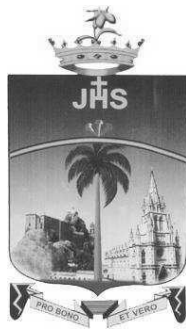


M.PHIL. SYLLABUS - 2013

MATHEMATICS



DEPARTMENT OF MATHEMATICS

St. JOSEPH'S COLLEGE (Autonomous)

*Accredited at 'A' Grade (3rd Cycle) by NAAC
College with Potential for Excellence by UGC*

TIRUCHIRAPPALLI – 620 002

GUIDELINES FOR FULL TIME M.Phil.

1. **Duration :** The programme runs for one year consisting of two semesters. The Semester- I is from August to February and the Semester- II runs from March to August, of the consecutive year.

2. **Course Work :**

Semester – I			Semester - II		
Course	Title	Cr	Course	Title	Cr
C1	General Skills for Teaching & Learning	3	C5	Dissertation (Topic selected should be relevant to the topic of the Guide Paper)	8
C2	Research Methodology	4			
C3	Core Subject	5			
C4	Guide Paper	5			
Total		17	Total		8

2. a. Each Course should contain 5 units, covering the subject requirements of the courses offered.

Marks for CIA and SE are in the ratio 40 : 60.

The CIA components are **Mid Semester Test (25), End Semester Test (25), Seminar (15), Objective Type Assignment Test (15)**. The total mark 80 will be converted into 40 marks. **The tests and Semester Examination are centrally conducted by COE for 3 hours.**

CIA & SE	Tentatively on
Mid Semester Test	December 2 nd Week
End Semester Test	February 2 nd Week
Semester Examinations	February 4 th Week

Scholar should acquire **a minimum of 20 marks from CIA to appear for SE.** He/She will be declared to have passed in the various courses in Semester I, provided he/she secures not less than 50 marks on an aggregate (CIA+SE).

2b(i). In course C1 on ‘ **General Skills for Teaching & Learning**’ the first 3 units are common to all the departments of our college. The first three unit titles are **Soft Skills, E-teaching & E-learning, Elements of Technology of Teaching and Learning**. The remaining two units are department specific to make use of the above mentioned skills & techniques to teach the course subject at the Allied / UG level. This paper is (to be) designed to exploit the various teaching-learning- research skills to be imbibed / cultivated to make the research scholars to be fit for the profession they would likely to acquire in the Education Industry. Thus only for the course (C1) the written component is 60% and Practical component 40% both in CIA and SE.

2b(ii) **EVALUATION for C1:**

Theory Component: For both CIA & SE, there will be a 2 hour test only from the first **THREE** units. The CIA components are Mid Semester Test (35), End Semester Test (35) and Assignment (30). The total 100 will be converted into 25 marks.

Practical Component: The last **TWO** units are department specific. There is no Mid and End Semester Tests. But the CIA for the same are assessed continuously by the teacher(s) concerned totaling 15 marks. For SE, the Practical evaluation is done by an external examiner.

2. c. Question papers for C1, C2 & C3 are set by external examiner.

2. d. Question paper for C4 will be set and valued by the Research Advisor only.

3. CREDITS

S E M E S T E R - I	Courses	Title		Contact Hrs.	Library Hrs.	Total Hrs.	Cr	CIA Mk	SE Mk	Total Mk
	C1	General Skills for Teaching & Learning	T	3	2	5	2	25	35	60
			P	2	2	4	1	15	25	40
	C2	Research Methodology		5	4	9	4	40	60	100
	C3	Core Subject		5	5	10	5	40	60	100
	C4	Guide Paper		5	5	10	5	40	60	100
	Total			20	18	38	17	160	240	400

S E M E S T E R - I I	C 5 D I S S E R T A T I O N	INTERNAL		EXTERNAL			
			Cr	Mk		Cr	Mk
		Seminar & Review of Related Literature	2	15	Dissertation Evaluation	6	75
		Mid term review Presentation	2	15	<i>Viva-voce</i>	2	25
		Dissertation work	3	60			
		<i>Viva-Voce</i>	1	10			
Total		8	100		8	100	

