KANCHI MAMUNIVAR GOVERNMENT INSTITUTE FOR POSTGRADUATE STUDIES AND RESEARCH

(Autonomous – Reaccredited with "B++" Grade by NAAC)

(A College with potential for Excellence)

LAWSPET, PUDUCHERRY - 605008

M.Sc. – MATHEMATICS

(Effect from 2022 – 2023)

SYLLABUS

DEPARTMENT OF MATHEMATICS

KMGIPSR

GOVERNMENT OF PUDUCHERRY
KANCHI MAMUNIVAR GOVERNMENT INSTITUTE FOR POSTGRADUATE STUDIES AND RESEARCH
(AUTONOMOUS)
College with Potential for Excellence & Re-Accredited by NAAC with "B++" Grade
[Affiliated to Pondicherry University]
Lawspet, Puducherry – 605 008
Phone: + (91) - 413-2251687 / Fax: + (91) - 413-2251613 Email: kmcpgs@gmail.com

Date: 10/08/2022

DEPARTMENT OF MATHEMATICS

BOARD OF STUDIES MEETING 2022-23

MINUTES OF THE XII BOARD OF STUDIES MEETING (ONLINE)

Date:10- 08-2022 **Time: 2.30 PM (Online)**

The following members attended the Online Board meeting and the same was chaired by the Head of the Department. http://meet.google.com/zru-zgrn-ijo

Name and Designation	Status	Signature
Dr. Gopal Sekar Associate professor of Mathematics & HOD KMGIPSR, Pondicherry 9489257826; gopsek28@gmail.com	Chairman	
Dr.Muthu Ganapathi Subramanian Associate professor of Mathematics, KMGIPSR,Pondicherry 9443484505; csamgs1964@gmail.com	Member	
Dr. V.Ilangovan Associate professor of physics &Head, KMGIPSR,Pondicherry 9344979417 ; veerailangovan@gmail.com	Member Programme Committee	
Dr. T. Duraivel Professor, Department of Mathematics Pondicherry University, Pondicherry 0413-2654397 tduraivel@gmail.com	Member, VC Nominee by Pondicherry University	
Dr. P.Manoharan Associate Professor, Dept. of Mathematics Annamalai University, Annamalai Nagar 608002 9994545666, manomaths.hari@gmail.com	Member Expert Nominated by AC	
Dr. V.Seenivasan Associate Professor, HOD Department of Science and Humanities University College of Engineering Panruti, 9952486979seenu@ucep.edu.in	Member Expert Nominated by AC	
Mr. Suresh Poobathy Assistant Professor of Mathematics, Pondicherry University Community College, Pondicherry University, Puducherry 605008 9994655605 spsureshpoobathi22@gmail.com	Member Meritorious Alumnus	
Mr.Sathya Sekar Mgr., Poclain Hydraulics Pvt. Limited, Puducherry 8220048193 **sathyasekar.c@poclain.com**	Member Industry/Placement Representative	

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Dr.Muthu Ganapathi Subramanian Associate professor of Mathematics KMGIPSR,Pondicherry 9443484505	Member	
Dr. V.Ilangovan Associate professor of physics &Head, KMGIPSR,Pondicherry 9344079417	Member Programme Committee	
Dr. T. Duraivel Professor, Department of Mathematics Pondicherry University, Pondicherry 0413-2654397	Member, VC Nominee by Pondicherry University	
Dr. P.Manoharan Associate Professor, Dept. of Mathematics Annamalai University, Annamalai Nagar 608002 9994545666,	Member Expert Nominated by AC	
Dr. V.Seenivasan Associate Professor, HOD Department of Science and Humanities University College of Engineering Panruti, 9952486979	Member Expert Nominated by AC	
Mr. Suresh Poobathy Assistant Professor of Mathematics, Pondicherry University Community College, Pondicherry University, Puducherry 605008 9994655605	Member Meritorious Alumnus	
Mr.Sathya Sekar Mgr., Poclain Hydraulics Pvt. Limited, Puducherry 8270048193	Member Industry/Placement Representative	

Date: 10/08/2022

RESOLUTIONS OF BOS-MATHEMATICS (2022-2023) (ONLINE)

The chairman introduced the members and explained about the syllabus of the CBCS system of curriculum. He distributed the schemes and drafted syllabi for semesters I, II, III, IV of M.Sc. Mathematics. The syllabi of all the papers were discussed and after the deliberations, consensus was arrived and resolved the following recommendations:

RECOMMENDATIONS

M.Sc. Mathematics

a) It was decided not to change any of the existing 12 hardcore papers.
b) The BOS proposed to introduce the following additional soft core paper along with existing soft core papers.
    1. **Combinatorial Mathematics**
    2. **Mathematical Modelling**
c) As the XI BOS was conducted very recently i.e. 23/11/2022 (Covid-19), the members of the board felt it was not necessary to make any changes in the curriculum and the same can be continued.

Also

1. The above change of syllabi which has been recommended by the BOS may be passed by Academic council and this structure is to come into effect from the first semester of 2022-2024 batch as recommended above.

2. The board also recommends continuing with the existing question pattern followed as per the XI BOS Meeting for M.Sc. Mathematics.

3. All other recommendations and resolutions passed in XI BOS Meeting are to be continued.

4. Authorise the chairman to suggest the panel of paper setters and Examiners for valuation.

5. The members were apprised that the students have taken up the internship program in various schools after the covid pandemic

6. The omissions and corrections suggested in the XII BOS-Mathematics meeting, held on 10/08/2022, were unanimously accepted and attested by the Members of BOS.

7. The members have expressed that the shortage of faculty may be brought to the notice of the higher ups.

8. The overall changes in the syllabus are around 10%.

Date: 10/09/2022

RESOLUTIONS OF BOS-MATHEMATICS (2022-2023)

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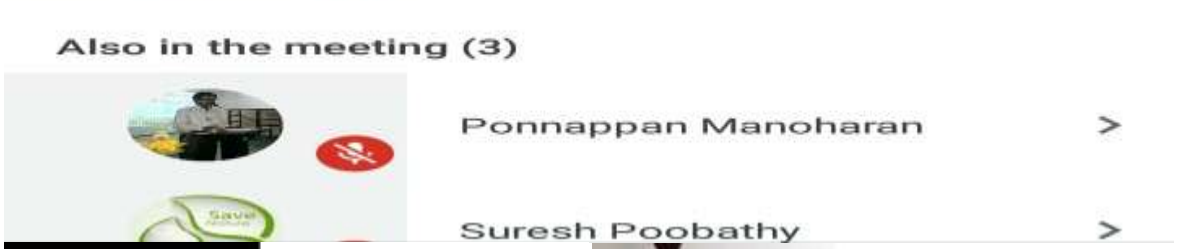
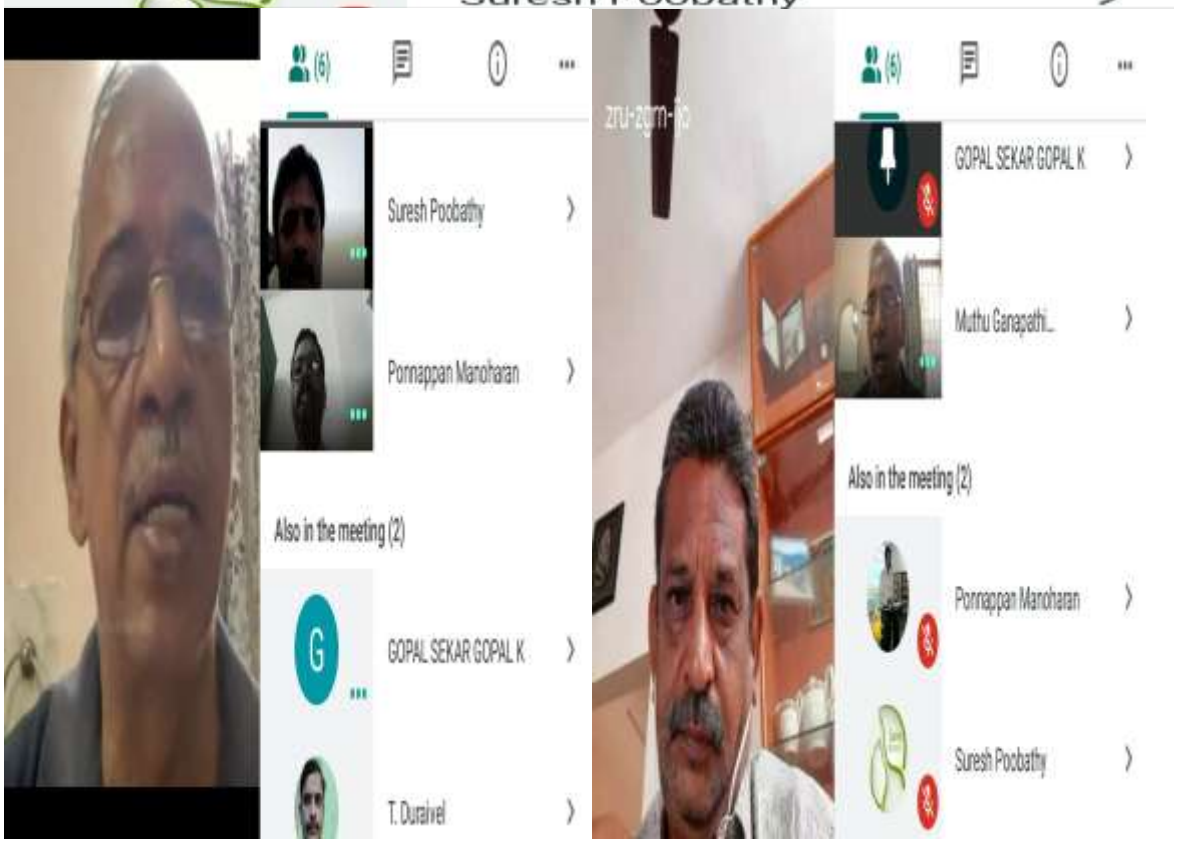




