GOVERNMENT COLLEGE (Autonomous) KALABURGI

PG DEPARTMENT OF STUDIES AND RESEARCH IN MATHEMATICS

Proposed syllabus for M.Sc. in Mathematics

Under choice Based Credit System (CBCS)

Semester Wise from the Academic year

2018-2019 on words

Approved by Academic council

PRINCIPAL
Govt. College
Kusnoor Road, GULBARGA-585 105

COURSE STRUCTURE FOR MASTER OF SCIENCE IN MATHEMATICS

SEMESTER-I

Course Code	Title of the Paper	Total Credits	Teaching Hours /week	Marks Allocation					Total Max. Marks
				Internal		Semester End Exam			
				Max. Marks	Min. Marks	Duration	Max. Marks	Min. Marks	
CCT1.1	Real Analysis	4	4	20	--	3hrs	80	32	100
CCT1.2	Advanced Algebra-I	4	4	20	--	3hrs	80	32	100
CCT1.3	Ordinary Differential Equations	4	4	20	--	3hrs	80	32	100
CCT1.4	Complex Analysis	4	4	20	--	3hrs	80	32	100
CCT1.5	Topology	4	4	20	--	3hrs	80	32	100
DSET 1.1	Operation Research	4	4	20	--	3hrs	80	32	100
DSET 1.2	Classical Mechanics	4	4	20	--	3hrs	80	32	100
Note: Student should choose any one subject of DSET IN every Semester.									
	Total	24							600

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(3) A. J. Reddy

COURSE STRUCTURE FOR MASTER OF SCIENCE IN MATHEMATICS

SEMESTER-II

Course Code	Title of the Paper	Total Credits	Teaching Hours /week	Marks Allocation					Total Max. Marks
				Internal		Semester End Exam			
				Max. Marks	Min. Marks	Duration	Max. Marks	Min. Marks	
CCT2.1	Advanced Algebra – II	4	4	20	--	3hrs	80	32	100
CCT2.2	Partial Differential Equations	4	4	20	--	3hrs	80	32	100
CCT2.3	Programming in C with ANSI features	4	4	20	--	3hrs	80	32	100
DSET2.1	Fuzzy Set and Fuzzy System	4	4	20	--	3hrs	80	32	100
DSET2.2	Probability and Statistics	4	4	20	--	3hrs	80	32	100
CCP2.3 LAB-I	Programming in C with ANSI features	2	4	10	--	3hrs	40	16	50
GET2.1	Applied Mathematics-I	4	4	20	--	3hrs	80	32	100
CCP2.3 LAB-II	Programming in SCILAB	2	4	10	--	3hrs	40	16	50
	Total	24							600

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3) G. J. Reddy

COURSE STRUCTURE FOR MASTER OF SCIENCE IN MATHEMATICS

SEMESTER-III

Course Code	Title of the Paper	Total Credits	Teaching Hours /week	Marks Allocation					Total Max. Marks
				Internal		Semester End Exam			
				Max. Marks	Min. Marks	Duration	Max. Marks	Min. Marks	
CCT3.1	**Functional Analysis**	4	4	20	--	3hrs	80	32	100
CCT3.2	**Computational Numerical Methods-I**	4	4	20	--	3hrs	80	32	100
CCT3.3	**Fluid Mechanics-I**	4	4	20	--	3hrs	80	32	100
DSET 3.2	**Research Methodology & Mathematical Methods**	4	4	20	--	3hrs	80	32	100
DSET 3.1	**Fuzzy Logic and Applications**	4	4	20	--	3hrs	80	32	100
CCP3.2 LAB-I	**Computational Numerical Methods-I**	2	4	10	--	3hrs	40	16	50
GET 3.1	**Operations Research**	4	4	20	--	3hrs	80	32	100
CCP 3.2 LAB-II	Programming in MATLAB	2	4	10	--	3hrs	40	16	50
	Total	24							600

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3) G.J.Reddy

COURSE STRUCTURE FOR MASTER OF SCIENCE IN MATHEMATICS

SEMESTER-IV

Course Code	Title of the Paper	Total Credits	Teaching Hours /week	Marks Allocation					Total Max. Marks
				Internal		Semester End Exam			
				Max. Marks	Min. Marks	Duration	Max. Marks	Min. Marks	
CCT4.1	Measure Theory	4	4	20	--	3hrs	80	32	100
CCT4.2	Fluid Mechanics-II	4	4	20	--	3hrs	80	32	100
CCT4.3	Graph theory	4	4	20	--	3hrs	80	32	100
CCT4.4	Computational Numerical Methods-II	4	4	20	--	3hrs	80	32	100
CCT4.5	Minor Project	6	6	30	--	-	120	48	150
DSET 4.1	Differential Geometry	4	4	20	--	3hrs	80	32	100
DSET 4.2	Computational Fluid Dynamics	4	4	20	--	3hrs	80	32	100
Note: Student should choose any one subject of DSET									
	Total	26	26						650

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11-04-18

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PROCEEDINGS OF THE BOARD OF STUDIES MEETING IN MATHEMATICS (PG) HELD ON 10-04-2018 IN THE PG DEPARTMENT OF MATHEMATICS, GOVT. COLLEGE (AUTONOMOUS), KALBURAGI – 585105

The following members attended the meeting:

1.	Dr. Sayed Anisfatima. H	Chairman (GCK)
2.	Dr. Mahantesh M.N	Member (GCK)
3.	Dr. S. B. Patil	Member(GCK)
4.	Prof. N.B. Naduvinamani	University Nominee GUG
5.	Dr. G. Janardhan Reddy	Member (External) CUK
6.	Dr. Patil Mallikarjun . B	Member (External) Tumkur University Tumkur

The Chairman welcomed all the BOS members. The following agenda was discussed:

1. Syllabus of M.Sc. (Mathematics) under CBCS Scheme
   The syllabus for four semesters as per the approved structure was discussed and approved.
2. Panel of Examiners for M.Sc. (Mathematics)

The panel of Examiners were approved.

QUESTION PAPER PATTERN

IA TEST FOR THEORY COURSES (CORE COURSE, DESCIPLINE ELLECTIVE & GENERAL ELECTIVES)

- There are two IA tests for CCT, DSET and GET.
- Duration of the test is one hour. Maximum marks 20.
- Average of the marks secured in two internal assessment test will be taken as the final awarded marks in the internal assessment test of the respective subject.

PRACTICAL INTERNAL ASSESSMENT TEST

- There shall be one internal assessment test in each of the practical courses for 10 marks.
- Duration of the practical test: 1 or 1 and 1/2hour.

SEMESTER END EXAMINATIONS

QUESTION PAPER PATTERN FOR THEORY COURSES (CORE COURSE, DESCIPLINE ELLECTIVE & GENERAL ELECTIVES)

There shall be 8 questions of 16 marks each (two questions from each unit), Students should answer five questions by choosing at least one question from each unit.

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(2) 11-04-18

(3) G. J. Reddy

M. Sc. I Semester

Paper : CCT 1.1 Real Analysis	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The aim is to provide the development of subject-matter which is honest, rigorous and at the same time not too pedantic. Most of the hard theorems which are either omitted or treated rather simply in many texts in advanced analysis are proved with care. Some of them are ordinarily considered too difficult for a course of analysis. With the inclusion of these theorems the syllabus attempts to fill the gap and to make the transfer from elementary calculus to advanced course in analysis as smooth as possible. The Syllabus starts with a quick review of the essential properties of rational numbers. The Dedekind's Cut properties of real numbers are established. This foundation supports the subsequent chapters: topological framework, sequences and series of numbers, continuity, differentiation, elementary functions, Riemann integration, with a quick look at the Riemann-Stieltjes integral and finally the functions of several variables and the implicit functions.