4. Question Pattern

P a r t s	Course	Mid & End Semester Tests and Semester Examinations		
	C1	Section A : Short Answers	7/9	7 x 2 = 14
		Section B : Either / Or – Essay Type	3	3 x 7 = 21
		Section A : Short Answers	10	10 x 2 = 20
		Section B : Either / Or – Essay Type	5	5 x 8 = 40
C2	Section A : Short Answers	10	10 x 2 = 20	
	Section B : Either / Or – Essay Type	5	5 x 8 = 40	
C3	Section A : Short Answers	10	10 x 2 = 20	
	Section B : Either / Or – Essay Type	5	5 x 8 = 40	
C4	Open Choice : Comprehensive Type	5/8	5 x 12 = 60	
A r t s	Course	Mid & End Semester Tests and Semester Examinations		
	C1	Section A : Short Answers	7/9	7 x 2 = 14
		Section B : Either / Or – Essay Type	3	3 x 7 = 21
	C2	Open Choice : Comprehensive Type	5/8	5 x 12 = 60
	C3	Open Choice : Comprehensive Type	5/8	5 x 12 = 60
C4	Open Choice : Comprehensive Type	5/8	5 x 12 = 60	

5. Dissertation

For carrying out the dissertation, it is mandatory to strictly adhering to the rules of the college as given below:

5.1 Requirement

Every student is expected to give two seminars one concerning Review of Related Literature within the four weeks from the beginning of the second semester and the other on Data Analysis/Result/Mid Term Review just before the submission of the final draft of the dissertation

5.2 Submission

Candidates shall submit the Dissertations to the Controller of Examination **not earlier than five months but within six months** from the date of the start of the Semester –II. The above said time limit shall start from 1st of the month which follows the month in which Semester - I examinations are conducted. If a candidate is not able to submit his/her Dissertation within the period stated above, he/she shall be given an extension time of **four** months in the first instance and another **four** months in the second instance with penalty fees. If a candidate does not submit his/her Dissertation even after the two extensions, his/her registration shall be treated as cancelled and he/she has to re-register for the course subject to the discretion of the Principal. However the candidate need not write once again the theory papers if he/she has already passed these papers.

At the time of Submission of Dissertation, the guide concerned should forward the mark for 90% as stated above to the COE in a sealed cover

5.3 Requirement

For the valuation of dissertation it is mandatory to have passed in all the four courses. One external examiner and the Research Adviser shall value the Dissertation. The external examiner should be selected only from outside the college and shall be within the colleges affiliated to Bharathidasan University. In case of non-availability, the panel can include examiners from the other university/colleges in Tamil Nadu. The external examiner shall be selected from a panel of 3 experts suggested by the Research Adviser. However, the Controller of Examination may ask for another panel if he deems it necessary. Both the internal and external examiner will evaluate the Dissertation and allot the marks separately. However the *viva-voce* will be done by both of them. The average marks will be considered.

5.4 Viva-Voce

The external examiner who valued the Dissertation and the Research Adviser shall conduct the *Viva-Voce* for the candidate for a maximum of 100 marks. A Candidate shall be declared to have passed in *viva-voce* if he/she secures not less than 50% of the marks prescribed for Dissertation and 50% of the marks in the aggregate of the marks secured in *viva-voce* and Dissertation valuation. *A student can undertake dissertation in the second semester whether or not he/she has passed the first semester.*

6. CLASSIFICATION OF SUCCESSFUL CANDIDATES

6.1 The candidates who pass the Semester– I and Semester – II examinations in their first attempt shall be classified as follows:

No.	Total Marks secured in Semester – I and Semester – II Examinations	Classification
1.	80% and above in the case of Science Subjects & 75% and above in the case of Arts and Social Science Subjects	I Class with Distinction
2.	60% to 79% in the case of Science Subjects & 60 % to 74% in the case of Arts and Social Science Subjects	I Class
3.	50% to 59% in all the subjects	II Class

Note : Mathematics, Statistics and Computer Science/ Application shall be treated as Science Subjects

6.2 Candidates who pass the courses in more than one attempt shall be declared to have completed the programme under II Class.