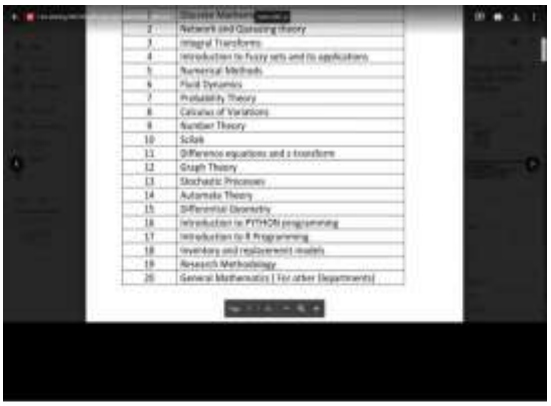
(6)

indhu poobathy (You)

GOPAL SEKAR GOPAL K

T. Duraivel

Suresh Poobathy



1	Network and Queueing theory
2	Integral Transforms
3	Introduction to fuzzy sets and its applications
4	Numerical Methods
5	Fluid Dynamics
6	Probability Theory
7	Calculus of Variations
8	Number Theory
9	Scilab
10	Difference equations and z transform
11	Graph Theory
12	Stochastic Processes
13	Automata Theory
14	Differential Geometry
15	Introduction to PYTHON programming
16	Introduction to R Programming
17	Inventory and replacement models
18	Research Methodology
19	General Mathematics (For other Departments)

(8)

Ponnappan Manoharan

GOPAL SEKAR GOPAL K

Also in the meeting (4)

Dr.Seenivasan V

(6)

indhu poobathy (You)

Suresh Poobathy

Ponnappan Manoharan

GOPAL SEKAR GOPAL K

(8)

indhu poobathy (You)

Muthu Ganapathi...

Muthu Ganapathi...

Dr.Seenivasan V

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Puducherry 605 008

Department of Mathematics

M.Sc. MATHEMATICS (CBCS)

SEM	CODE	TITLE OF THE PAPER	CREDIT	THEORY HOURS	SEMINAR / Assignment/ Test	TUTORIAL/ CSIR-NET COACHING
I	MAHT-101	Real analysis	4	4	1+1	2 hours per week
	MAHT-102	Linear Algebra	4	4	1+1	
	MAHT-103	Ordinary Differential Equations	4	4	1+1	
	MASC-104	Soft core – I offered by the Dept.	3	3	1+1	
	MASC-105	Soft core – II offered by the Dept.	3	3	1+1	
II	MAHT-206	Advanced algebra	4	4	1+1	2 hours per week
	MAHT-207	Complex Analysis	4	4	1+1	
	MAHT-208	Statistical Inference	4	4	1+1	
	MASC-209	Soft core – III offered by the Dept.	3	3	1+1	
	MASC-210	Soft core – IV offered by the other Dept.	3	3	1+1	
III	MATH-INT	INTERNSHIP/MINI PROJECT	3	-	-	2 WEEKS
	MAHT-311	Topology	4	4	1+1	2 hours per week
	MAHT-312	Partial Differential Equations	4	4	1+1	
	MAHT-313	Classical Dynamics	4	4	1+1	
	MASC-314	Soft core – V offered by the Dept.	3	3	1+1	
	MASC-315	Soft core - VI offered by the Dept.	3	3	1+1	
IV	MAHT-416	Measure theory	4	4	1+1	2 hours per week
	MAHT-417	Functional Analysis	4	4	1+1	
	MAHT-418	Operations Research	4	4	1+1	
	MASC-419	Soft core – VII offered by the Dept.	3	3	1+1	
	MASC-420	Soft core – VIII offered by the Dept.	3	3	1+1	

Credits for 12 Hard core papers = 12*4 = 48 credits
Credits for 8 soft core papers = 8 * 3 = 24 credits
Internship/mini Project = 3 credits
Total Credits = 75

LIST OF HARDCORE PAPERS

SLNO	SUBJECT CODE	TITLE OF THE PAPER
1	MAHT101	Real analysis
2	MAHT102	Linear Algebra
3	MAHT103	Ordinary Differential Equations
4	MAHT206	Advanced Algebra
5	MAHT207	Complex Analysis
6	MAHT208	Statistical Inference
7	MAHT311	Topology
8	MAHT312	Partial Differential Equations
9	MAHT313	Classical Dynamics
10	MAHT416	Measure theory
11	MAHT417	Functional Analysis
12	MAHT418	Operations Research

LIST OF SOFT CORE PAPERS

SLNO	TITLE OF THE PAPER
1	Discrete Mathematics
2	Network and Queueing theory
3	Integral Transforms
4	Introduction to Fuzzy sets and its applications
5	Numerical Methods
6	Fluid Dynamics
7	Probability Theory
8	Calculus of Variations
9	Number Theory
10	Scilab
11	Difference equations and z-transform
12	Graph Theory
13	Stochastic Processes
14	Automata Theory
15	Differential Geometry
16	Introduction to PYTHON programming
17	Introduction to R Programming
18	Inventory and replacement models
19	Combinatorial Mathematics
20	Mathematical Modeling
21	Research Methodology
22	General Mathematics (For other departments)

QUESTION PATTERN FOR M.SC MATHEMATICS

Each paper will have 100 marks with CIA (40 marks) and End semester examination (60 marks)

CIA

The CIA component of 40 marks shall have the following split-up

Best 2 tests out of 3 tests	15 marks
Mid-Semester examination	15 marks
Seminar/Assignment	10 Marks

External examination

Question Paper Pattern

Part A consists of 10 questions and each question carries 1 mark

Choose not less than two questions from each unit. (10 x1=10)

Part B consists of 5 Questions of internal choice type (5 X 4=20)

Choose questions compulsorily from each unit.

Part C consists of 5 questions and answers any three (3X10=30).

Choose five questions from four units. Do not omit any unit.

