowledge about the concept of MATHEMATICA and its wide range of applications	
Unit No	Topics	Hours
Unit I	**Introduction to Mathematica:** Running Mathematica-Numerical calculations–Building up calculations–Using the Mathematica system–Algebraic calculations-Symbolic mathematics **Chapter 1: Sections 1.0.1 – 1.5.16**	13
Unit II	**Numerical Mathematics:** Basic operations – Numerical sums, product and integrals - Numerical equation solving – Numerical differential equations – Numerical optimization –Manipulating numerical data – Statistics. **Functions And Programs:** Defining functions – functions as procedures – Repetitive operations – Transformation rules for functions .LISTS – Collecting objects together – Making tables of values – Vectors and matrices – Getting pieces of lists – Testing and searching list elements – adding, removing and modifying list elements – combining lists – rearranging lists – ordering in lists. **Chapter 1: Sections 1.6.1-1.8.11**	13
Unit III	**Graphics:** Basicplotting – options– Redrawing and Combiningplots– manipulating options– Threedimensionalsurface-plots– convertingbetweentypesof Graphics. **Input And Output In Notebooks:** Entering Greek letters – Two dimensional inputs – editing and evaluating two – dimensional expressions – entering formulas – entering tables and matrices – subscripts, bars and other modifiers – Non-English characters and key boards – other mathematical Notation – Forms of input and output – mixing text and formulation - displaying and printing mathematica notebooks. advanced mathematics in mathematica- Calculus. **Chapter1: Sections 1.9.1-1.9.7,1.10.1,1.10.11,Chapter3:Sections3.5.1-3.5.12**	13
Unit IV	**Series, Limits And Residues .Linear Algebra :** Constructing matrices – Getting pieces of matrices – Scalars, Vectors and Matrices – Operations on scalars, vectors and matrices – Multiplying Vectors andmatrices – Matrix inversion – Basic matrix operations – Solving linear systems – Eigen values and Eigen vectors. **Chapter 3: Sections 3.6 .1- 3.7.9**	13

Unit V	**Numerical Operations On Data :** Curve fitting – Approximate functions and Interpolation – Fourier Transforms. **Numerical Operations On Functions :** Numerical Integration – Numerical evaluation of sums and products – Numerical Solution of Polynomial equations – Numerical root finding – Numerical solution of Differential equations **Chapter 3: Sections 3.8.2 - 3.8.4,3.9.3-3.9.7**	**13**

Text book :

1. Stephen Wolfram. "The Mathematica Book" Fifth Edition. Wolfram media, Cambridge, 2003.

Reference book:

1. Eugene Don,mathematica (Schaum"s outline) Mc.Graw Hill.

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Code No	Subject	Semester No
16MAP17	PRACTICAL II : MATHEMATICAL SOFTWARE-II	III
Objective:	To gain knowledge about the concept of MATHEMATICA and its wide range of applications	

1. Using MATHEMATICA to compute the area bounded by the curves $f(x) = 1-x^2$ and $g(x) = x^2-3x^2$.

2. Using MATHEMATICA, sketch the Sphere $x^2 +y^2+z^2 =14$ and its tangent plane at the point (1,2,3).

3. Using MATHEMATICA, plot the (five) solutions for : $d^2 y/dx^2+0.3\ dy/dx+siny=0$ with $0\leq x\leq 30$ and using

initial conditions y'(0)=0,y(0)= -2,-1.0,1and 2.

4. Using MATHEMATICA, solve the differential equation $dy/dx =1+1/2\ y^2$, $y(0)=1$, $0\leq x\leq 1$, with DSolve and NDSolve and compare the results.

5. Using MATHEMATICA, Numerical Calculations.

6. Using MATHEMATICA, Mathematical Functions.

7. Using MATHEMATICA. Algebraic Calculations.

8. Using MATHEMATICA, Symbolic Mathematics.

9. Using MATHEMATICA, Lists

10. Using MATHEMATICA, Graphics-Two Dimensional Plots

11. Using MATHEMATICA, Graphics – Three Dimensional Plots

12. Using MATHEMATICA, Input and Output in Notebooks

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Code No	Subject	Semester No
16MAP18	FUNCTIONAL ANALYSIS	IV
Objective:	To gain knowledge about Banach, Hilbert spaces ,Spectrum, Spectral radius and Banach algebras and their applications.	
Unit No	**Topics**	**Hours**
Unit I	**Banach Spaces:** The definition and some examples-Continuous linear transformations-The Hahn-Banach theorem. **Sections 46 - 50**	**17**
Unit II	**The natural imbedding of N in N^{**}** The open mapping theorem- The conjugate of an operator. **Sections 51 - 54**	**17**
Unit III	**Hilbert spaces:** The definition and some examples-Orthogonal compliments-Orthonormal sets-The conjugate space H^*. **Sections 55 – 59**	**17**
Unit IV	**The adjoint of an operator** Self-ad joint operators-Normal and unitary operators-Projections. **Sections 60 – 63**	**17**
Unit V	**Finite dimensional Spectral theory:** Matrices-Determinants and the spectrum of an operator-The spectral theorem - General Preliminaries on BanachAlgebras:The definition and some examples-Regular and singular elements. **Sections 64 - 68**	**16**

Text book :

1. Simmons.G.F., Introduction to Topology and Modern Analysis Tata McGraw-Hill Edition 2004

Reference Book:

1.Erwin Kreyszig-John wiely and sonsIntroduction To Functional Analysis with Application (1978)

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Code No	Subject	Semester No
16MAP19	MATHEMATICAL METHODS	IV
Objective:	To gain knowledge about Differential Equations arising in daily life and solving them.	