6.3 Candidates who have failed in the courses may take the supplementary exams conducted by the COE immediately. Even then if they could not complete the course(s), they will be given two more chances only to appear for those courses along with the next batch scholars. The maximum duration for the completion of the M.Phil. Programme is 2 Years.

7. ATTENDANCE

Daily attendance for 90 working days should be enforced for the students.

Periodical report of a student to the guide concerned should be recorded in the register kept by the guide.

8. **Scholar must obtain 80% of attendance per semester in order to appear for the Semester Examinations/Viva-Voce**

M.PHIL. MATHS COURSE PATTERN-2013

Sem	Code	Title of the Paper
I	13MMA101	Course– C1: General Skills for Teaching and Learning
	13MMA102	Course–C2: Research Methodology
	13MMA103	Course –C3: Algebra And Analysis
	13MMA104A	Course–C4: Wavelets, Fuzzy Automata And Chaotic Systems
	13MMA104B	Course – C4: Fundamentals Of Domination In Graphs
	13MMA104C	Course –C4: Product Graphs
	13MMA104D	Course –C4: Labeling Of Graphs
	13MMA104E	Course –C4: Homological Algebra And Semi groups
	13MMA104F	Course –C4: Stochastic Models In Queueing Theory
	13MMA104G	Course –C4: Harmonic Analysis
	13MMA104H	Course –C4: Advanced Fluid Dynamics
	13MMA104I	Course –C4: Nonlinear Differential Equations
	13MMA104J	Course –C4: Advanced Fuzzy Automata
	13MMA104K	Course –C4: Cryptography
13MMA104L	Course–C4: Topology of Metric Spaces And Fixed Point Theory	
II	13MMA205	Course –C5: Dissertation

C1: GENERAL SKILLS FOR TEACHING AND LEARNING

Objectives:

To enhance the employability of the students by empowering them with soft skills.

To provide students a theoretical background of educational psychology and its important concepts.

To help them understand the application of theories of educational psychology in education practice.

To enable them to understand the nature of growth and development, learning, motivation and its various educational implications.

Unit I: SOFT SKILLS

- a) Communication skills – Oral-Written- verbal – nonverbal-Aids and blocks –intrapersonal and interpersonal communication-Effective communication.
- b) Behavioural skills – attitudes- Time management – Leadership- Team building
- c) Lateral Thinking –conventional teacher and lateral teacher-Creativity and innovation.
- d)Facing interviews- Different types of interviews-Dress code-Do's and Don'ts – Frequently asked questions – preparing a resume- Mock interviews.
- e) Group Dynamics – knowledge – Leadership – Thinking-Listening – Mock GD's

Unit II: e-Teaching and e-Learning

An Overview of Microsoft Office-2007: MS WORD-2007-MS-Excel-2007-MS Powerpoint-2007- Concepts in e-Resources and e-Design: World Wide Web Concepts- making use of Web Resources- Web Site Creation concepts- creating Web page Editors- creating web Graphics- Creating Web Audio Files.

Unit III: Elements of Technology of Teaching and Learning

Psychology – Meaning Branches Scope and Methods -- Emerging areas of Educational Psychology -- kinds and levels of learning -- Different theories of learning – Factors affecting learning – Intrinsic and extrinsic motivation- motivation – Memory and forgetting- Approaches to learning (Pavlov, skinner) -- Creative thinking – Theories of intelligence.

Unit IV: Material Resources for Class Room Teaching

Basics of a LaTeXfile, Command names and arguments, Environments, Declarations, Lengths, Special Characters, Fragile commands, Documentclass, Page style, Parts of the document, Table of contents, Changing font, Lists, Theorem-like declarations, Tables, Footnotes and marginal notes, Mathematical Formulas, Mathematical environments, Main elements of Math mode, Mathematical symbols, Additional elements , Fine-tuning Mathematics. Floating tables and figures.

Unit V: Material Resources for Class Room Learning

Basics of MATLAB, input-output, General commands, Matrices and Vectors- Matrix and Array operations- inline functions- Using built-in functions- Plotting simple graphs- Programming in MATLAB: Scripts and Functions- Script files – Functions files- Linear Algebra – Curve Fitting and interpolation – Data analysis and Statistics- Numerical integration- Ordinary differential equations – Nonlinear Algebraic Equations.