INTERNSHIP/MINI PROJECT

a) Report submission and evaluation	**60 marks**
b) Viva – voce examination	**40 marks**
	Total : 100 marks

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DEPARTMENT OF MATHEMATICS
M.Sc. MATHEMATICS (CBCS)
(From 2022-23 Batch Onwards)

SCHEME OF EXAMINATIONS

SEM	CODE	TITLE OF THE PAPER	Duration of the examination	Marks		
			Hours	IA	UM	TOTAL
I	MAHT-101	Real analysis	3	40	60	100
	MAHT-102	Linear Algebra	3	40	60	100
	MAHT-103	Ordinary Differential	3	40	60	100
	MASC-104	Soft core – I offered by the Dept.	3	40	60	100
	MASC-105	Soft core – II offered by Dept.	3	40	60	100
II	MAHT-206	Advanced algebra	3	40	60	100
	MAHT-207	Complex Analysis	3	40	60	100
	MAHT-208	Statistical Inference	3	40	60	100
	MASC-209	Soft core – III offered by the Dept.	3	40	60	100
	MASC-210	Soft core – IV offered by other Dept.	3	40	60	100
III	MATH-INT	INTERNSHIP/MINI PROJECT	Report submission and evaluation 60 External Viva-voce 40			100
	MAHT-311	Topology	3	40	60	100
	MAHT-312	Partial Differential Equations	3	40	60	100
	MAHT-313	Classical Dynamics	3	40	60	100
	MASC-314	Soft core – V offered by the Dept.	3	40	60	100
	MASC-315	Soft core - VI offered by the Dept.	3	40	60	100
IV	MAHT-416	Measure theory	3	40	60	100
	MAHT-417	Functional Analysis	3	40	60	100
	MAHT-418	Operations Research	3	40	60	100
	MASC-419	Soft core – VII offered by the Dept.	3	40	60	100
	MASC-420	Soft core – VIII offered by the Dept.	3	40	60	100

PROGRAM OUTCOME (PO): Master of Science

Programme outcomes describe what students are expected to know or be able to do by the time of Post graduation. On completion of M.Sc. Mathematics programme student will be able to:

PO 1: mastery in the discipline

PO 2: Ability to solve issues

PO 3: Ability to work in any environment and show leadership quality

PO 4: To develop critical thinking towards the deep understanding of the Principle of science and Mathematics and apply them in various real time situations

PO 5: Ability to organise presentation in logical and feasible manner

PO 6: Identify themselves as agents of change

PO 7: To develop interdisciplinary approach amongst students

PO 8: Make them to part in building our nation

PO 9: To develop innovative thinking

PO 10: Make them to stand in own leg

PO 11: To develop Numerical skill

PO 12: To inculcate sense of scientific responsibilities and social & environment awareness

PO 13: To help student build-up a progressive and successful career in academics and industry

PO 14: To increase self confidence

PO 15: Demonstrate the ability to conduct research independently and pursue higher studies towards Ph.D. degree

PROGRAM SPECIFIC OUTCOME (M.Sc. Mathematics)

PSO 1: Students will acquire a comprehensive knowledge, sound understanding and deep learning of fundamentals of Mathematics.

PSO 2: Numerical, analytical and logical skills will be developed

PSO 3: They are in a position to identify the social issues and provide solutions through their mathematical skill.

PSO 4: They are good enough to use software and provide mathematical solutions to IT industries

PSO 5: They become a source of inspiration for young community

PSO 6: Teaching quality will be improved and become a good teacher for society

PSO 7: Due to their aptitude and logical skill, they will become Scientist, Bank officer, good personal in Government sector etc.

The Department of Mathematics provides the following 12 Hard core courses and 8 soft core courses from a list of soft core papers. The **OBJECTIVES** of each paper are listed below

SLNO	TITLE OF THE PAPER	OBJECTIVES
1	Real analysis	The objective is to make decision making and developing logical thinking
2	Linear Algebra	The objective is to create Skelton of real time models
3	Ordinary Differential Equations	The objective is to make convert real time model into mathematical models in terms of differential equations
4	Advanced Algebra	The objective is to create Skelton of real time models
5	Complex Analysis	The objective is to make decision making and developing logical thinking
6	Statistical Inference	The objective is to analyse statistical data and provide decision making to industries, Stock market etc.,
7	Topology	The objective is to make decision making and developing logical thinking
8	Partial Differential Equations	The objective is to make convert real time model into mathematical models in terms of partial differential equations
9	Classical Dynamics	The objective is to make convert real time model into mathematical models in terms of differential equations
10	Measure theory	The objective is to make decision making and developing logical thinking

SLNO	TITLE OF THE PAPER	OBJECTIVES
11	Functional Analysis	The objective is to make decision making and developing logical thinking
12	Operations Research	The objective is to develop the cost minimization and profit maximization models for industries
13	Discrete Mathematics	The objective is to help to design logical gates and algorithm construction in data structures
14	Network and Queuing theory	The objective is to develop network models , hospital management, traffic control , Queue in ATM management etc.,
15	Integral Transforms	The objective is learn various transforms and applications
16	Introduction to Fuzzy sets and its applications	The objective is to learn Fuzzy environment
17	Numerical Methods	The objective is to create numerical ability and solve real time problems
18	Fluid Dynamics	The objective is to make convert real time model into mathematical models in terms of differential equations
19	Probability Theory	The objective is to make convert real time model into probabilistic models
20	Calculus of Variations	The objective is to make convert real time model into mathematical models in terms of differential equations

SLNO	TITLE OF THE PAPER	OBJECTIVES
21	Number Theory	The objective is to understand various number systems and apply in security analysis in IT fields
22	Scilab	The objective is to learn program coding
23	Difference equations and z-transform	The objective is to make convert real time model into mathematical models in terms of differential equations
24	Graph Theory	The objective is solve to real life problems using graphs
25	Stochastic Processes	The objective is to develop queuing model, reliability model etc.,
26	Automata Theory	The objective is to understand the Machine code
27	Differential Geometry	The objective is to various high level applications
28	Introduction to PYTHON programming	The objective is to learn coding and to become data Analytics
29	Introduction to R Programming	The objective is to learn coding and to become data Analytics
30	Inventory and replacement models	The objective is to make decision making in inventory departments in industries
31	Combinatorial Mathematics	The objective is to understand the generating functions and its applications
32	Mathematical Modelling	The objective is to establish link between the real time and mathematical model
33	Research Methodology	The objective is to develop research among students.
34	General Mathematics (For other Departments)	The objective is to develop quantitative aptitude and help students from other departments in competitive examinations

The Department of Mathematics provides the following 12 Hard core courses and 8 soft core courses from a list of soft core papers. The Course outcomes of each paper are listed below

COURSE OUTCOMES OF HARDCORE COURSES

SLNO	NAME OF THE COURSE	COURSE OUTCOMES
1	Real analysis (Life Skill paper)	**CO 1: Know about limit of a function and continuity** **CO 2:Able to identify continuity in real models** **CO 3:Know about R-S integral** **CO 4:They can find area of any irregular shapes using Riemann integral** **CO 5:Due to Abstract nature of this paper, they can take very effective decision in real life situations**
2	Linear Algebra (Life Skill Paper)	**CO 1: Study about vector spaces and linear transformations** **CO 2:They can apply these concepts in geometrical applications model** **CO 3: They can derive theorems and find applications in various fields** **CO 4: Due to Abstract nature of this paper, they can take very effective decision in real life situations** **CO 5:They can analysis Big data model using these concepts**
3	Ordinary Differential Equations	**CO 1: To know about various types of Differential equations** **CO 2: Able to solve Bessel's equations** **CO 3: Able to solve real time models in Queuing problems** **CO 4: convert real situations in terms of differential equations and provide mathematical solutions** **CO 5:Able to solve initial value problems**
4	Advanced algebra	**CO 1: Study about field extensions** **CO 2: To identify splitting field** **CO 3: Able to prove four square theorem** **CO 4: Able to prove** Wedderburn's theorem on division rings **in efficient manner** **CO 5:Able to find applications in real life**