Unit No	Topics	Hours
Unit I	**Integral transforms:** Fourier sine and cosine transforms – Fourier transform of derivatives – Fourier transform of simple function – Convolution integral – Passeval'Theorem – Solution of PDE by Fourier transform – The linear diffusion equation on a semi infinite line – The two dimensional diffusion equation. **Chapter 2: Sections 2.4 - 2.7,2.9,2.10,2.16-2(a).(b).(c)2.16**	17
Unit II	**Hankel transforms:** Properties of Hankel transform – Hankle transformation of derivatives of functions- Hankel inversion theorem (proof is deleted) – The Passeval' relation – relation between Fourier and Hankel transforms – axisymmetric Dirichlet problem for a half plane . **Chapter 5: Sections 5.2 - 5.4,5.6-5.7,5.10.1**	17
Unit III	**Integral equations:** Type of integral equations – integral Fredholm alternative – approximate method – Equation with separable Kernel – Volterra integral equations – Fredholm's theory – Fredholm's first and second theorems. **Chapter 2: Sections 2.3 - 2.5, Chapter 3: Section 3.3 - 3.4**	17
Unit IV	**Application of integral equation to ordinary differential equation** Initial value problem – boundary value problem – singular integral equation – Abel integral equation. **Chapter 5: Sections 5.1 – 5.2, Chapter 8: Section 8.1 – 8.2**	17
Unit V	**Calculus of variations:** Variation and its properties-Euler's equation-functionals of the integral form-Functional dependent on higher order derivatives-variational problems in parametric form- applications. **Chapter 6: Sections 6.1 – 6.7**	16

Text book :

1. Ian.N.Sneedon,The use of integral equations for Unit I and Unit II

Reference Book:

1. Kanval.R.P. , Linear Integral equations theory & Technique for Unit III and Unit IV

2. Elsgolts. L, Differential equations and calculus of variations for Unit V

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Code No	Subject	Semester No
16MAP20	C++ PROGRAMMING	IV
Objective:	To gain knowledge about Oriented languages, Control structures and Managing output with manipulators.	
Unit No	Topics	Hours
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 –Benefits of OOP –Object-Oriented languages –Applications of OOp-Applications of C++ - Structure of C++ **Chapter 1: Sections 1.1 – 1.8 Chapter 2: Sections 2.2 and 2.6**	12
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 compactability –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 Over loading –operator precedence –Control structures **Chapter 3: Sections 3.1 – 3.24**	12
Unit III	**Functions in C++:** Introduction –The main function –Function prototyping –call by reference –return by reference inline functions – default arguments –constant arguments –function over loading – friend and virtual functions –Math library functions –Managing Console I/O operations: Introduction –C++ streams –C++ stream classesUnformatted I/O operations -Formatted I/O operations – Managing output with manipulators. **Chapter 4 : Sections 4.1 – 4.11 Chapter 10 : Sections 10.1 – 10.6**	12
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	12

	Arguments –Friendly functions –Returning Objects –Constant Member Functions. Constructors and Destructors: Introduction – Constructors –Parameterized Constructors –Multiple Constructors in a class –Constructors with Default Arguments – Dynamic Initializations of Objects –Copy Constructor –Constructing Two dimensional arrays –Constant Objects –Destructors **Chapter 5: Sections 5.1 – 5.17 Chapter 6 : Sections 6.1 – 6.7,6.9 – 6.11**	
Unit V	**Operators 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: Extending Classes: Introduction –Defining Derived Classes – Single inheritance –Making a Private Member Inheritable – Multilevel Inheritance –Multiple .Inheritance –Hierarchial Inheritance –Hybrid Inheritance. **Chapter 7 : Sections 7.1 – 7.7 Chapter 8 : Sections 8.1 – 8.8**	**12**

Text book :

1. Balaguruswamy..E Object –Oriented Programming with C++ ,Tata McGraw-Hill Publishing Compan limited. 1999.

Reference Book:

1. RaviChandran.D – „ Programming with C++", Tata McGraw-Hill publishing company limited (1996), New Delhi.

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Code No	Subject	Semester No
16MAP21	PRACTICAL II - C++ PROGRAMMING	IV
Objective:	To gain knowledge about Oriented languages, Control structures and Managing output with manipulators.	