Unit-1: The Riemann-Stieltje's Integral: Definition and existence of the integral, properties of the integral, change of variable, integration and differentiation, integration of vector valued functions, rectifiable curves. (16 Hours)

Unit-: Sequence and Series: Uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentiation, uniform convergence and bounded variations, equicontinuous families of functions. , The Stone - Weierstrass theorem. (16 Hours)

Unit-3: Power Series: Definition of power series , the exponential and logarithmic functions, the trigonometric functions, Fourier series, trigonometric series, Parseval's theorem, the gamma functions. (16 Hours)

Unit-4: Functions of Several Variables

Linear transformations, differentiation, the contraction principle, the inverse function theorem, the implicit function theorem, the rank theorem illustration and examples. (16Hours)

References:

1. W. Rudin: Principles of Mathematical Analysis, 3rd Ed., McGraw Hill Book Co., New York, (1986).
2. T. M. Apostol: Mathematical Analysis, 2nd Ed., Addison-Wesley, Narosa, New Delhi.
3. H. L. Royden: Real Analysis, 2nd Ed., The McMillan Co., New York, (1968).
4. R. R. Goldberg: Method of Real Analysis, Oxford & IBH Publishing Co., New Delhi.
5. R. G. Bartle: The Elements of Real Analysis, 2nd Ed., Wiley International Edition, New York.
6. W. H. Flemming: Functions of Several Variables. Addison-Wesley, Narosa, New Delhi.
7. E. C. Titchmarsh: The Theory of Functions, Oxford University Press, Fairlawn, NJ.
8. S. C. Malik: Mathematical Analysis, Wiley Estern Wiley Limited, 6th Ed.

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Paper : CCT 1.2 Advance Algebra-1	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Algebra frequently provides a student's first encounter with an abstract mathematical discipline, a secondary objective is to sow the seeds from which a modern mathematical attitude may grow, Mastery of this syllabus constitute a firm foundation for more specialized work in algebra and also should be of great help in any further axiomatic study of mathematics.

Unit-1: Groups- conjugate elements, conjugate class, normalizer of an element of a group, center of a group, quotient groups, direct products, Cauchy's theorem for Abelian group. (16 Hours)

Unit-2: Sylow's theorems, p-group , Sylow p- group, finite Abelian group, exponent of a group, solvable groups, Schreier's refinement theorem. (16.Hours)

Unit-3: Rings- Field of quotients of an integral domain, Euclidean rings , properties of. Euclidean ring . Unique factorization domain, polynomial rings over unique factorization domains, Gauss lemma, Eisensein's. Criterion. (16.Hours)

Unit-4:Field- Extension of fields, algebraic extension, factor theorem. Splitting field, separable and Inseparable extensions, Finite field, perfect field. (16 Hours)

References:

1. J. N. Herstein: Topics in Algebra, 2nd Ed., Wiley Eastern Ltd., New York , 1990.
2. J. B. Fralagh: A First Course in Abstract Algebra, 2nd Ed., Addison Wesley, (1967).
3. N. Jacobson: Lectures in Abstract Algebra, Van Nostrand, (1954).
4. Surjeet Singh and Qazi Zameruddin: Modern Algebra, 6th Ed., V. P. House, New Delhi.

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Paper : CCT 1.3 Ordinary Differential Equations	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: the course has been designed for the use of post graduate students according to the latest semester system and unified syllabus prescribed by U.G.C for all Indian Universities. Besides it will also be very helpful for those students preparing for various competitive examinations. We have fully understood the need of the students and hence we have tried our level best to provide clear concepts of each unit, the subject matter, illustrations and exercises. We tried to put the subject matter in our own way from the student's point of view.

Unit-1:Basic Theory of Differential Equations and Wronskian:-Introduction, Differential Equations and their Classification, Function of Two Real Variables, the Lipschitz Condition, Basic theory of the homogeneous Linear Differential Equations, The Wronskian, Fundamental Set, Initial Value Problem, Existence and Uniqueness Theorems. (16 Hours)

Unit-2:Qualitative Properties of Solutions and Oscillation Theory:- Introduction, The Adjoint Equation, Self – Adjoint Equation and Standard Properties, The Sturm Theory, Oscillation (Differential Equations), Abel's Formula, Sturm Separation theorem, Sturm Comparison Theorem, Conversion of Standard Form to Normal Form. (16 Hours)

Unit-3:Power Series Solution of Differential Equation:- Introduction, Basic Concepts of Power series Solutions; Examples, Power series Solutions About an Ordinary Point; Examples, The Working Rule of Frobenius Method, The Frobenius Methods; Examples, Power series Solutions About Regular Singular Point at Infinity; Miscellaneous Examples.

(16Hours)

Unit-4.: Orthogonal Sets of Functions and Strum–Liouville Problem; Orthogonality, Orthogonal set of function, Orthonormal set of functions, Orthogonality with respect to a weight function, Orthogonal set of functions with respect to a weight function, Orthonormal set of functions with respect to a weight function, working rule for getting orthonormal set, Strum – Liouville problem, Eigen (or characteristic) functions and eigen (or characteristic) values, Orthogonality of eigen functions, Reality of eigen values, Examples.

(16Hours)

References:

1. E.A. Coddington: An Introduction to Ordinary Differential Equations, Prentice Hall. (1968).
2. G. Birkof and G.C. Rota: Ordinary Differential Equation, Ginn and Co..(1962).
3. Zalman RAubinstein: A Coourse in Ordinary Differential and Partial Differential Equations, Acadamic press, (1969).
4. Williams E Boyce and Richard C Diprima: Elementary Differential Equations and Boundary Value problems, John Wiley and Sons, (1067).
5. A. K. Bhargava and A. B. Chandramouli: Differential Equations, First Edition (2012) Pragati Prakashan.

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Paper :CCT 1.4 Complex Analysis	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The study of complex analysis is beautiful from a mathematical point of view and it provides a powerful tool for solving several problems arising in real applications. Mathematicians, scientists and engineers often resort to the "complex plane" while explaining the real phenomena. Using complex analysis one can solve many problems that are either very difficult to solve or impossible to solve by other means. The present syllabus is designed for the post graduate students to understand the basic concepts of complex analysis and also to equip them with complex analysis tools to find the solutions of complex problems.

Unit-1: Analytic Function: Functions of Complex Variables, Limits, Continuity, Derivatives, .C.R.Equations, Analytic Functions.

Complex Integration: Complex Valued Functions, Contours, Contour Integrals, Cauchy – Gourat Theorem, Cauchy integral Formula, Morera's Theorem, Louville's Theorem, Fundamental Theorem of Algebra.

(16Hours)

Unit-2: Power Series : Congruence of Sequences and Series, Power Series and Analytic Functions, Taylor Series, Laurent's Series, Absolute and Uniform Convergence, Integration and Differentiation of Power Series, Uniqueness of Series Representation, Zeros of an Analytic Function, Classification of Singularities.

(16Hours)

Unit-3:Residues and Poles : Residues, Cauchy Residue Theorem, Residue at Poles, Evaluation of Improper Integrals, Evaluation of Definite Integrals, The Argument Principle, Rouche's Theorem, Schwartz Lemma, Maximum Modules Principle. (16Hours)

Unit-4: Spaces of Analytic Functions, Spaces of Meromorphic Functions, The Riemann Mapping Theorem, Weierstrass Factorization Theorem, Schwartz Reflection Principle. (16Hours)

References:

1. R. V. Churchill, J. W. Brown: Complex Variables and Applications, 5th Ed., McGraw Hill Series.
2. B. Choudary: The Elements of Complex Analysis, 2nd Ed. , Wiley Eastern Ltd.
3. L. V. Alfors: Complex Analysis, McGraw Hill , Kogakusha , (1979).
4. J. S. Conway: Functions of One Complex Variable, Springer Verlag , New York, (1973).
5. R. V. Churchill, J. W. Brown and R. F. Verhey: Complex Variables and Applications, 3rd Ed., McGraw Hill, Kogakusha , (1968).
6. Ian Stewart and David Tall: Complex Analysis, Cambridge University Press,1Ed., (1963).