BOOKS FOR STUDY:

1. **Success through soft skills** by G. Ravindran, Dr. S.P.B. Elango and Dr. L. Arockiam.
2. **Soft Skills** by Dr. K. Alex
3. **Lateral Thinking** by Edward De Bono.
4. **Step by Step 2007 Microsoft Office System** by Joyce Cox
5. **Internet: The Complete Reference** by Margaret Levine young,
6. **Educational Psychology in classroom** by Lindaren Henry
7. **Psychology of classroom learning** by Holt Richard.
8. **A Guide to LaTeX** by H. Kopka and P.W. Daly
[Sections 1.5,2.1-2.6,3.1-3.4,4.1,4.3,4.5,4.10,5.1-5.5and 6.6]
9. **Getting Started with MATLAB 7- A Quick introduction for Scientists and Engineers** by Rudra Pratap, Oxford University Press..

C2: RESEARCH METHODOLOGY**Unit I: Research Methodology**

An Introduction – Defining the Research Problem- Research Design-Rise of Abstract Algebra-Aspects of Twentieth Century
(Text Book 1: Chapter I, II & III pp 1-67, Text Book 2)

Unit II: Chaos

Three simple Chaotic systems Mechanical, Chemical oscillators, The Lorenz equation – Mappings Logistic, Henon maps– Fixed and periodic points of maps – Tents and Horse shoes. (Chapter XV, Section 15.1, 15.2 – 15.2 .2)

Unit III: Domination of Graphs

Domination number of Graph-The Independent Domination number of a Graph-Other Domination parameters.
(Text Book 4: Chapter 10, Sections 10.1, 10.2, 10.3)

Unit IV: Metric Spaces

Complete Metric Spaces-Compactness in Metric Spaces-Pointwise Compact Convergence.
(Text Book 5: Chapter 7 Sections 43, 45 & 46)

Unit V: Homotopy

Homotopy of Paths –The Fundamental Group-Covering Spaces – Fundamental group of Circle.
(Text Book 5: Chapter 9 Sections 51, 52, 53 & 54)

BOOKS FOR STUDY:

1. **Research Methodology** by C.R. Kothari, Wishwa Prakashan 1990.
2. **A History of Mathematics** by Boyer B.Carl
3. **Differential Equations(Linear, Non-Linear, Ordinary, Partial).**- A.C.King, J. Billingham, S.R. Oho Cambridge University Press (2003)
4. **Graphs and Digraphs**, Fourth Edition - G.Chartrand and Lesniak, S Chapman & Hall/CRC. 3rd edition (August 1, 1996)
5. **Topology** by James R.Munkres-Prentice Hall of India. (Second Edition),2002.

Reference Books:

1. **General Topology** by James Dugundji, Allyn and Bacon , Boston,1996.

C3: ALGEBRA AND ANALYSIS**Unit-I: Modules**

Modules homomorphism and exact sequence, Projective and injective. Modules homomorphism and duality.

(Chapter 4.1, 4.3, 4.4, Text Book-1)

Unit-II: Commutative Rings and Modules

Chain conditions – Prime and primary ideals – Primary decomposition. Noetherian Rings and modules

(Chapter 8.1, 8.2, 8.3, 8.4, Text Book – 1)

Unit III: Positive Borel Measures

Vector spaces – Topological preliminaries – Urysohn's Lemma-The Riesz representation theorem. (Chapter 2, Text Book -2, Sections 2.1-2.14).

Unit-IV: L^p -Spaces

Convex functions and inequalities-- The L^p -Spaces –Approximation by continuous functions.

(Chapter 3, Text Book-2)

Unit V: Banach Algebras

Banach algebras –Spectrum of an element in Banach algebra-Spectral radius formula-Quotient algebras-applications.

(Chapter 18, Text Book-2)

BOOKS FOR STUDY:

1. **Algebra** by Thomas W Hungerford, Springer Verlag Indian reprint 2004.
2. **Real and Complex Analysis** by Walter Rudin, Tata McGraw Hill (II Edition) 1996.