1. DISTANCE CONVERSION PROBLEM:

Create two classes DM and DB which store the value of distances. DM store the value ofdistances. DM stores distances in meters and centimeters in DB in feet and inches. Write a Program that can create the values of the class objects and add one object DM with another object DB.Use a friend function to carry out addition operation. The object that stores the result
may be DM object or DB object depending on the units in which results are required. The display should be in the order of meter and centimeter and feet or inches depending on theorder of display.

2. OVERLOADING OBJECTS:

Create a class FLOAT that contains one float data member overload all the four arithmetioperators so that operate on the objects of FLOAT.

3. OVERLOADING CONVERSIONS:

Design a class polar which describes a pant in a plane using polar Co-ordinates radius and angle. A point in polar Co-ordinates is as shown below.Use the overloader + operator to add two objects of polar. Note that we cannot add polar values of two points directly. This requires first the conversion.Points into rectangular Co-ordinates and finally converting the result into polar Co-ordinates.
You need to use following trigonometric formulas.
X= r * cos (a);
Y= r * sin (a);
$a = \tan^{-1}(Y/X)$
r = sqrt (X * X +Y * Y);

4. OVRELOADING MATRIX:

Create a class MAT of size M*N. Define all possible matrix operations for MAT type objects. Verify the identity(A-B)^2 = A^2+B^2 –2*A*B

5. AREA COMPUTATION USING DERIVED CLASS:
Area of rectangle = X*Y
Area of triangle = ½ * X * Y

6. VECTOR PROBLEM:

Define a class for vector containing scalar values. Apply overloading concepts for vector addition, Multiplication of a vector by a scalar quantity, replace the values in a position vector.

7.INHERITANCE

Create three classes alpha, beta and gamma, each containing one data member. The class gamma should be inherited from both alpha and beta. Use a constructor function in the class gamma to assign values to the data members of all the classes. Write a program to print the data members of all the three classes

8. CLASS AND OBJECTIVES

Create a class which consist of employee details E.No. , E.Name, Dept, Basic Salary. Write a member function to get and display them.Derive a class pay from the above class and write a member function to calculate DA, HRA and PF depending on the grade.

9. OVERLOADING OPERATORS

Create a class FLOAT that contains one float data member. Over load all four arithm,etic operators.

10. DISPLAYING STRINGS

Write a C++ program to display strings using WRITE function.

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Code No	Subject	Semester No
16MAP22	ELECTIVE II : a) MAGNETO HYDRO DYNAMICS	IV
Objective:	To gain knowledge aboutMagnetostaticEnergy ,Navier-stokes equations, Incompressible viscous flows in the presence of magnetic field and gravitational instability.	

Unit No	Topics	Hours
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.	15
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	15
Unit III	**Alfven's theorem Law of isorotation :** Magneto hydrostatics –Force-free field –Alfven waves in incompressible MHD	14
Unit IV	**HartmannFlow :** Incompressible viscous flows in the presence of magnetic field –unsteady Hartmann flow –Magnetofluid dynamic pipe flow.	14
Unit V	**Stability :** Instability of linear pinch –Sausage and flute types –Method of small oscillations –gravitational instability.	14

Text book :

1.Crammer K.R. and Pai S.I, Magneto Fluid Dynamics for Engineers and Applied Physicists, McGraw Hill, 1973.

Reference book:

1.Ferraro, VCA and Plumpton: Introduction to Magneto Fluid Dynamics, Oxford, 1966

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Code No	Subject	Semester No
16MAP22	ELECTIVE II : b) OPERATOR THEORY	IV
Objective:	To gain knowledge about the various types of operator which will be very much useful in scientific and mathematical research.	
Unit No	**Topics**	**Hours**
Unit I	**Fundamental properties of bounded linear operators Bounded linear operators on a Hilbert space:** Norm of bounded linear operators –Adjoint operators – Generalized polarization identity and its applications–Several properties on projection operators –Generalized Schwarz inequality and square root of positive operator –spectral representations of self adjoint operator.	**15**
Unit II	**Partial isometry operator: Partial isometry operator and its characterization Polar decomposition of an operator:** Invariant subspace and reducing subspace –Polar decomposition of non-normal operator–Hereditary property on the polar decomposition of an operator.	**15**
Unit III	**Spectrum of an operator:** Two kinds of classification of spectrum –Spectral mapping theorem Numerical range of an operator: Numerical range is a convex set –Numerical radius is equivalent to operator norm – The closure of numerical range includes the spectrum – Normaloid operator and spectraloid operator.	**14**
Unit IV	**Relations among several classes of non-normal operators:** Paranormal operators –Characterizations of convexoid operators: some examples related to hyponormal, paranormal, normaloid and convexoid operators –Relations among several non-normal operators.	**14**
Unit V	**Further development of bounded linear operators:** Young inequality and Holder –McCarthy inequality –Aluthge transformation on p-hyponormal operators and log-hyponormal operators	**14**

Text book :

1. Takayuki furuta,taylor ,invitation to linear operators, Francis, 2001.

Reference Book:

1. Halmos. P.R., Hilbert space problembook,SpringerVerlag, New York

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