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Paper : CCT1.5 Topology	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Nowadays, studying general topology really more resembles studying a language rather than mathematics: one needs to learn a lot of new words, while proofs of most theorems are extremely simple. On the other hand, the theorems are numerous because they play the role of rules regulating usage of words. The subject of topology is of interest in its own right, and it also serves to lay the foundations for future study in analysis, in geometry, and in algebraic topology. There is no universal agreement among mathematicians as to what a first course in topology should include; there are many topics that are appropriate to such a course, and not all are equally relevant to these differing purposes. In choice of material to be treated, the framed syllabus tries to strike a balance among the various points of view.

Unit-1:Topological Spaces:- Definition of a topology, Types of topologies, neighborhoods, limit point, closure, interior and boundary of a set, Base, sub-base, subspace, continuous map, open and closed maps, homeomorphism.

(16Hours)

Unit-2:Separation Axioms:- T_0, T_1, T_2 spaces, Regular space, Normal space, Urysohn's characterization of normality, T_3, T_4, T_5 spaces, countability Axioms, separable space, convergence of a sequence. (16Hours)

Unit-3: Connectedness and Compactness; Connected and disconnected spaces, components, connectedness and continuous map. (16 Hours)

Unit-4: Compactness; Cover, subcover, compactness, characterizations, Heine-Borel theorem, compactness and continuous map, finite intersection property, one point – compactification. (16 Hours)

References:

1. J. T. Munkers: Topology, PHI, New Delhi, (1998).
2. J. Dugundgi: Topology, UBS, Pub., New Delhi , (1997).
3. Willard: General Topology, Hocking and Young Publications.
4. Munders C. F.: Algebraic Topology, Academic Press.
5. W. Massey: Introduction to Algebraic Topology, PHI, New Delhi.

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Paper : DSET 1.1 Operations Research	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The subject of Operations Research has being growing theoretically and has a wide ranging applications in the field of life namely engineering, business, management, economics and medical sciences etc. In view of this, a course of Operations Research is introduced to the students of Mathematics as a job-oriented course. The main aim of this paper is to introduce the fundamentals of operations research and its techniques used in different fields of interest and greater use of these tools in planning, scheduling, cost and job control for the efficient and economical conduct of industrial Endeavour.

Unit-1. Linear Programming: Basic concept, convex sets, open and closed half spaces, simplex formulation of linear programming problem (LPP), feasible solution, basic feasible solution, optimal solution, graphical method, simplex method. Artificial variables. (16Hours)

Unit-2: Transportation problem (PT): Mathematical formulation, existence of feasible solutions, transportation table, initial basic feasible solution; North-west corner rule, row minima method column minima method, matrix minima method, Vogel's approximation Method (VAM) Transportation algorithm, degeneracy in TP, unbalanced TP. (16 Hours)

Unit-3:Theory of Games: Introduction, Two-person Zero-Sum games, Maximin-minimax principle, mixed strategies graphical solution of 2 x N and M x 2 games, dominance property, saddle point theorems.

(16 Hours)

Unit-4: Assignment Problem: Mathematical formulation, assignment algorithm, routing problem, traveling salesman problem.

Networks: Network Minimization, Shortest Route Problem, Shortest Route Algorithms for Acyclic Networks, Maximal Flow Problem, Linear Programming Representation of Networks. (16 Hours)

References:

1. Hamdy A. Taha: Operations Research, Macmillam, (199=89).
2. Kanti Swarup; P.K. Gupta and Manmohan: Operations Research, S. Chand & Sons, (1987)
3. S. Kalavathy: Operations Research, vikas, (2001).
4. S.D. Sharma: Operations research.
5. G. Hadley: Linear programming Narosa publishing Hoarse, New-Delhi, (1987).

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Paper : DSET 1.2 Classical Mechanics	
Teaching hours : 4Hrs/week	**Credits: 04**
Maximum Marks : 100(SEE-80+IA-20)	

Preamble: The subject "Classical Mechanics" is the oldest branch of physics. Which deals with the description explanation of the motion of point-like as well extended, rigid as well as deformable, objects embedded in a three dimensional Euclidian space. In this course students will study the geometrical description of the motion. Some of the greatest minds of all times such as Sir Isaac Newton, JosePh Lagrange, Leonhard euler, Sir William Hamilton laid the foundation and built the theoretical structure of the subject.

Unit-1 Analytical Dynamics- Generalized, Co-ordinates, Holonimic and non holonomic systems. Seleronomic and rheonomic systems. D' Alembert's Principle and Lagrange's equation for holonomic system. Lagrange's equation for impulsive motion. Deduction of Lagrange's equation from D' Alembert's principle. Velocity dependent potentials and the dissipation function. (16 Hours)

Unit-2 Energy equation for conservative field; generalized momenta and Hamilton's canonical equations. Rigid body and Euler an angles, infinitesimal rotation. Coriolis theorem. Motion relative to rotating earth, Euler's dynamical equations of motion of a symmetrical top. (16 Hours)

Unit-3 Hamilton's principle of least action. Deduction of Lagrange and Hamilton equations from Hamilton's Principle. Hamilton's variation Principle. Poincare integral invariants. Whittaker's equation, Jacobi's equations. Statement of Lee Hwa Chung's theorem, Hamilton-jacobi's equation and its complete integral. Solutions of Harmonic oscillator problem by Hamilton Jacobi method. (16 Hours)

Unit-4 Cyclic co-ordinates, Rout's equation, Poisson's bracket, Poisson's identity, Lagrange's Bracket. Condition of canonical character of a transformation in terms of Lagrange's bracket, Poisson's bracket. Invariance of Lagrange's brackets and Poisson brackets under canonical transformations. (16 Hours)

Reference Books:

1. A. S Ramsey, Dynamic part I, the English language books society and Cambridge University press.

2. F. Gantmacher, lectures in analytical Mechanics, MIR Publisher mascow. (1975)

3. H. Goldstien Classical mechanics(2nd edition) Narosa publishing house, new Dehli.

4. Narayan Chandra rana and sharad Chandra jog, classical mechanics TMH, 1991

5. F. choltron textbook of dynamics(ELBS edition), G. Van Nostrand and co (1969)

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Second Semester

Paper : CCT2.1 Advanced Algebra – II	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The main goal of classical algebra was to use algebraic manipulation to solve polynomial equations in one variable of degree at most four. It also developed methods for dealing with linear equations containing several variables, but little was known about the solution of non linear equations. The most useful mathematical tool in science, engineering and the social science is the method of solution of a system of linear equations together. All its allied Linear algebra.

Unit-1: Linear Algebra: Recapitulation of vector space, Basis, Linear transformation, algebra of linear transformations, characteristics roots, interpretation in terms of matrices. (16 Hours)

Unit-2: Canonical Form : Triangular, Nilpotent, Jordan and Rational forms, Trace, transpose and the determinant of linear transformations. (16 Hours)

Unit-3: Functionals and Dual Spaces: Inner product spaces, orthogonal sets, Hermitian, Unitary and normal transformation, bilinear, quadratic and Hermitian forms. (16 Hours)

Unit-4: Quadratic Residues: Sum of two squares, sum of more than two squares, Tau and sigma functions, Fibonacci sequence, finite continued fractions. (16 Hours)

References:

1. I. N. Herstein: Topics in Algebra, 2nd Ed. , Wiley Eastern Ltd. , New York, (1998).
2. S. Lang: Linear Algebra, Addison Wesley, (1972).
3. T. M. Apostol : Introduction to Analytic Number Theory, Springer Verlag, New York.
4. David M. Burton: Elementary Number Theory, 2 Ed. , Universal Book Stall 5, Ansari Road, New Delhi-110002.

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Paper : CCT2.2 Partial Differential Equations	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The course on PDE gives a really comprehensive introduction to all those parts of the theory of PDE that are needed in practical applications of that theory, whether in the physical sciences or in the different branches of engineering. The course is also set out excellently as a body of mathematical analysis of wide general interest. All the essential ideas of the subject are explained with great clarity. We can particularly admire the way in which ideas are first introduced in relatively simple cases and then gradually extended to more complicated cases and to more advanced applications.