C4: WAVELETS, FUZZY AUTOMATA AND CHAOTIC SYSTEMS**Unit I: The Discrete Fourier Transform**

Properties of Discrete Fourier Transform – Translation – Translation-invariant- The Fast Fourier Transform.
(Chapter II , Section 2.1,2.2,2.3).

Unit II: Wavelets on Z_N

Construction of wavelets on Z_N : First Stage – Construction of wavelets on Z_N : The Iteration step – Examples and Applications.
(Chapter III, Section 3.1,3.2,3.3)

Unit III: Fuzzy Automata

Fuzzy subsets-finite state machines-finite state automata-languages and grammar-nondeterministic finite state automata-relations between languages and automata - Fuzzy languages-types of fuzzy grammars.
(Sections 1.4,1.6-1.10,4.1,4.2.)

Unit IV: Fuzzy Grammar

Fuzzy context- free grammars- fuzzy context-free Max-product grammars - Fuzzy finite state machines – Homomorphisms - Submachines of a fuzzy finite state machine-fuzzy recognizers and its languages.
(Sections 4.3,4.4, 6.1 - 6.3,6.7, Pages 337,338 of section 7.2.)

UNIT V: Chaotic Systems

Periodic orbits – Denseness of orbits – Invariant measure – Lyapunov number – Chaos in conservative and dissipative systems – Attractor and Poincare section.
(Text Book 3: Chapter 2, Section 2.2, 2.6-2.8, Chapter 4, Section 4.1, 4.2)

BOOKS FOR STUDY:

1. For units I and II :
An Introduction to Wavelets through Linear Algebra – Michael W. Frazier, Springer ,1999.
2. For units III and IV:
Fuzzy Automata and Languages Theory and Applications.
John. N. Mordeson and Davender, S. Malik, CRC Press Company, 2002.
3. For unit V:
Introduction to Chaos by H. Nagashima and Y. Baba, Overseas Press, New Delhi, 2005.

C4: FUNDAMENTALS OF DOMINATION IN GRAPHS**UNIT – I: Bounds in terms of degree**

Bounds in terms of order and size – Bounds in terms of degree, diameter, and girth.

UNIT – II: Bounds in terms of covering

Bounds in terms of independence and covering – Product graphs and Vizing's conjecture – Grid graphs.

UNIT –III: Varieties of domination

Varieties of domination – Multiple dominations – Parity restrictions.

UNIT –IV: Location of dominating sets

Locating domination – Distance domination.

UNIT –V: Global domination

Strong and weak domination – Global and factor domination.

BOOK FOR STUDY:

Teresa W Haynes, Stephen T Hedetniemi, Peter J Slater, Marceal Dekker, *Fundamental of Domination in Graphs*, 1998., Marcel Dekker inc., 270 – Madison Avenue, Newyork.
(Sections: 2.3 to 2.6, 7.1 to 7.6.)

REFERENCE BOOKS:

1. Walikar H.B., Acharya B.D. and Sampathkumar E. – *Recent developments in the theory of domination in graphs: - MRI lecture notes in Maths*, volume 1, 1979, Mahta Research Institute, Allahabad,
2. Teresa W. Haynes, Stephen T. Hedetniemi, and Peter. J. Slater. *Domination in graphs Advanced Topics* 1998., Marcel Dekker inc., 270 – Madison Avenue, Newyork.

C4: PRODUCT GRAPHS

UNIT –I: Basic concepts

Graphs – Automorphisms and invariants – Hyper cubes and isometric sub graphs.

UNIT –II: The Cartesian product

Prime factor decomposition – Automorphisms.

UNIT –III: Strong products

Strong products and retracts – Direct products in Γ and Γ_o .

UNIT –IV: Algebraic Structures

Basic algebraic properties of Lexicographic products.

UNIT –V: Automorphisms

Automorphism in Lexicographic products.

BOOK FOR STUDY:

Wilfred Imrich and Sandi Klavzar. *Product graphs Structure and recognition*, JOHN WILEY & SONS, INC. NEW YORK. 2000 (Sections 1.1 to 1.4, 4.1, 4.2, 5.1, 5.3, 6.1 and 6.3)

C4: LABELING OF GRAPHS

Unit – I: History of Labellings

Statement of the problem – A context for the problem – A history of sub problems.