5	Complex Analysis	**CO 1: learn about harmonic functions and conformal mapping** **CO 2:Able to derive Weierstrass theorem for infinite product** **CO 3:Deeping learning of Hadamard's theorem.** **CO 4: know about Jensen's formula** **CO 5: To find out solutions for real time model using complex analysis**
6	Statistical Inference (Skill developed paper)	**CO 1: To study about various distribution** **CO 2: To make decision on the basis of tools used in statistics** **CO 3: Able to work statistical survey** **CO 4: Learn about estimation theory** **CO 5: Able to define statistical hypothesis for various real time models**
7	Topology	**CO 1: Understand the basic concepts of metric spaces, open sets, closed sets and continuous functions on metric spaces.** **CO 2: The student will be able to define and illustrate the concept of topology and prove theorems concerning Topological spaces, continuous functions and product topologies** **CO 3: The student will be able to define and illustrate the concepts of the separation axioms** **CO 4: Able to derive Urysohn's lemma, Urysohn imbedding theorem** **CO 5:The student able to work on Topography of real situations**
8	Partial Differential Equations	**CO 1: Able to classify various types of PDE** **CO 2: To work on Neumann problem and Dirichlet problem** **CO 3: To learn about effective use of Green's function** **CO 4: Able to apply Greens function for diffusion equation.** **CO 5: Able to identify PDE in real time models like analysis of steady state temperature**
9	Classical Dynamics	**CO 1: know about Holonomic, Non-Holonomic and unilateral constraints** **CO 2: Able to understand Principle of Virtual Work and D'Alembert's principle and Konig's theorem .** **CO 3: able to explained the Kepler Problem and Routhian Function.** **CO 4: The effective usage of Legendre transformation.** **CO 5: Able to find applications in physics**

10	Measure theory	**CO 1: Learn about Lebesgue outer measure of any subset of R** **CO 2: Able to construct various measurable sets** **CO 3: Know about applications of measurable functions** **CO 4: Construction of Lebesgue set** **CO 5: Able to differentiate R-S and Lebesgue integration**
11	Functional Analysis	**CO 1: Understanding of Banach Space** **CO 2: Able derive the Schwartz inequality and Bessel's inequality** **CO 3:Able to handled various operators** **CO 4: Applications of Eigen values and Eigen vectors in Spectral theory** **CO 5: know about applications in real field**
12	Operations Research	**CO 1: Able to identify management problems and provide solutions.** **CO 2: Able to solve LPP through graphical and Simplex method** **CO 3:Able to apply Transportations problems in real time situations** **CO 4: Decision making in game theory problems** **CO 5: Know about branch and bound techniques**

COURSE OUTCOMES OF SOFTCORE COURSES

SLNO	NAME OF THE COURSE	COURSE OUTCOMES
1	Discrete Mathematics	**CO 1: Know about Set, Relation and Functions** **CO 2:Able to Construct Hasse diagram** **CO 3:Able derive theorems related to Lattice** **CO 4:Know about Boolean Algebra** **CO 5:Able to find out applications in the field of Computer Science**
2	Network and Queueing theory	**CO 1: Construction of Project network for Management problems and provide solutions through CPM and PERT** **CO 2:Know about various time estimates and their relations** **CO 3: Able to identify Queueing models in Banking, Tele communications etc.,** **CO 4: Able to derive system measures for any queueing model** **CO 5:know about analysis of Multi server models**
3	Integral Transforms	**CO 1: To know about Fourier transform and its applications** **CO 2: Able to solve ODE using Laplace transform techniques** **CO 3: Able to understand the concept melline transform** **CO 4: Solving real model using Hankel transform** **CO 5:Able to apply in various fields**
4	Introduction to Fuzzy sets and its applications	**CO 1: know the concept of fuzzy** **CO 2: To identify fuzzy environment in real time and find out suitable fuzzy functions.** **CO 3: Able to solve queueing model using fuzzy** **CO 4: know the applications of fuzzy control system** **CO 5:Identify fuzzy model in real life and provide suitable solutions**
5	Numerical Methods	**CO 1: Able solve any simultaneous equations using various methods** **CO 2:Able to solve algebraic equations by Newton Raphson methods** **CO3:Converting real time problems in terms of equations and provide solutions** **CO 4: Able to class PDE and provide solutions** **CO 5: Compute Numerical solution to any real time problems using existing methods**

6	Fluid Dynamics	**CO 1: To study about equation of continuity** **CO 2: Able to analyse two dimensional flowcs** **CO 3: basic concepts of** Sources, Sinks and Doublets **CO 4: Learn about** Schwarz- Christoffel Transformation **CO 5: Able to find the application in Physics**
7	Probability Theory	**CO 1: Understand the basic concepts of probability, probability distributions and its properties .** **CO 2: The student will be able to derive various properties of discrete and continuous distributions** **CO 3: know about normal distribution and its applications** **CO 4: Able to correlate distributions with real time model** **CO 5:Able to provide solutions for uncertain model through probabilities**
8	Calculus of Variations	**CO 1: Study of variational problems** **CO 2: Able to work on** Rayliegh Ritz method and Galerkin method **CO 3: Abe to derive the** Relation between Integral and Differential Equations **CO 4: Able to apply Greens function for diffusion equation.** **CO 5: Able to solve** Fredholm Equations with separable kernels
9	Number Theory	**CO 1: know about Divisibility and prime numbers** **CO 2: Able to understand Chinese reminder theorem.** **CO 3: Able to explained the Jacobi Symbol.** **CO 4: Jacobi symbol and its applications.** **CO 5: Able to find applications of Mobious transformations in physics**
10	Scilab	**CO 1: Learn about basic syntax of various commands** **CO 2: Able to write program for solving numerical methods problems** **CO 3: Know about matrix operations through scilab** **CO 4: Able to write coding for find solution of queueing problems** **CO 5: well versed in coding for any type of mathematical problems**

11	Difference equations and z-transform	**CO 1: Understanding of finite difference operators** **CO 2: Able solve nth order difference equations** **CO 3:know the method of solving simultaneous difference equations** **CO 4: learn about z-transform** **CO 5: Able to apply Z- transform to solve integral equations**
12	Graph Theory	**CO 1: Know about various Puzzles and provide solution through Graph theory.** **CO 2: Able to analyse Konigsberg bridge problem** **CO 3:apply concept of tree in data structure** **CO 4: Study various real time problems through graph theory** **CO 5: Know about Berge theorem and proof**
13	Stochastic Processes	**CO 1: understanding of classification of stochastic processes** **CO 2: Able to construct TPM for Markov chain** **CO 3: Provide Stationary distribution solution to Markov chain** **CO 4: Solving Queueing problems.** **CO 5: Application in various fields**
14	Automata Theory	**CO 1: Learn about Grammar and languages** **CO 2: Able to construct Finite state machine** **CO 3: Know about applications of DFSM and NDFSM** **CO 4: Apply in the field of computer Science** **CO 5: Able to differentiate CFL,CSL and RL**
15	Differential Geometry	**CO 1: Learn about various level sets** **CO 2: Gauss map and its applications** **CO 3: Know about applications of curvature of plane curves** **CO 4: Know about curvature of surfaces** **CO 5: Learned various applications in physics**
16	Introduction to R programming	**CO 1: Learn about creating vectors, matrices** **CO 2: To learn various conditional statements** **CO 3: generate tables, bar diagram** **CO 4: use R in statistical testing** **CO 5: one and two sample test**
17	Introduction to PYTHON Programming	**CO 1: Learn about declaration of objects** **CO 2: To understand strings** **CO 3: to define classes** **CO 4: listing functions** **CO 5: Testing files**

18	Inventory and Replacement Models	**CO 1: Learn about Inventory** **CO 2: To understand Various inventory models** **CO 3: Learn about Replacement models** **CO 4: To understand various inventory model** **CO 5: discuss various real time problems**
19	Combinatorial Mathematics	**CO 1: Learn about recurrence relation** **CO 2: Construction of generating function** **CO 3: To study Polya theory** **CO 4: To study permutation and cobination**
20	Mathematical Modelling	**CO 1: To analysis linear growth and decay problems** **CO 2: Analysis of epidemics through ODE** **CO 3: To study motion of satellites** **CO 4: To study genetics through DE**
21	Research Methodology	**CO 1: Study various research methods** **CO 2: Research and scientific methods** **CO 3:To know about review process** **CO 4: To know about IT tools**
22	General Mathematics	**CO 1: To study percentage, profit and loss** **CO 2: To study number system** **CO 3: Time and distance** **CO 4: to develop skill for aptitude test**

MAHT-101: REAL ANALYSIS

Unit I : Continuity

Limits of Functions-Continuous Functions- Continuity and compactness-continuity and connectedness – Discontinuities- Monotonic functions.