Unit-1: Partial Differential Equations of First Order: Introduction, Classification of the First Order Partial Differential Equations, Solution of Partial Differential Equations of the First Order, Integral Surfaces Passing Through a Given Curve, Surfaces Orthogonal to a given System of Surfaces, Geometrical Proof of Lagrange's Differential Equation, Nonlinear Partial Differential Equations of the First Order, Compatible Systems of First Order Equations, Condition of Compatibility: Particular Case; Examples, Jacobi's Method; Examples, The method of characteristics for Semi linear, Quasilinear equations. (16 Hours)

Unit-2: Linear Partial Differential Equations of Second Order: Introduction, The Origin of Second Order Equations, Classification of Partial Differential Equations, Partial Differential Equation of Second Order with Variable Coefficients .Introduction, Classification of Linear Partial Differential Equation of Second Order in two Independent Variables, Reduction of Canonical (or Normal) Forms by Laplace Transformation, Working Method for Reducing a Hyperbolic Equation to its Canonical Form, Working Method for Reducing a Parabolic Equation to its Canonical Form, Working Method for Reducing a Elliptic Equation to its Canonical Form. (16 Hours)

Unit-3: Wave, Laplace and Diffusion Equations: Introduction, One – dimensional Wave Equation in Rectangular Co-ordinates, Two - dimensional Wave Equation in Rectangular Co-ordinates, Laplace's Equation in Rectangular Co-ordinates, Diffusion Equation, Solution of a Linear Partial Differential Equation by Separation of Variables, Solution of One – dimensional Wave Equation by Separation of Variables, Solution of Two – dimensional Wave Equation by Separation of Variables, Solution of Two – dimensional Laplace's Equation by Separation of Variables in Rectangular Co-ordinates, Solution of the Diffusion Equation in Rectangular Co-ordinates. (16Hours)

Unit-4: Non-linear Partial Differential Equations of Second Order; Introduction, Monge's Method of Integrating $Rr + Ss + Tt = V$, Working Method of the Equation $Rr + Ss + Tt = V$, Monge's Method of Integrating $Rr + Ss + Tt + U(rt - s^2) = V$, Working Method of the Equation $Rr + Ss + Tt + U(rt - s^2) = V$, when the roots of the quadratic are identical , Working Method of the Equation $Rr + Ss + Tt + U(rt - s^2) = V$, when the roots are distinct.

(16Hours)

References:

1. Sneddon: Elements of PDE's, McGraw Hill Book Company Inc., (2006).
2. L. Debnath: Nonlinear PDE's for Scientists and Engineers, Birkhauser, Boston, (2007).
3. F. John: Partial Differential Equations, Springer, (1971)
4. A. K. Bhargava and A. B. Chandramouli: Differential Equations , Pragati Prakashan, Educational Publishers , (2012).
5. M. D. Raisinghania: Ordinary and Partial Differential Equations, S. Chand and Company Ltd., New Delhi, (2011).
6. F. Treves: Basic Linear Partial Differential Equations, Academic Press, (1975).
7. M. G. Smith: Introduction to the Theory of Partial Differential Equations, Van Nostrand, (1967).
8. Shankar Rao: Partial Differential Equations, PHI, (2006).

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Paper : CCT2.3 Programming in C with ANSI features	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble : This paper introduces computer programming to a beginner using the programming language C. The version of C used is the one standardized by the American National Standards Institute (ANSI C). C has rapidly gained users due to its efficiency, rich data structure, variety of operators and affinity to UNIX operating system. C is a difficult language to learn if it is not methodically approached. Our attempt has been to introduce the basic aspects of C to enable the student to quickly start writing C programs.

Unit-1: Introduction: Introduction to Computers, Characteristics of Computers, Application Areas of Computer, Classification of Computers, Overview of Programming, Types of Programming Languages, Introduction to C , Features of C, Program Structure, Concept of Header File, Preprocessor, Character Set, Identifiers, Reserved Words, Constants and Variables, Data Type, Modifiers, Types of Statements, Declaration and Initialization, Comments. (16 Hours)

Unit-2: Type of I/O Statements: Formatted and Unformatted I/O Statements, Escape Sequences and Format Specifies. Types of Operators (unary, binary and ternary), Classification of Operators: Assignment, Arithmetic, Relational, Logical, Comma Operator, Size of Operator, Operator, Hierarchy and Associatively, Type Conversion (explicit and implicit), Library Functions. (16Hours)

Unit-3: Control Statements: If, If Else, Switch Statements, Looping Statement (for, while, do while), Nested Loops, Infinite Looping, Break and Continue. (16 Hours)

Unit-4: Classification of Arrays: One, Two and Multidimensional Arrays, Function Definition, Arguments and Parameters, Category of Functions, Arrays iv Functions, Local and Global Variables, Static and Register Variables, Function Declaration, Parameter Passing Mechanisms, Recursion. (16 Hours)

References:

1. Brian W. Kernighan, Dennis M. Ritichie: The C Programming Language (2nd Ed.).
2. Peter Darnell and P. E. Marglis: C- Software Engineering Approach, Narosa Publication, New Delhi, (1993).
3. M. T. Somashekar: Programming in C, PHI, New Delhi, (2006).
4. Balguruswamy: Programming in ANSI C.
5. Yeshwant Kanetkar: Let US C.

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Paper : DSET2.1 Fuzzy Sets and Fuzzy Systems	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Fuzzy theory has become a subject that generates much interest among students of mathematics and engineers. The main objective of this paper is to introduce basic and concrete concepts of fuzzy theory and its applications.

Unit-1: Basic Concepts of Fuzzy Sets: Introduction. Crisp set, Fuzzy sets, types of Fuzzy sets, Basic, concepts, properties of a cuts, representation of Fuzzy sets, extension principle of Fuzzy sets.

(16 Hours)

Unit-:. Operations on Fuzzy Sets: Types of operations Fuzzy complements, Fuzzy intersections, -norms. Fuzzy unions: t-co-norms, combinations of operations, aggregation operations. (16Hours)

Unit-3: Fuzzy Arithementic: Fuzzy numbers, Linguistic variables, Arithmetic operations on Fuzzy numbers, Lattice of Fuzzy numbers, Fuzzy equations. (16Hours)

Unit-4: **Fuzzy Relations:** Crisp Versus fuzzy relations. Projections and cylindrical extension, Binary fuzzy relations, on a single set. (16 Hours)

References:

1. Groge J. Klor. And Yuan Fuzzy sets and Fuzzy logic, Theory and Applications. PHI. Georgo J. Klir and Tina a, Fotger Fuzzy sets uncertainty and information, PHI (1994).
2. Kaufmann, A,. Introduction to the theory of Fuzzy subsets-vol. Academic press (1975).
3. Driankov D, and others. An Introduction to Fuzzy control.
4. B. Kosko & others, Fuzzy logic with Engineering Applications. PHI

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Paper : DSET2.2 Probability and Statistics	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Probability and statistics play a vital role in every field of human activity. Probability and statistics theory are widely used in areas as diverse as golf, law, and medicine to ascertain the likelihood of future events. Statistics and the underlying theory of probability are obviously useful for opinion pollsters and professional gamblers. Statistics is about gaining information from sets of data. Statistics is intimately linked to probability theory.

Unit-1: Random Experiment; Trial , Sample space(both discrete and continuous), events, algebra of events, mutually exclusive events, exahaustive events.Concept of probablity;classical and axiomatic approach to probability ,theorem on probability involving only finite number of events-proof based on axiomatic approach. Independence of events, conditional probablity, multiplication theorem, ayes theorem and its applications. (16Hours)

Unit-2: Random variable; distribution function (univariate only) probablity mass function(pmf); probablity density function(pdf),expectation of a random variable, moment generating functions(mgf).

(16Hours)

Unit-3: Study of Standard Distribution; Discrete Distribution—Bernoulli Distribution, Binomial Distribution, Poisson Distribution through proof, computation of moment generating function.

Continuous Distribution—Definition through probability density function, computation of moment generating function, Gamma, Beta, Normal distribution, chai-squre ,t and F statistics.