Unit – II: Characterization

Necessary conditions for graceful graphs – Classes of graceful graphs – some general Questions.

Unit – III: Labelling of complete graphs

Euclidean models and complete graphs – Numbered graphs and difference sets.

Unit – IV: Path Number

Results on path number – The unrestricted path number.

Unit – V: Special type of labelling

Felicitous labellings of graphs.

BOOK FOR STUDY:

For units I to IV:

Ronald C. Read, *Graph theory and Computing*, 1972,

Academic press,

Chapter 2 and 3 (page 23 to 44)

(Except 2.9 and 3.4)

For Unit V:

Arumugam S., Acharya B.D. and Sampathkumar S. (Edited)

Graph theory and its applications, Tmh Publications,

1997 Chapter 3 Pages 47 to 61

C4: HOMOLOGICAL ALGEBRA AND SEMIGROUPS**UNIT - I Modules**

Modules, Free modules, Exact sequences, Semi exact sequences, Tensor Products.

UNIT – II Modules of Homomorphisms

Modules of Homomorphisms. Projective Modules Injective modules – Categories and Functors – Notion of Category and functors and exam ples

(Treatment as in “**Introduction to Homological Algebra**” by S. T.Hu.)

Chapter I and Chapter II Pages 24 – 100

UNIT – III Semigroup

Semigroup. Basic definitions, Semigroup of relations on a set of Congruences. Factor groupoids and homomorphisms – Units and Maximal sub groups.

UNIT –IV Bands and semilattices

Bands and semilattices. regular semi groups, Inverse semi groups. Embedding semigroups in groups Free semi groups and generating relations.

UNIT – V Green’s relations

Green’s relations. D-structre of the full transformation semi group T_x on a set x . Regular D-classes. Simple semigroups. Principal factors of a semigroup

(Treatment as in “**The Algebraic theory of Semigroups**”, Vol-I by A. H. Clifford and G.B. Preston Chapter I and II pages 1 –75)

BOOK FOR STUDY:

NORTHCOTT D.G., *An introduction to Homological Algebra*. Cambridge, University Press, 1960

C4 : STOCHASTIC MODELS IN QUEUEING THEORY**UNIT –I M/M models**

Steady state solution for M/M/1 model – Measures of effectiveness – Waiting Time distributions – Little's formula – Finite system capacity – Queues with truncation (M/M/1/K) – Transient behaviour – Busy period analysis. (Sec 3.1 to 3.4).

UNIT –II Birth-Death Processes

Birth-Death Processes – Queues with parallel channels (M/M/C) – Queues with parallel channels and Truncation (M/M/C/K) – Erlang's formula (M/M/C/C). (Sec 3.1 to 3.4).

UNIT –III Queues with Unlimited Service

Queues with Unlimited Service (M/M/∞) – Steady state results – Transient analysis – Finite source Queues – State dependent Service – Queues with impatience – M/M/1 Balking – M/M1 Reneging. (Sec 3.5 to 3.8).

UNIT –IV Bulk Input

Bulk Input (M/M/1) – Bulk Service (M/M/1) Erlangian Models (M/E_k/1 and E_k/M/1).

UNIT –V General Service

Single Server Queues with Poisson Input and General Service (M/G/1) – Measures of effectiveness – Steady system size Probabilities – Special Cases (M/E_k/1 and M/D/1) (Sec 5.1.1 to 5.1.5).

BOOK FOR STUDY:

Donald Gross, Carl M. Harris, *Fundamentals of Queueing Theory*, John Wiley & Sons. Newyork., 1974

C4: HARMONIC ANALYSIS**UNIT 1: Fourier Series & Integrals**

Definition and easy results – The Fourier transform – Convolution, approximate identities, Fejer's theorem – Unicity theorem, Parseval relation; Fourier Stieltjes Coefficients – The Classical Kernels
(Chaper 1)

UNIT 2: Fourier series and Integrals

Summability: Metric Theorems – Pointwise summability – Positive definite sequences: Herglotz theorem – The inequality of Hausdorff and Young – Measures with bounded powers; endomorphisms (Chapter1)