Unit II : The Riemann Stieltjes Integral

Definition and existence of the integral- properties of the integral – Integration and Differentiation – Integration of vector valued functions.

Unit III : Sequences and Series of functions

Discussion of main problem – Uniform convergence – uniform convergence and continuity - uniform convergence and Integration - uniform convergence and Differentiation.

UNIT IV :Functions of several variables

Differentiation – Contraction principle – inverse Function theorem – Implicit Function theorem.

TEXT BOOK

Treatment as in Principles of Mathematical Analysis by Walter Rudin.

SECTIONS

4.1 - 4.6, 6.1- 6.4, 7.1-7.5, 9.2-9.5.

REFERENCE BOOKS

1. Walter Rudin –Real and Complex Analysis– Mc-Graw Hill International Edition, III edition.
2. Charles Chapman Pugh – Real Mathematical Analysis – Spinger.
3. Patrick M. Fitz Patrick – Advanced Calculus – AMS Pine and Applied undergraduate text – Indian edition,2006.
4. N.L Carothers – Real Analysis – Cambridge University Press.
5. Tom M Apostal -Treatment as in Mathematical Analysis

MAHT-102: LINEAR ALGEBRA

Unit I :Algebra of linear transformation

Algebra of linear transformation – regular and singular linear transformation – Range of a Linear Transformation - rank of a linear transformation -Idempotent - – nilpotent - characteristic roots and characteristic vectors of a linear transformation.

Unit II :Canonical Forms

Matrix of a linear transformation – Canonical form – Similar linear transformations – invariant under linear transformation - Triangular form - Nilpotent transformation – index of nilpotence – cyclic with respect to linear transformation

Unit III: Types of linear transformation

Trace and Transpose of a matrix and linear transformation- Transpose of matrix – symmetric matrix – skew- symmetric matrix – adjoint – Hermitian – skew- Hermitian - Theory of determinants – Cramer's rule

Unit IV: Special linear transformation

Hermitian, Unitary and Normal transformations – real quadratic form

TEXT BOOK

Topics in Algebra byI.N.Herstein , Second Edition Wiley Eastern Ltd.

SECTIONS : 6.1 – 6.5, 6.8-6.11.

REFERENCE BOOKS

1. Michael Artin – Agebra – Prentice Hall of India Pvt. Ltd – Edn. 1991.
2. A Ramachandra Rao and P. Bhimasankaran – Linear Algebra – Tata McGraw Hill publishing company Ltd, New Delhi – Edn 1992.
3. Klaus Janich – Linear Algebra – Springer International Edition – Edn. 1994.
4. Gilbert Strang – Linear Algebra and its applications – Cenjage Learning India Pvt. Ltd. – Edn 2006.
5. SiymourLipschutz and Marc Lipson – Linear Algebra - Tata MC Graw Hill Education Private Ltd. – Edn 2001.
6. Kenneth Hoffman and Ray Hunze – Linear Algebra – Prentice Hall of India – II edition – 2002.

MAHT-103: ORDINARY DIFFERENTIAL EQUATIONS

Unit I : Boundary Value problems

Boundary Value problems and Characteristic function Representations – Initial Value and Boundary Value Problem – Sturm-Liouville Problem. Orthonormal Function – Proper Sturm-Liouville Problems and properties - Characteristic numbers – Orthogonality of Characteristic functions – Expansion of arbitrary functions in a series of orthogonal functions.

Unit II : Power Series Solution

Series solution of first order equations – Second order linear equations – Ordinary points – Regular singular points – Gauss's Hyper-geometric equation.

Unit III : Legendre and Bessel

Legendre polynomials – Properties of Legendre polynomials – Bessel functions – Properties of Bessel's function .

Unit IV : System of First order equations and Non-linear equations

Linear system-homogenous linear systems with constant coefficients - Autonomous systems – The phase plane and its phenomena – Types of critical points – Stability – Critical points and stability for linear systems.

TEXT BOOK

1. **Francis B.Hilderbrand – Advanced calculus for applications – Prentice Hall Inc – Edn 1962**
2. **George F. Simmons - Differential equations with application and historical notes – Mc Graw Hill International edition - Second edition.**

SECTIONS

5.1, 5.6 & 5.7 (Text book 1) &7.43

5.27 – 5.31, 8.44 – 8.47, 10.54-10.56, 11.58 – 11.60(Text book 2)

REFRENCE BOOKS

1. Richard Bronson – Differential Equations – Schaum's outline series – Mc-Graw Hill International edition - Second edition.
2. Purna Chandra Binual – Ordinary Differential Equation - Prentice Hall India learning Pvt. Ltd. – Edn 2008.

MAHT- 206: ADVANCED ALGEBRA

Unit-I : Sylow's Theorems and Polynomial Rings

The class equation of a finite groups – First Sylow theorem(only first proof) – Second part of Sylow theorem – Third part of Sylow theorem -Direct products - Polynomial rings- Polynomials over the rational field – Polynomial rings over Commutative rings.

Unit-II : Field Extension

Extensions fields – Finite extension – Algebraic extension - Roots of polynomial – More about roots – Simple extension - Separable extension – Perfect field

Unit-III : Elements of Galois Theory

Fixed fields – Normal extensions – Galois group - Fundamental theorem of Galois theory.

Unit-IV : Solvability by Radicals

Solvable groups - Solvability by radicals – Not solvable of the general equation of degree more than 5 - Finite fields

Text Book

Topics in Algebra by I. N. Herstein , Wiley Eastern Ltd., New Delhi, 1975.

Sections – 2.11, 2.12 and 2.13

Sections – 3.9, 3.10 and 3.11

Sections – 5.1, 5.3 and 5.5

Sections - 5.6, 5.7 and 7.1

Reference Books

1. M.Artin, Algebra, Prentice-Hall of India, 1991.
2. N.Jacobson, Basic Algebra, Volumes I & II, W.H.Freeman, 1980.
3. S.Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
4. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra (2nd Edition) Cambridge University Press, Indian edition, 1997.

MAHT-207: COMPLEX ANALYSIS

Unit I : Conformality and Linear transformation

Area and closed curves-analytic functions in regions-conformal mapping-length and area- linear group- cross ratio- symmetry- oriented circles-families of circles
Harmonic Functions: Definition and Basic Properties – The Mean Value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle.

Unit 2 :Harmonic Functions

Definition and Basic Properties – The Mean Value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle.

Unit – 3 : Infinite Products

Infinite products – Convergence of infinite products – A necessary and sufficient condition for the absolute convergence of the product $\prod_1^{\infty}(1+a_n)$ - Canonical products – Weierstrass theorem for infinite product – The Gamma functions – Legendre's duplication formula – Entire functions – Jensen's formula – The Genus and order of an entire functions – Hadamard's theorem.

Unit – 4 :Weierstrass theory

Simple periodic function – doubly periodic function-The Weierstrass theory – The Weierstrass p-function – The function $\zeta(z)$ and σ(z) – Legendre's relation – The Laurent expansion of $\zeta(z)$ - The first order differential equation for p(z).

TEXT BOOK:

Complex Analysis by Lars V. Ahlfors , McGraw Hill Company , Third edition

SECTIONS:

Chapter 3: sections 2.1 – 2.4, 3.1-3.5
Chapter 4: sections 6.1-6.5
Chapter 5: sections 2.1-2.5,3.1-3.2
Chapter 7: sections 1.1-1.3,2.1-2.4,3.1-3.3

REFERENCE BOOK:

1. John B Conway – Functions of one complex variable – Springer International student edition (II edition).
2. Ponnusamy – Foundations of Complex Analysis – Narosa Publications,1995.
3. Ponnusamy and Silverman- Complex Variable with application-Narosa

MAHT- 208 STATISTICAL INFERENCE

Unit 1: Sampling distribution

Introduction – The distribution of the mean – The distribution of the mean finite population – The chi square distribution – The t-distribution – The F-distribution.