(16Hours)

Unit-4: Correlation and Regression Analysis; methods, properties, multiple and partial

Correlation coefficients. (16Hours)

References:

1. Abraham, Ledolter: Statistical Methods for Forecasting, Wiley.
2. Chapman, Schauffle: Elementary Probability Models and Statistical Inference, Ginn Blaisdell.
3. Devore: Probability and Statistics for Engineering and the Sciences, Brooks/Cole.
4. Evans, Rosenthal: Probability and Statistics: The Science of Uncertainty, Freeman.
5. S.D Sharma: Mathematical Statistics

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Paper : CCP 2.3 Programming in C with ANSI features	
Teaching Hours: 2 Hrs/Week	**Credits :** 02
Maximum Marks: 50 (SEE-40 + IA-10)	

List of Practicals

1. Dos Commands.
2. Windows Commands.
3. Finding Smallest and Largest of Three Numbers.
4. Searching for the Smallest in a List.
5. Sorting a List of Integers in Ascending / Descending Order.
6. Finding the Roots of Quadratic Equation.
7. Difference Table.
8. Interpolation.
9. Finding whether a year is leap year or not?To find whether a number is positive, negative or zero.
10. Matrix Multiplication

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Paper :GET2.1 Applied Mathematics	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Applied Mathematics prefers to development of mathematical methods for application to other fields to provide the depth knowledge of mathematical computation.

Unit –I: Introduction to C , Features of C, Program Structure, Concept of Header File, Preprocessor, Character Set, Identifiers, Reserved Words, Constants and Variables, Data Type, Modifiers, Types of Statements, Declaration and Initialization, Comments, Formatted and Unformatted I/O Statements, Escape Sequences and Format Specifies. Types of Operators (unary, binary and ternary), (16 Hours)

Unit-2: Classification of Operators: Assignment, Arithmetic, Relational, Logical, Comma Operator, Size of Operator, Operator, Hierarchy and Associatively, Type Conversion (explicit and implicit), Library Functions.

Control Statements**:** If, If Else, Switch Statements, Looping Statement (for, while, do while), Nested Loops, Infinite Looping, Break and Continue. (16 Hours)

Unit-3: Algebraic and transcendental equations, iteration method, Bisection method, Regula falsi method, Newton-Raphson method.

Interpolation: Newton's Interpolation Formula, Lagrange's Interpolation Formula, Divided differences, Newton's Divided differences Formula.

Unit -4: Numerical Differentiation and Integration: Introduction, Newton's forward differences Formula, Newton's backward differences Formula, Trapezoidal rule, Simpson's 1/3 and 3/8 rules, solutions of ordinary differential equations: Euler's modified method and Runge-Kutta method.

References:

1) S S Sastry ,Introductory methods of numerical analysis ; PHI, 1995.

2) Venugopal and Prasad, Programming in C; TMH.

3)Balguruswamy: Programming in ANSI C.

4)Yeshwant Kanetkar: Let US C.

5) Jain .M.K ,Iyengar S.R.K . and Jain R.K**:** Numerical methods for scientific and engineering computation,New age International (P) Ltd., 5th ED.,2007

6)RicheardL.Busden and J.DouglasFaires**:** Numerical analysis, Thomson Brooks/code , 7th ED., 2005.

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CCP 2.3 : Programming in SciLab LAB-II	
Teaching Hours: 2Hrs/Week	**Credits :** 02
Maximum Marks: 50 (SEE-40 + IA-10)	

- Introduction to SciLab and commands related to topics.

Use the SciLab open source software to execute the practical problems.

SciLab: It can be downloaded from http://www.scilab.org/download AND http://wiki.scilab.org /Tutorialsarchives.

List of Practical:

1. Solution of system of homogenous differential equation.
2. Solution of system of non-homogenous differential equation.
3. Solution of linear differential equation.
4. Solution of non-linear differential equation.
5. Bisection method
6. Newton-raphson method
7. Interpolation.
8. Difference Table
9. Trapezoidal Rule
10. Simpson's 1/3-Rule
11. Simpson's 3/8 Rule
12. Runge-kutta method

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Thired Semester

Paper : CCT 3.1 Functional Analysis	
Teaching Hours: 4Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The development of the subject "functional Analysis" started at the beginning of the last century and has grown tremendously during the past few decades. The fundamental concepts gradually emerged from the classical analysis and began to establish rapidly and hence attracted the attention of the mathematicians. The roots of the subject in the concepts of the older elementary analysis and connected branches of algebra and geometry. The development of newer concepts embodies the abstract approach enabling to study classes of functions rather than individual functions. The study of Functional analysis is an essential part of the post graduate students in mathematics.

Unit-1: Metric Spaces - Open sets , closed sets, Bounded Sets, Convergence , continuity , Compactness, Connectedness, completeness and Bair's Theorem , Cantor's Intersection Theorem , Weierstrass Approximation Theorem , Spaces of continuous Function . (16 hours)

Unit-2: Banach space- Continues linear Transformation, Dual spaces, Hahn Branch Theorem, The Nature Embedding of Normed linear space in to its Second Conjugate Space,The Open Mapping Theorem, closed Graph Theorem. The Conjugate Operator, Banach steinhans Theorem. (16 hours)

Unit-3: Hilbert Spaces- orthogonal Complements, Orthogonal Sets , conjugate Spaces. Gram Schmidt ortho normalization Process, Riesz–Representation theorem, the adjoint of an operator, self–adjoint operators. Normal and unitary operators, projections. (16 hours)

Unit-4: Normal and unitary operators, projections, Finite Dimensional spectral Theory, Matrices, Determinants, and the spectrum of an operator, special theorems. (16hours)

References:

1.G.F. simmons:Introduction to Topology and modern Analysis, McGraw Hill (1968).

2.B.V.Limaye:Functional Analysis ,Wiley Eastern Ltd.,(1981).

3.A.E.Taylor: Introduction to Functional Analysis,John Wiley & Sons, Inc., New York, (1958).

4. A.L.Brown and A.Page : Elements of functional Analysis , Van Nostrand , London (1970).

5. E.Kreysizg:intrtoduction to functional analysis with applications , jhonwiley , new York, (1978).

6. Goffiman and pedrick : Functional ,analysis ,PHL.

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Paper : CCT 3.2 Computational Numerical Methods-I	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: In the process of problem solving it is possible to distinguish several distinct phases like mathematical formulation, selection of numerical method for its solution and implementation of these numerical methods on a computer. The phenomenal development of computers during the last few decades has helped the scientists and engineers in solving very complicated problems in terms of their complexity and the amount of information to be processed .applied mathematicians, scientists and engineers are to be equipped with the computational techniques for solving the problems arising under new situations in the future. The aim of this course is to study several computational methods such as functional approximations, solutions of non-linear equations and matrix algebra and also to give hands-on experience of implementation of these numerical methods on a computer using C-language.

Unit-1: System of nonlinear equations- Newton Raphson method , general iteration methods; polynomial equations- descrates 'rule of signs, iterative methods- birge- vieta methods , bairstow methods, Muller's method, Direct method- Graffe's root squaring method. (16 Hours)

Unit-2: Interpolation and approximation- Gregory- newton forward difference interpolation, Greggory-newton backward difference interpolations, sterling and Bessel interpolations ,Hermite interpolations , piecewise and spline interpolations , cubic spline interpolations. (16 Hours)

Unit-3: Bivariate interpolations- lagrange bivariate interpolations, newton's bivariate interpolations for equi- spaced points, approximations–least squares approximations, Gram-schmidt orthogonalizing process , Legendre polynomials , chebyshev polynomials. (16 Hours)

Unit-4: System of linear algebraic equations and eigen value problems- Direct methods- Gauss elimination method, Gauss-Jordan elimination method, triangularization method, cholesky method, partition method, error analysis for direct methods. Iteration methods- Jacobi method, Gauss-Seidal method, SOR method, convergence analysis of iterative methods; Eigen value and eigenvectors- Bounds on eigen values, Jacobi method for symmetric matrices, givens method for symmetric matrices, Power method. (16 Hours)

REFERENCES:

1. Jain .M.K ,Iyengar S.R.K . and Jain R.K: Numerical methods for scientific and engineering computation, New age International (P) Ltd., 5th ED.,2007
2. Richeard L.Busden and J.DouglasFaires: Numerical analysis, Thomson Brooks/code , 7th ED., 2005.
3. Hildebrand F.B: Introduction to numerical analysis , Dover Publications, Inc.,2nd ED., 1982.
4. Sastry S.S:introduction methods of numerical analysis , PHI, 4th ED., 2006.