UNIT 3: The Fourier Integral

Introduction – Kernels of \mathbb{R} – The Plancherel theorem – Another convergence theorem; the Poisson summation formula – Bochner's theorem – The continuity theorem. (Chaper 2)

UNIT 4: Discrete and Compact groups

Characters of discrete groups – Characters of compact group – Bochner's theorem (Chapter 3; Sec 3.1, 3.2, 3.3)

UNIT 5: Measure

Examples – Minkowski's theorem – Measure on infinite product spaces – continuity of seminorms. (Chapter 3; Sec 3.4, 3.5, 3.6, 3.7)

BOOK FOR STUDY:

Henry Helson, **Harmonic Analysis**. Addison-Wesley Pub (Sd) (May 1983)

C4: ADVANCED FLUID DYNAMICS**Unit 1: Motion of a Sphere**

Motion of a Sphere through an infinite mass of a liquid at rest at infinity - Liquid streaming past a fixed sphere - Equations of motion of a Sphere - Sphere projected in a liquid under gravity - Pressure distribution on a Sphere.

[Chapter 8 Articles 8.1 to 8.7 P 350 to 371]

Unit 2: Concentric Spheres

Concentric Spheres - Problem of Initial motion - Three dimensional sources, sinks and doublets - Complex Potential due to a 3D doublet - Image of a 3D source w.r.to a plane - Image of a 3D doublet w.r.to a plane - Image of a 3D source w.r.to a Sphere - image of a doublet in front of a Sphere.

[Chapter 8 Articles 8.9 to 8.17 P 371 to 396]

Unit 3: Wave motion

General expression of a wave motion - Mathematical representation of wave motion - standing or Stationary waves - Types of liquid waves - Surface waves - Energy of Progress waves - Energy of Stationary waves - Progressive waves reduced to a case of Steady motion - Waves at the interface of two liquids.

[Chapter 10 Articles 10.1 to 10.10 P 508 to 524]

Unit 4: Newtonian

Newton's law of viscosity - Newtonian and Non-Newtonian fluids - Body and Surface forces - Stress vector - State of stress at a point - Plane Stress, Principal stresses and Principal directions.

[Chapter 11...Articles 11.1 to 11.10 P 553 to 572]

Unit 5: Nature of strain

Transformation of the rates of strain components Relation between stress and rates of strain - Stoke's law of viscosity.

[Chapter 11...Articles 11.12 to 11.14 P 582 to 594]

Text Book BOOK FOR STUDY:

RAISINGHANIA M.D., *Fluid Dynamics*, 2003, S.Chand & co

Reference Book:

Frank Charlton, *Text Book of Fluid Dynamics*, 2000, CBS Publishers and Distributors.

C4:– NONLINEAR DIFFERENTIAL EQUATIONS**Unit I : Integral Manifolds**

Groanwall's inequality - phase space - critical points - periodic solutions -- First integrals and integral manifolds - Liouville's theorem.

Unit II: Linear System

Two, three dimensional linear systems - critical points of nonlinear equations - The Poincare-Bendixson theorem and its applications - periodic solutions in \mathbb{R}^n .

Unit III: Stability Theory

Stability - stability of equilibrium solutions - stability of periodic solutions - linearisation - asymptotic stability - instability.

Unit IV: Centre Manifolds

Bifurcation - averaging and normalisation - centre manifolds - bifurcation of equilibrium solutions - Hopf bifurcation.

Unit V: Chaos

Chaos - The Lorenz equations - one dimensional chaos: the quadratic map, the tent map - Fractal sets and its dynamical characterisations-- Lyapunov exponents.

BOOK FOR STUDY:

Ferdinand Verhulst, *Nonlinear Differential Equations and Dynamical Systems*, 2nd Edition . Springer , 1996. (Chapters: 1 -- 5, 7, 13 and 14.)