Unit 2: **Estimation theory**

Introduction – Unbiased estimators – Cramer-rao inequality – Efficiency – Consistency- Sufficiency – Neyman factorization theorem – The method of moments – The method of maximum likelihood.

Unit 3: **Estimation application**

Introduction – Estimation of means – Estimation of difference between means – Estimation of proportions – Estimation of difference between proportions – Estimation of variances – Estimation of ratio of two variances.

Unit 4: Statistical hypothesis

Statistical hypothesis - Testing a statistical hypothesis - Test concerning means - Test concerning difference between means - Test concerning Variances - Test concerning proportions - Test concerning differences among k proportions - The analysis of r × c table - Goodness of fit.

Text book

Irwin Miller, Marylen Miller – John E. Freund's. Mathematical Statistics with applications – 6thedition , Prentice hall.

Sections: 8.1-8.6, 10.1-10.5, 10.7 & 10.8, 11.1-11.7, 12.1, 12.2, 13.1 -13.8

Reference books:

1. V.K. Rohatgi - An introduction to probability theory and mathematical statistics - Wiley Eastern Limited, 1988.

2. S.C. Gupta and V.K. Kapoor - Fundamentals of mathematical statistics - Sultan chand and sons, 2003.

3. Paul G. Hoel - Introduction to mathematical statistics - 5th edition - John wiley and sons, 1984.

4. Sheldon M. Ross - Introduction to probability and statistics for engineers and scientists - 3rd edition - Academic press, 2005

MATH-INT : INTERNSHIP/MINI PROJECT

All students will have to undergo atleast two weeks Internship (during semester vacation between second and third semester) in teaching of Mathematics at the school level which has to be duly certified by the Head of the institution and a report should be submitted.

(or)

The student will have to submit a mini project.

MAHT – 311: TOPOLOGY

Unit 1 : Topological Spaces

Elementary concepts – Open bases and open sub bases – Separability – Second countability – Lindelof's theorem – Characterization of continuous mappings by basic open set and sub basic open sets – Characterization of open mappings by basic open sets – Weak topologies – Weak topology generated by continuous mappings.

Unit 2 : Compactness

Basic results of compactness – Characterization of compactness by basic and sub basic open covers – The Heine Borel theorem – Products of spaces – Tychonoff's theorem – locally compact space- compactness for metric spaces – Ascoli's theorem

Unit 3 :Separation

T_1 spaces and Hausdorff spaces – Completely regular spaces and normal spaces – Uryshon's lemma and Tietze extension theorem – The Urysohn imbedding theorem- Stone's-cech compactification

Unit 4 : Approximation

Weierstrass approximation theorem-Stone Weierstrass theorem-Locally compact Hausdorrf space- Extended Stone Weierstrass theorem

TEXT BOOK

Treatments as in "An Introduction to Topology and Modern Analysis" by G.F.Simmons:", Tata Mc- Graw Hill publishing company limited – Edition 2004

SECTIONS:

17-19, 21-30, 35-38.

REFERENCE BOOKS:

1. J.R.Munkers: Topology, Pearson Education Inc., Second Edition, 2000.
2. J.Dugundgi: Topology, Allyn and Bacon, Boston, 1996.
3. C. Wayne patty - Foundations of Topology - Jones and Bartlett - Student edition - 2nd edition,2010.
4. K.P. Gupta - Topology - Pragati edition,19th edition, 2010.

MAHT- 312 : PARTIAL DIFFERENTIAL EQUATIONS

Unit 1 : Classification of PDE

Introduction – Classification of second order PDE – Canonical forms for Hyperbolic, Parabolic and Elliptic equation – Adjoint operator – Riemann's method.

Unit 2 : Elliptic Equation

Derivation of Laplace and Poisson equations- BVP-Some important mathematical tools - Properties of Harmonic functions – Separation of variables – Dirichlet problem for a rectangle – Neumann problem for a rectangle – Interior Dirichlet problem for a circle – Exterior Dirichlet problem for a circle – Interior Neumann problem for circle.

Unit 3 : Parabolic and Hyperbolic equations

Boundary conditions-Elementary solutions of the Diffusion equation – Separation of variables method – Solution of one dimensional wave equation by canonical reduction – The initial value problem and D'Alembrt's solution – Vibrating string – Variables separable solution.

Unit 4 : Green's functions

Green's function – Introduction – Greens function for Laplace equation – The method of images – Greens function for wave equation – Helmholtz theorem – Greens function for diffusion equation.

TEXT BOOK

K.Sankararao – Introduction to Partial Differential Equations, 2nd edition– Prentice Hall of India Pvt. ltd., 2009.

SECTIONS:

1.1-1.5, 2.1-2.10, 3.2,3.3,3.5, 4.3(except example 4.3), 4.4, 4.5, 5.1-5.3, 5.5 and 5.6

REFERENCE BOOKS:

1. Ian N. Sneddon – Elements of Partial Differential Equations – Mc graw hill International edition 1984.

2. T. Amarnath – An elementary course in PDE – Narosa publishing house, 2009.

3. F. John – Partial Differential Equations – Springer 1982.

4. L.C. Evans – Partial Differential Equations – American Mathematical Society providence 1998.

MAHT-313: CLASSICAL DYNAMICS

Unit I : Introductory concepts

The Mechanical System – Equations of Motion - Generalized Coordinates – Configuration – Holonomic, Non-Holonomic and unilateral constraints - Principle of Virtual Work – D'Alembert's principle - Energy and Momentum – conservation of energy – Konig's theorem .

Unit II : Lagrange's Equations

Derivation of Lagrange's Equations – Examples (Spherical Pendulum, Double Pendulum, Lagrange's Multiplier method to solve for the interaction force between the blocks of masses m_1 & m_2) – Integrals of Motion – Ignorable Coordinates – Example – The Kepler Problem – Routhian Function.

Unit III : Hamilton's Equation

Stationary values of a function – Brachistochrone problem – Geodesic problem - Hamilton's Principle – Hamilton's canonical Equations – forms of Hamilton functions Legendre transformation.

Unit IV :Canonical Transformation

Canonical transformation - Examples – Principal forms of Generating Functions – examples – Special transformations – Homogeneous canonical transformations - Lagrange and Poisson Brackets.

TEXT BOOK

Classical Dynamics by Donald T.Greenwood, Prentice Hall of India Private limited New Delhi 1977.

SECTIONS

Chapter 1: Sec 1.1 to 1.5
Chapter 2: Sec 2.1 to 2.3
Chapter 4: Sec 4.1 to 4.2
Chapter 6: Sec 6.1 to 6.3

REFERENCE BOOKS

1. Herbert Goldstein - Classical Mechanics - Narosa Publishing House, New Delhi 1998.
2. Bhatia V.B - Classical Mechanics - Narosa Publishing House, New Delhi 1997, I Edition.
3. Sankara Rao K.- Classical Mechanics – Prentice hall of India Pvt. Ltd. New Delhi, 2005.

MAHT- 416: MEASURE THEORY

UNIT I : Measure on the Real Line

Lebesgue outer Measure- Measurable sets – Regularity – Measurable Functions.

UNIT II : Integration of Functions of a Real Variable

Integration of Non-negative Functions-The General Integral-Integration of Series-Riemann and Lebesgue Integrals

UNIT III : Differentiation

Continuous Non-differentiable Functions- Functions of bounded variation - Lebesgue's Differentiation Theorem-Differentiation and Integration-The Lebesgue Set

UNIT IV: Abstract Measure Spaces

Measures and Outer Measures-Extension of Measure-Uniqueness of the Extension-Completion of a Measure-Measure Spaces-Integration with respect to a Measure

TEXT BOOK

Measure Theory and Integration by G.de Barra

SECTIONS

2.1 -2.5, 3.1 – 3.4, 4.2 - 4.6, 5.1-5.6 .