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Paper : CCT3.3 Fluid Mechanics-I	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Fluid mechanics is that branch of science which deals with the behavior of the fluids (liquids or gases) at rest as well as in motion. Thus this branch of science deals with the static, kinematics and dynamic aspects of fluids. This field of mechanics obviously encompasses a vast array of problems that may vary from the study of blood flow in a capillaries to the flow of crude oil across Alaska through an 800-mile long, 4 feet diameter pipe fluid mechanics principles are needed to explain why airplanes are made streamlined with smooth surfaces for the most efficient flight, whereas golf balls are made with rough surfaces (dimpled) to increase their efficiency. As this branch of mathematics is closely related with the real world problems. The students will have a good exposition to implement mathematics in solving and doing modeling which occurs in geohydrology, aeronautics, bio mechanics, medicine, turbines etc.

Unit-1: Kinematics- Lagrangian method , Eulerian method , local and individual time rates of change , stream line , path line , velocity potential , boundary surface, Eulerian and Lagrangian equations of continuity , equations of continuity in different co-ordinates , symmetrical forms of equations of continuity. (16 hours)

Unit-2: Equations of Motion- Equations of motion , pressure equations, Bernoulli's equations , Lagrangian equations of motion, Helmholtz vorticity equations , equations for impulsive action , Kelvin circulation theorem , irrational motion in two dimensions, sources , sinks , complex potential , image with respect to a straight line , image with respect to a straight line , image with respectto a circle, Milne-Thomson circle theorem, Blasius theorem.

(16 hours)

Unit-3: Motion of Cylinders- General motion of any cylinders , motion of circular cylinder , applications of circle theorem , initial motion between to co-axial cylinders, kinetic energy of liquid , streaming and circulation about a fixed circular cylinder , equation of motion of circular cylinder with circulation. (16 hours)

Unit-4: General Theory of Irrotation Motion- Irrotational motion, kinetic energy of finite liquid , kinetic energy of infinite liquid, Kelvins minimum energy theorem ,Mean value of potential function , Green's theorem.

(16 hours)

REFERENCE:

1.F. Chorlton: Textbook of fluid dynamics , CBS publishers, new Delhi , (1985)

2.A.CEringen: Mechanics of continua.

3.W.Prager: Mechanics of continiuousmedia .

4.W. I. I Besaint and A. S. Ramesy: A teratise on hydrodynamics, part 2 , CBS publishers, new Delhi

5.L.D. Landav and E.M lipschil: fluid mechanics, Pragamon Press, London, (1985)

6..K. Rathy: An introduction to fluid dynamics, oxford and IBH publishing company, new DELHI (1976)

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Paper : DSET3.2 Research Methodology & Mathematical Methods	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Z transform is used in many applications of mathematics and signal processing. It is analysis tool that analyze the whole discrete time signals and systems and their related issues. It has major role in our life. Perturbation theory comprises mathematical method for finding an approximate solution to a problem. Tensor calculus has many real life applications in physics and engineering. Tensor analysis is powerful tool that enables the reader to study and understand more effectively the fundamentals of fluid mechanics.

UNIT-1: Research- Meaning and Definition, need and purpose of research; Types of research; Barriers to research. Identification, Selection and Formulation of a research problem hypothesis: Meaning and definition of types, Formulation and testing of hypothesis. Research design; Design, types and their characteristics; Preparation of a research proposal. (16Hours)

Unit-2: Z-Transforms- Introduction, Definition, Some standard Z- transform, Linearity property, Damping rule, Shifting un to right and left, multiplication by n, some theorems, Inverse Z- transform, Convolution theorems, Convergence of Z-transform, Two-sided Z-transform, Evaluation of inverse Z-transform, Application to Difference equation. (16 Hours)

Unit-3: Perturbation Technique- Introduction to polynomial equations and I.V.P,regular and singular perturbation theory, Introducing example with boundary layer equations, asymptotic series, asymptotic matching, matched asymptotic expansion, applications to differential equations. (16 Hours)

Unit-4: Tensor Analysis- Introduction, Transformation of co-ordinate, Zero and higher order Tensor, Symmetric and skew-symmetric tensor, addition and outer inner product of two tensor, Contraction of tensor, Metric, Conjugate and associate tensors, Christoffel symbols, transformation of Christoffel symbols, Covariant, Contravarient and their derivatives. (16 Hours)

References:

1.Poularikas,A.D:The Z-Transform,CRCPress LLc,2000

2. Nayfeh. A.M: Perturbation methods. wiley ,New York.

3.Sokolnikof,w.F: Tensor Analysis, John wiley and sons,inc.

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Paper : DSET3.1 Fuzzy Logic and Applications	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Fuzzy logic has wide ranging applications in science and engineering. The goal of this paper is to introduce fuzzy logic and its applications to post graduate students in Mathematics so that they can develop a reasonably in-depth understanding of the principle and the practice of technology as well as a working of how to use the technology themselves.

Unit-1: Fuzzy Relations-Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy ordering relations, Fuzzy morphisms, Sup-I compositions of fuzzy relations, Inf- w_i compositions of Fuzzy relations. (16Hours)

Unit-2: Fuzzy Relation Equations- Introduction, Problem partitioning, Solution method, Fuzzy relation equations based on Sup-I compositions and Inf- w_i compositions, approximate solutions. (16 Hours)

Unit-3: Fuzzy Logic- Classical logic an overview, multi valued logics, Fuzzy propositions, Fuzzy quantifiers, Linguistic hedges, inferences from conditional fuzzy propositions and qualified propositions and quantified propositions. (16 Hours)

Unit-4: Applications of Fuzzy Sets and Logic- Signal processing, image processing, and hand written character recognition and visual image recognition, Communications systems, intelligent controller, other applications. (16Hours)

References:

1. Groge J. Klor. and Yuan, Fuzzy sets and Fuzzy logic, Theory and Applications. PHI.
2. Georgo J. Klir and Tina A Fotger , Fuzzy sets uncertainty and information, PHI (1994).
3. Kaufmann, A,. Introduction to the theory of Fuzzy subsets-vol. Academic press (1975).
4. DriankovD, and others. An Introduction to Fuzzy control.
5. B. Kosko& others, Fuzzy logic with Engineering Applications. PHI

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Paper : CCP 3.2 Computational Numerical Methods-I	
Teaching Hours: 2Hrs/Week	**Credits :** 02
Maximum Marks: 50 (SEE-40 + IA-10)	

List of Experiments: Students have to implement the following numerical methods by using C programming language.

1. **Numerical solution of transcendental and polynomial equations:**
   - Bisection method
   - Newton-raphson method
   - Muller Method
2. **Interpolation:**
   - Generation of forward difference table, backward difference table , central difference table for the given set of tabular values (Xi, Y0, I=0,1,2,3.....n).
   - Lagrange's interpolation formulae(for unevenly spaced points).
   - Newtons forward difference and backward difference formulae (for evenly spaced points).
3. **Numerical solutions of systems of linear algebraic equations :**
   - Gauss elimination method.
   - Gauss-jordan elimination method
   - Jacobi method
   - Gauss-sedial method

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Paper : GET 3.1 Operations Research	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: The subject of Operations Research has being growing theoretically and has a wide ranging applications in the field of life namely engineering, business, management, economics and medical sciences etc. In view of this, a course of Operations Research is introduced to the students of Science as a job-oriented course. The main aim of this paper is to introduce the fundamentals of operations research and its techniques used in different fields of interest and greater use of these tools in planning, scheduling, cost and job control for the efficient and economical conduct of industrial Endeavour

Unit-1: Linear Programming- Basic Concepts, Convex Sets, Open and Closed Half Spaces, Simplex, Formulation of Linear Problem (LPP), Feasible Solution, Basic Feasible Solution, Optimal Solution, Graphical Method, Simplex Method. (16Hours)

Unit-2: Transportation Problem (TP)- Mathematical Formulation, Existence of Feasible Solutions, Transportation Table, Initial Basic Feasible Solution ; North-West Corner Rule, Row Minima Method , Column Minima Method , Matrix Minima Method, Vogel's Approximation Method (VAM). Transportation Algorithm, Degeneracy in TP, Unbalanced TP. (16 Hours)

Unit-3: Assignment Problem-Mathematical Formulation, Assignment Algorithm, Routing Problem, Traveling Salesman Problem.