C4: ADVANCED FUZZY AUTOMATA**UNIT 1: FINITE AUTOMATA**

Finite State System - Basic Definitions - Non-Deterministic Finite Automata- Finite Automata with ϵ -moves - Regular Expressions.
Chapter- 2 (Section: 2.1 to 2.5)

UNIT II: PROPERTIES OF REGULAR SETS

The Pumping Lemma for regular sets- Closure Properties of regular sets.
Chapter-3 (Section: 3.1, 3.2), Chapter- 4 (Section: 4.1, 4.2)

UNIT III: CONTEXT FREE GRAMMARS

Motivation and Introduction-Context-Free Grammars - Derivation Trees- Implication of Context-Free Grammars - The Pumping Lemma for Context-Free Languages - Closure Properties of Context-Free Languages.
Chapter- 4 (Section: 4.3, 4.4), Chapter- 6 (Section: 6.1, 6.2)

UNIT IV: FUZZY SET THEORY

Definitions - Basic Operations on Fuzzy Sets - The Extension Principle Membership functions and Fuzzification.
Chapter- 2 (Section: 2.2 to 2.5)

UNIT-V FUZZY GRAMMAR AND FUZZY AUTOMATA

Fuzzy Languages - Fuzzy Grammars - Fractionally Fuzzy Grammars - Fuzzy Automata. Chapter- 8 (Section: 8.2 to 8.4, 8.10)

BOOKS FOR STUDY

1. For UNIT I, II & III: JOHN.E.HOPCROFT (J.E.H) & JEFFREY.D.ULLMAN (J.D.U), *Introduction to Automata Theory, Languages and Computation*, Narosa Publishing House, 1997.
2. For UNIT IV & V: SANKAR K.PAL AND DWIJESH K.DUTTA MAJUMDER, *Fuzzy Mathematical Approach to Pattern Recognition*. Wiley Eastern Ltd, 1987.

C4: CRYPTOGRAPHY

UNIT – I: Symmetric key encryption

Symmetric key encryption – Stream ciphers – Block Ciphers - DES – Modes of operation.

UNIT –II: Public-key cryptography

Modular arithmetic – Discrete key log function – RSA system.

UNIT –III: Operations in RSA

Digital signature – Hash functions – Merkle’s method – Probabilistic signatures

UNIT – IV: Discrete logarithm

Elgamal’s encryption – Digital signature algorithm - Robin’s encryption

UNIT –V: Protocols

Kerberos – Diffie - Hellman key agreement – Fiat-Shamir identification scheme – Zero knowledge

BOOK FOR STUDY:

1. Hans Delfs and Hellmut Knebl, *Introduction To Cryptography*, 2003, Springer Chapter 2 : 2.1, 2.2, Chapter 3, Chapter 4 : 4.1, 4.2.1 to 4.2.3

Reference Book:

1. Koblitz, *A course in Number Theory and Cryptography*, 1994, Springer-Verlag.

C4: TOPOLOGY OF METRIC SPACES AND FIXED POINT THEORY**Unit I: Metric Contraction Principles**

Banach's contraction Principles – Extensions of Banach's Principle – the Caristi-Ekeland Principle – Equivalent of the Caristi-Ekeland Principle – Set valued contractions – Generalised contractions.
(Chapter 3: Sec : 3.1-3.6)

Unit II: Hyper convex spaces

Hyper convexity – Properties of Hyper convex spaces – a fixed point theorem – intersection of hyper convex spaces – approximate fixed points – Isbell's hyper convex hull. (Chapter 4: Sec: 4.2-4.7)

Unit III: Normal structures in Metric spaces

A fixed point theorem – structure of the fixed point set – uniform normal structure – uniform relative normal structure – Quasi normal structure – Stability and normal structure – ultra metric spaces – fixed point set structure – separable case. (Chapter 5: Sec : 5.1-5.8)

Unit IV: Metric Fixed Point Theory

Contraction mapping – Basic theorems for nonexpansive mapping – A closer look at l_1 – The Goebel-Karlovitz Lemma – Orthogonal Convexity
(Chapter 8: Sec: 8.1-8.6)

Unit V: Fixed Point Theory in Banach Lattices

Structure of the fixed point set – Asymptotically regular mapping – set valued mappings – Fixed point theory in Banach lattices.
(Chapter 8: Sec : 8.7-8.10)

BOOK FOR STUDY:

An introduction to Metric spaces and fixed point theory – Mohamed A.Khasi and William A. Kirk., A Wiley – Inter Science Publication JOHN WILEY and SONS, INC. First edition (March 6, 2001)