REFERENCE BOOKS

1. **Real Analysis by H L Royden**
2. **Measure and Integration by Inder K Rana**
3. **Measure Theory by P R Halmos**
4. **Measure Theory by Donald Cohen.**

MAHT-417: FUNCTIONAL ANALYSIS

Unit 1 :Banach Spaces

The definition and some examples of Banach spaces – Continuous linear transformations – Norm of a linear transformation - Operator on a normed linear space - Conjugate space of N - The Hahn-Banach Theorem - Second conjugate space of N.

Unit 2 : Hilbert Spaces

The open mapping theorem – Projection on a Banach space - The closed graph theorem - The conjugate of an operator – The uniform boundedness theorem - Isometric isomorphism of $\mathcal{B}$(N) into $\mathcal{B}(N^*)$ - Hilbert spaces – The definition and some simple properties – Schwarz inequality - Parallelogram law - Orthogonal complements – Orthonormal sets - Bessel's inequality - Complete orthonormal set.

Unit 3 :Operators

The conjugate space H^* - The adjoint of an operator – Properties of the adjoint operator on $\mathcal{B}(H)$ - Self adjoint operators – Normal and unitary operators - Necessary and sufficient condition for an operator on H to be normal and unitary.

Unit 4 : Spectral Theory

Definition of Projections - Perpendicular projection - Projection as an operator - Related theorems - Finite dimensional spectral theory - Eigen values and Eigen vectors of an operator T on a Hilbert space - Eigen space of T - Matrices - Determinants and the spectrum of an operator - Spectral theorem .

TEXT BOOK

"An Introduction to Topology and Modern Analysis " BY G.F.Simmons,

Tata Mc Graw hill publishing company limited – Edition 2004.

SECTIONS:

46 – 48, 50 - 62.

REFERENCES BOOKS

1. M.ThambanNair: Functional Analysis – A first course – prentice hall of India, Pvt. limited, New delhi – 2002.

2. D.Somasundaram: A first course in functional analysis – Narosa publishing house – 2008

3.R.V. Limaye: Functional analysis – Wiley eastern, New delhi – 1981.

4. K. Chandrasekhara Rao - Functional analysis - Narosa publishing house - Reprint 2004

5. S.Ponnusamy:Foundation of Functional Analysis , Narosa- 2002

MAHT-418: OPERATIONS RESEARCH

UNIT-I : Linear Programming Problems

Introduction-Graphical solution-some exceptional cases-General LPP- canonical and standard forms of LPP-Computational Procedure-Use of artificial variables-Duality and Simplex method-Dual simplex method.

UNIT –II : Special cases of LPP

General Transportation Problem-Formulation of the transportation problem-solution of transportation problem- finding initial basic feasible solution –degeneracy- transportation algorithm - Transhipment problem-Assignment problem – Travelling salesman problem.

UNIT-III : Integer Programming and Sequencing problems

Integer Programming: Introduction-Gomary's all IPP method- Branch and Bound Technique Sequencing problem: problems of sequencing- processing of n jobs through 2 machines – processing of n jobs through k machines- processing of 2 jobs through k machines .

UNIT–IV : Decision Analysis and Game Theory

Decision Analysis: Decision making problem- Decision making process- decision making environment- Decisions under Uncertainty- Decisions under risk.

Game Theory: The maximin- minimax principle- Games without saddle points–Dominance-graphical method-Arithmetic method for nxn –general solution of mxn rectangular games

TEXT BOOK :

Operations Research byKantiSwarup, P.K. Gupta, Manmohan - Sultan chand& Sons, New Delhi, 12th Edition.

SECTIONS : 3.1 to 3.5, 4.3, 4.4, 5.7, 5.9, 10.1 to 10.12,10.16,11.1 to 11.6,7.1 to 7.6, 12.1 to 12.6, 16.1 to 16.6, 17.1 to 17.9

REFERENCE BOOKS:

1. Hamdy A.Taha, Operations Research An Introduction. Phi Learning Private Ltd. New Delhi, 8th Edition
2. S.D.Sharma, Operations Research, Kedarnath,14th edition
3. P.R. Vittal, Introduction to Operations Research, Margham Publications, Chennai, 2nd Edition.
4. P.K. Gupta, D.S. Hira, Problems in Operations Research, Principles and Solutions, S. Chand & Company Ltd., New Delhi.
5. R. Pannerselvam, Operations Research,Prentice Hall of India, 2nd Edition, 2006
6. S.D.Sharma, Operations Research, Kedarnath,14th edition

LIST OF SOFTCORE PAPERS OFFERED BY THE DEPARTMENT

DISCRETE MATHEMATICS

Unit I : Lattices

Set - Relation – Relation matrix and graph - Partition and covering of a set - Equivalence relation – Composition of binary relation - Partial Ordering – Partially ordered set – Lattices as partially ordered sets – Properties of lattices – Lattices as Algebraic systems – Sub lattices – Direct Product – Homomorphism.

Unit II : Boolean Algebra

Special lattices (Complete lattices, bounded lattices, complemented lattices, distributive lattices and their properties) - Boolean Algebra – Sub algebra – Direct product – Homomorphism.

Unit III : Canonical Forms

Join-irreducible elements, atoms – Boolean Forms - Min terms, sum-of-product canonical form , Max terms, Product of sum canonical form – Free Boolean Algebra.

Unit IV : Boolean functions

Values of Boolean Expression (a binary valuation process) – Boolean Function – Symmetric Boolean Expression- Representation of Boolean functions - Karnaugh map for 2,3 ,4 variables only - minimization Boolean function using Karnaugh map

TEXTBOOK

Discrete Mathematical Structures with application to Computer science by J.P Tremblay and R. Manohar , Tata McGraw-Hill

SECTIONS

Chapter 2: Sections 2-1.1 to 2-1.9, 2-3.1 to 2-3.5, 2-3.7 to 2-3.9

Chapter 4: Sections 4-1, 4-2, 4-3.

REFRENCE BOOK

1. Grimaldi R.P., Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Edition, Asia, Delhi, 2002

2. KolmanB.,Busby R.C and Ross S.C., Discrete Mathematical Structures, Pearson Edn. Pvt. Ltd. New Delhi,2003

NETWORK ANALYSIS AND QUEUEING THEORY

UNIT-I : Network Analysis :

Introduction to Networks- Minimal Spanning tree Algorithm- Shortest Path Problem- Maximal Flow problem.

UNIT – II : Project Management:

Introduction – Critical Path Method – Critical path determination – Optimal scheduling by CPM-PERT

UNIT-III : Single Server Queueing Models :

Structure of queueing systems - Performance measures of queueing systems - Probability distribution of queueing systems – classification of queueing models- Derivation of arrival process – Derivation of Steady state Solutions of M/M/1 with Infinite capacity - Derivation of Steady state Solutions of M/M/1 with finite capacity – Simple Problems

UNIT-IV : Multi Server Queueing Models

Derivation of steady state solutions of M/M/c with infinite capacity - Derivation of steady state solutions of M/M/c with finite capacity – Simple problems

TEXT BOOKS:

1. **Introductory Operations Research Theory and Applications by H.S Kasana and Kumar, Springer 2007.**
2. **Operations Research Theory and Applications by J.K. Sharma, Macmillan Fifth Edition.**

SECTIONS:

Chapter 8 : 8.1-8.4 (Text book 1)
Chapter 9 : 9.1-9.5 (Text book 1)
Chapter 16 : 16.1- 16.8 (Text book 2)

REFERENCE BOOKS:

1. F.S. Hillier and J. Lieberman – Introduction to Operations Research (8^{th} Edition), Tata McGraw Hill Publishing company, New Delhi, 2006.
2. Beightler. C, D. Phillips, B. Wilde, Foundations of Optimization (2^{nd} Edition) Prentice Hall Pvt Ltd., New York, 1979.
3. Bazaraa, M.S; J.J. Jarvis, H.D. Sharall, Linear Programming and Network flow, John Wiley and sons, New York 1990.
4. Gross, D and C.M. Harris, Fundamentals of Queueing Theory, (3^{rd} Edition), Wiley and Sons, New York, 1998.
5. Hamdy A. Taha, Operations Research (6^{th} Edition),Prentice – Hall of India Private Limited, New Delhi.