Networks- Network Minimization, Shortest Route Problem, Shortest Route Algorithms for Acyclic Networks, Maximal Flow Problem, Linear Programming Representation of Networks. (16 Hours)

Unit-4: Theory of games- Introduction , Two-person zero-sum games, maximin- minimax principle, mixed strategies , graphical solution of 2 X N and M X 2 games, Dominance property , saddle point theorems. (16 hours)

References:

1. Hamdy A. Taha: Operations Research, MacMillan, (1989).
2. Kanti Swarup, P. K. Gupta and Manmohan: Operations Research, S. Chand & Sons, (1980).
3. S. Kalavathy: Operations Research, Vikas, (2001).
4. S. D. Sharma: Operations Research.
5. G. Hadley: Linear Programming, Narosa Publishing House, New Delhi, (1987).

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Paper : CCP 3.1 Programming in MATLAB LAB II	
Teaching Hours: 2 Hrs/Week	**Credits :** 02
Maximum Marks: 50 (SEE-40 + IA-10)	

MATLAB:

Introduction , Basic features , A minimum MATLAB session, , Starting MATLAB ,Using MATLAB as a calculator, , Quitting MATLAB , Getting started , Creating MATLAB variables , Overwriting variable , Error messages , Making corrections , Controlling the hierarchy of operations or precedence , Controlling the appearance of floating point number, Mathematical functions , Basic plotting.

List of Practical

1 Creating Matrices

2 Performing operations on Matrices

3 Plotting the Graph of a function of one variable

4 Plotting the Graph of a function of two variable

4 Vector Product and Transpose

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Fourth Semester

Paper : CCT 4.1 Measure theory	
Teaching hours : 4 hrs/week	Credits : 04
Maximum marks : 100(SEE-80+IA-20)	

Preamble: The subject being very modern in nature. All needed definitions have been given at the beginning of the chapters, and though apparently the volume looks very thin but it covers the entire course as laid down in various Indian universities. It is needless to emphasize that the style adopted in this syllabus is lucid, clear, easy, and clearly understandable to the students, a good many solved and unsolved examples have been given in every chapter so that students may have enough practice in the subject.

Unit-1: Measure and outer Measure: Ring of a set, sigma-algebra of sets, measure space, Caratheodory's postulates of outer measure, measurable set, problems related to measure function , ring of sets, sigma algebra of sets and lebesgue measure of set, exterior and interior measure, vial's covering theorem, borel measurable set.

(16 Hours)

Unit-2: Measurable functions: Measurable function, almost everywhere, equivalent characteristic function, borel measurability of functions, little wood's three principle's, lebesgue integral of a function, first mean value theorem. **(16 Hours)**

Unit-3: Convergance in measure, Reisz's theorem, D.f.egoroff'stheorem,lebesgue, bounded convergence theorem, fatou's lemma, absolute continuous function, indefinite integration and differentiation.

(16 Hours)

Unit-4: Signed Measure: Signed measure, positive and negative sets, Hahn decomposition theorem, singular measure, Jordan decomposition, absolutely continuous measure function.

(16 Hours)

Referances:

1.PaulR.Halmos:Measure Theory, D.Van. Nostrand Co. Inc., New York and Affiliatedb East-West Press Pvt.Ltd., Delhi,(1996).

2. I.K.Rana:An introduction to measure and integration, narosa publishing house,(1997)

3. K.P.Gupta:measure theory, Krishna prakashan media(p) ltd,II,shivaji road, meerut(U.P),India.

4. Haroldwodom:lectures on measure and integration, van nostrandreinhold company, new-york.

5. J.F.C.KinmamassndS.J.Taylor:introduction to measure and probability, Cambridge University Press.

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Paper: CCT 4.2Fluid Mechanics - II	
Teaching hours:4 hrs/week	**Credits:04**
Maximum marks:100(SEE-80+IA-20)	

Preamble: Fluid mechanics is that branch of science which deals with the behavior of the fluids (Liquids or gases) at rest as well as in motion. Thus this branch of science deals with the static, kinematics and dynamic aspects of fluids. This field of mechanics obviously encompasses a vast array of problems that may vary from the study of blood flow in a capillaries to the flow of crude oil across Alaska through an 800-mile long, 4 feet diameter pipe. Fluid mechanics principles are needed to explain why airplanes are made streamlined with smooth surfaces for the most efficient flight, whereas golf balls are made with rough surfaces (dimpled) to increase their efficiency. As this branch of Mathematics is closely related with the real world problems. The Students will have a good exposition to implement mathematics in solving and doing modellings which occurs in geohydrology, aeronautics, biomechanics, medicine, turbines etc.

Unit-1: Fluid equation for Newtonian fluids: momentum equation, general stress state of deformable bodies, relation between stresses and rate of deformation, stokes hypothesis, navier-stokes equations, energy equation. (16 Hours)

Unit-2: Dimentional analysis: Reynolds number, bickinham's theorem, physical significance of non dimensional numbers (16Hours)

Unit-3: Exact solutions of navier stokes equations:couttepoiseulle flows, hagen-poiseuille flow through a circular pipe, steady flow between co-axial circular pipes, steady flow in pipes of elliptic cross section, steady flow in pipes of equilateral tringlular section, steady flow in pipes of rectangular sections, unsteady motion of a flat plate, flow due to an oscillating flat plate, pulsatile flow between parallel surfaces, unsteady flow of viscous incompressible, incompressible fluid between two parallel plates. (16Hours)

Unit-4:Lminar boundry layer flow: two dimensional boundary layer equatins for flow over a plane wall, boundary layer flow along a flat plate, boundary layer thickness, energy thickness, displacement thickness, momentum thickness, friction drag, momentum integral equation for the boundary layer, van karmanspohlhausen method. (16Hours)

Referances:

1. W.h.besaint and a.s. ramsey: a treatise of hydrodynamics, part II, CBS publishers, delhi,(1958)
2. G.k. batchelor: a introduction to fluid mechanics, foundation books, new delhi,(1994)
3. F.chorltan: text book of fluid dynamics, CBS publishers, delhi,(1985)
4. H.schlichting: boundary layer theory, mcgraw hill book company, new York, (1979)
5. R.k.rathy: an introduction to fluid dynamics, oxford and IBM publishing company, new delhi,(1976)
6. A.d.young: boundary layers AJAA education series, Washington DC,(1989)
7. S.w.yuan: foundations of fluid mechanics, prentice hall of indai(p) ltd., new delhi,(1976)
8. S.i.pai: viscous flow theory, vol.1; laminar flow, D Von Moptrand Comp

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Paper : CCT 4.3 Graph Theory	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

Preamble: Graph theory is particularly suited to selective study and this syllabus here provides materials for individual to tailor to their courses requirements. A blend of the theory with some of its many varied applications of the graphs is highly desirable for both the disciplines.

Unit-1: Graphs: Basic properties, complement, isomorphism, regular graph, complement of a graph, self-complementary graphs. Operations on graphs, planar graph, combinatorial and geometric graphs detection of planarity, subdivision of a graph, inner vertex set and number , geometric dual of graph and its properties , crossing number and thickness of a graph.

(16 Hours)

Unit-2: Directed Graphs: Digraphs, kinds of digraphs, Weekly connected, strongly connected digraphs, Euler digraph , tournaments , directed trees , arborescence, condensation of a Graphs.

(16 Hours).

Unit-3: Colouring , Covering and Independence : colouring , color class, chromatic number , bio chromatic number, vertex colouring algorithm , simple sequential algorithm , smallest last sequential algorithm, cliques edge-colouring n-edge colouring of a plane map , uniquely colourable graph, covering number , edge covering number vertex independence number, edge independence. **(16 Hours)**

Unit-4: Matching and Factorization: Matching and augmenting paths, factors of G, n-factorization, 1-factorization 2-factorization.

(16 Hours)

References:

1. **F.Harary :**Graph Theory,Addison-Wesley,Reading Mass(1969).
2. **M.Behzad and G.Ghartrand:** Introduction to theory of graphs.All and Bacon Inc, Mass,(1971)
3. **G. Chartrand and O.R .Ollerman:** Applied and algorithmic Graph theory .McGraw Hill , Inc.,(1993)
4. **L.W. Beineke and R.J Wilson:** selected Topics in Graphs Theory .academic Press LTD,.!1988).
5. **Jhonclark and Derek allanHolton :**A First look at graph Theory , allied pub.Ltd(1995).

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Paper: CCT 4.4 Computational Numerical Methods-II	
Teaching hours:4 hrs/week	**Credits:04**
Maximum marks:100(SEE-80+IA-20)	

Preamble: the purpose of this course is to study various numerical methods for the solution of ordinary and partial differential equations. The single step methods like range-kutta method for solving simultaneous and higher order ordinary differential equations, shooting method are useful for solving several problems arising in the study of real life problems. Similarly, the finite difference techniques for the solution of parabolic, hyperbolic and elliptic partial differential equations to be studied in this paper are very vuseful for the students in solving some of the problems arising in fluid mechanics.

Unit-1:Numirical Solution or Ordinary Differential Equations: Initial value Taylor's series method, picard'smethod(Recapitation). Euler's method, Rung-Kutta 4^{th} order method, stability of 1^{st} order and 2^{nd} order methods, Rung-Kutta method for simultaneous and higher order differential equations. **(16 Hours)**

Unit-2:Predictor-Corrector Methods: Adam bashforth's method, Mine's method. Boundary Value problems-Finete difference method, shooting method. **(16 Hours)**

Unit-3:Numerical solution of partial Differential Equations: Classification of Differential Equation, Finite difference approximations to derivatives, parabolic partial Differential Equations-Non dimensional form, explicit finite difference scheme, Crank-Nicholson method, Gauss-seidal iterative scheme for Crank-Nicholson method, successive over Relaxations(SOR), parabolic equation with derivative boundary condition, ADI method; Elliptic partial differential equations-Laplace equation, poisson equation, explicit finite difference method, implicit method, iterative methods. **(16 Hours)**

Unit-4: Hyperbolic partial differential equations: Explicit finite difference method, implicit method. Finite Element Method-Introduction, functional, base functions, methods of approximation-Raylefgh-Ritx method, Galerkin method, applications to two-dimensional problems, Finite Element method for one-dimensional problems. **(16 Hours)**

References :

1. Jain M. K Iyenger S. R K and Jain R. K: Numerical method for Scientific and Engineering Computation, New age international(p) Ltd. 5^{th} Ed(2007).
2. Mitchell A. A and Griffiths D J the Finite Difference method in partial differential equations, Wiley Interscience publication, John wiley& Sons, new York (1980).
3. Richeard L Busden and J. Douglas Faires : Numerical Analysis, Thomos Brooks/Cole, 7^{th} Ed (2005)
4. Hildebrand F B: Introduction to Numerical Analysis, Dover publications, Inc, 2^{nd} Ed (1987)
5. Sastry S. S: Introductory methods of Numerical analysis, PHI, 4^{th} Ed (2006).

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DSET:4.1 DIFFERENTIAL GEOMETRY	
Teaching Hours : 4 Hrs week	Credits : 04
Maximum Marks : 100(SEE-80+IA-20)	

Preamble : This syllabus is an elementary account of the geometry of curves and surfaces. It is written for students who have completed standard First course in calculus and linear algebra, and its aim is to introduce some of the main ideas of differential geometry. The traditional undergraduate course in advancing very rapidly has changed very little in the last few decades. By contrast, geometry has been needs to be brought up to date. However, the syllabus is framed with ne idea only if It really pasy its way by simplifying and clarifying the exposition.

Unit-1: Directional Derivatives: Definition of Directional derivatives curves in E3, reparametrization of a curve, 1-Forms, differential forms, mappings, derivative map. (16Hours)

Unit-2: Frame Fields: Frame at a point, Dot and cross product of the vector fields, geometric study of curves, the Frenet Formulas, arbitrary-speed curves, covariant derivations, Frame Field, connection forms. (16Hours)

Unit-3: Euclidean Geometry : Isometric of E 3, the derivative map of an isometry, orientation, Euclidean geometry, convergence of curves. (16Hours)

Unit-4 :Calculus on a surface : Surface in E 3, patch computations functions and tangent vectors. Differential Forms on a surface, Mapping of surfaces, Topological properties of surfaces. (16Hours)

References:

1. Barrett O' neil: elimentary differential geometry, academic press, new York, (1966)
2. T.j.wilmore:introduction to differential geometry, oxford clarendon press,(1959)
3. Langwitz.d: differential and Riemann geometry, academic press, new York,(1965)
4. W.k.hugenberg: a course in differential geometry, springer,(1978)
5. Elementary topics in differential geometry, springer verlag, new York(1979)

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Paper : DSET 4.2 Computational Fluid Dynamics	
Teaching Hours: 4 Hrs/Week	**Credits :** 04
Maximum Marks: 100 (SEE-80 + IA-20)	

1. Fundamentals: Finite Difference Method, Programming languages such as FORTRAN and C++, Conservation Equations, Reynold's-Averaged Navier-Stokes Equations, Stokes's Flow, Boundary layers, Stability Equations, Classification of Conservation Equations, Boundary Conditions.

(16 Hours)

2. Numerical Methods for Modeling Parabolic and Elliptical Equations: Model Equations, discritization of derivatives with Finite Differences, Explicit methods, Implicit methods for Parabolic Equations, Finite Difference Methods for Elliptic Equations using Direct Method, Iterative Method and Multigrid Method. (16 Hours)

3. Numerical Methods for Modeling Hyperbolic Equations: Explicit Methods using Two-Step Lax-Wendroff Method, MacCormack Method, Implicit Methods, Upwind Methods, Numerical Dissipation and Dispersion: Artificial Viscosity. (16 Hours)

4. Inviscid Flow Equations for Incompressible Fluids: Laplace Equation and its Fundamental Solutions, Finite Difference Method, A Panel Program for Airfoils:- 1. Main Program, 2. Subroutine COEF, 3. Subroutine GAUSS, 4. Subroutine VPDIS, 5. Subroutine CLCM.

(16 Hours)

References:

1. J.E. Wendt, J.D. Anderson, G. Degrez and E Dick: Computational Fluid Dynamics: An Introduction, Springer-Verlog, (1996).
2. J.D. Anderson: Computational Fluid Dynamics: Basic with applications, McGraw Hill, (1986).
3. M.T. Somashekar: Programming in C, PHI, New Delhi, (2006).
4. Ian Sneddon: Elements of Partial Differential Equations, International Student Editions.

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Paper : CCT 4.5 Minor Project	
Teaching Hours: 6 Hrs/Week	**Credits :** 06
Maximum Marks: 150 **SEE:** Project Report – 80 + Viva – Voce - 40 + **IA: 30**	

SEE- Semester End Examination

IA – Internal Assessment

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Paper : CCT 4.5 Minor Project	
Teaching Hours: 6 Hrs/Week	**Credits :** 06
Maximum Marks: 150 **SEE:** Project Report – 80 + Viva – Voce - 40 + **IA: 30**	

SEE- Semester End Examination

IA – Internal Assessment

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