INTEGRAL TRANSFORMS

Unit I : Fourier Integrals & Fourier Transforms:

Fourier integral representations- Proof of the Fourier integral theorem-Fourier transform Pairs-Properties of Fourier transform – Transforms of more complicated functions-convolution integrals of Fourier

Unit II : Laplace Transform:

Transforms of some typical functions-basic operational properties-Transforms of more complicated function -Inverse Laplace transform- Complex inversion formula –evaluating integrals – solutions of ODE and PDE- linear integral equations.

Unit III: Mellin Transform:

Evaluation of Mellin transforms -complex variable method and applications- table of Mellin transforms.

Unit IV: The Hankel Transforms:

Evaluation of Hankel transforms – applications – table of Hankel transforms.

TEXT BOOK

1. **Larry Andrews, Bhimsen Shivamoggi. Integral Transforms for Engineers, Prentice Hall of India, New Delhi, 2005.**

SECTIONS:

Chapter 2: 2.1-2.7,
Chapter 4 4.1- 4.6,
Chapter 5: 5.1-5.5.
Chapter 6: 6.1-6.5.
Chapter 7: 7.1-7.4.

REFERENCE BOOKS

1. N. Sneddon,The use of Integral Transforms, New York : Mac Graw Hill 1974.
2. Ronald N. Bracewell, The Fourier transform and its applications : Mac Graw Hill 2003.
3. Allan Pinkus and Samy Zafrany, Fourier Series and Integral Transforms : Cambridge University Press: 1997

Introduction to Fuzzy sets and its applications

UNIT – I Interval arithmetic and multi–level interval numbers

Interval Numbers – Arithmetic Operations – Rules for Operations – Distance Between Intervals - Interval Operations in Z – Exercises –Two-Level Interval Numbers – Arithmetic Operations with Two- Level Intervals - More General Two-Level Intervals - Interval Numbers with n Levels – General n-Level Intervals - Infinite-Level Interval Numbers - Exercises

UNIT – II Fuzzy sets

Definition of Fuzzy sets –Fuzzy Sets and Fuzzy Numbers – Basic Operations on Fuzzy Sets – Properties of Fuzzy sets – Algebraic Product and Sum of Fuzzy Sets – Power and Related Operations on Fuzzy Sets - The Extension Principle – Exercises

UNIT – III Fuzzy relations

Definitions of Fuzzy Relation – Basic Operations on Fuzzy Relations – Direct Product – Projections of a Fuzzy Relation – Max–Min and Min–Max Compositions – Basic Properties of Fuzzy Relations - Fuzzy Relations and Approximate Reasoning – Exercises

UNIT – IV Fuzzy control systems

Introduction – Fuzzy Control Structure – Modelling the Control Parameters – If… and...Then Rules – Rule Evaluation – Conflict Resolution – Defuzzification - Exercises

TEXT BOOK

1. George Bojadziev and Maria Bojadziev, Fuzzy Sets, Fuzzy Logic, Applications, World Scientific Publishing Co.Pte. Ltd. Singapore, 1995

SECTIONS

Chapter 1 : 1.1 – 1.6
Chapter 2 : 2.1 – 2.7
Chapter 6 : 6.1 – 6.8
Chapter 7 : 7.1 – 7.8
Chapter 11 : 11.1 – 11.6,11.9

REFERENCE BOOKS

1. George J.Klir/Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, 2000

2. George J. Klir and Tina A. Folger, Fuzzy Sets, Uncertainty and Information, Prentice-Hall of India, 1993

NUMERICAL METHODS

Unit I : Solution of Algebraic and Transcendental Equation

Introduction – The Bisection Method – The Iteration Method – Aitken's Δ^2 –Process – The Method of False Position – Newton-Raphson Method – Ramanujam's Method – Muller's Method – Graeffe's root squaring method – Lin-Bairstow's Method.

Unit II : Matrices and Linear system of simultaneous Equations

Gausian Elimination Method – Modification of the Gauss Method to Compute the Inverse – Method of Factorization – LU decomposition – Solution of Centro-Symmetric Equations – Ill-Conditioned Linear Systems – Method of Ill-Conditioned Matrices. solutions of Linear Systems – Iterative Methods- The Eigen Value Problem – House Holder's Method.

Unit III : Numerical solutions for ODE

Introductions – Solution by Taylor's series– Picard's Method for Successive Approximation – Euler's Method - Runge-Kutta Method - Predictor Correcter Method – Boundary Value Problems – Finite Difference Method – The Shooting Method- Cubic Spline.

Unit IV : Numerical solution for PDE

Introduction – Finite Difference Approximation to Derivatives – Laplace and Poisson Equation – Jacobi's Method – Gauss-Seidel Method – Parabolic Equation – Iterative Methods for the Solution of Equations – Hyperbolic Equations.

TEXT BOOK : Introductory methods of Numerical Analysis BY S.S.Sastry – Prentice Hall of India (III edition)

SECTIONS

Chapter 2 – Sec. 2.1 – 2.9

Chapter 6 – Sec. 6.3.2 – 6.5.2

Chapter 7 – Sec. 7.1 – 7.6, 7.10.1 - 7.10.3

Chapter 8 - Sec. 8.1 – 8.3.2, 8.4 – 8.6

REFERENCE BOOKS

1. M.K.Jain - Numerical Solution of Differential Equations -Wiley Eastern Ltd. 1979.
2. M.K.Jain , S.R.K Iyengar, R.K.Jain – Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, (IV edition)
3. B.D Gupta – Numerical Analysis – Konark Publishers Pvt. Ltd. – I edition

FLUID DYNAMICS

UNIT 1 : Kinematic of Fluids in Motion

Real and Ideal Fluids-Velocity of a fluid at a point - Streamlines and path lines - Steady and unsteady flows - The velocity potential - The vorticity vector - Local and particle rates of change - The equation of continuity –worked example-acceleration of a fluid- conditions at a rigid boundary.

UNIT 2: Equations of Motion of a Fluid

Euler's equations of motion - Bernoulli's equation - Worked examples - Discussion of the case of steady motion under conservative body forces - Some flows involving axial symmetry - Some special two dimensional flows.

UNIT 3: Two dimensional flows

The stream function - The complex potential for two dimensional, Irrotational, Incompressible flow - Complex velocity potentials for standard two dimensional flows - Some worked examples - The Milne-Thomson circle theorem - The theorem of Blasius – Schwarz- Christoffel Transformation

UNIT 4 : Three dimensional flows

Introduction - Sources, Sinks and Doublets - Images in a rigid infinite plane - Images in solid spheres - Axi-symmetric flows - Stoke's stream function - Some special forms of the stream function for Axi-symmetric irrotational motions.

TEXT BOOK:

F. Chorlton - Text book of Fluid dynamics - CBS Publishers and Distributors - Reprint 1998.

SECTIONS : 2.1 - 2.10, 3.4 - 3.7, 3.9, 3.10, 4.1 - 4.5, 5.3 – 5.6, 5.8, 5.9, 5.11

REFERENCE BOOKS:

1. L.M.Milne -Thomson- Text book of Theoretical Hydrodynamics-Fourth edition -

London Macmillan & Co LTD., 1962

2. J.K. Goyal and K.P. Gupta - Fluid dynamics - Pragati edition - 16th edition 2009.

3. Yunus A. Cengel and John M. Cimbala - Fluid mechanics - Tata McGraw hill

education Pvt. Ltd.

PROBABILITY THEORY

UNIT 1 : Random Variable

Random variables – Probability distributions – Continuous random variables – Probability density functions – Multivariate distributions – Marginal distributions – Conditional distributions.

UNIT 2 : Mathematical Expectation

The expected value of a random variable – Moments – Chebyshev's theorem – Moment generating function – Product moments – Moments of linear combination of random variables – Conditional expectation.

UNIT 3 : Discrete distribution

The discrete uniform distribution – Bernoulli distribution – Binomial distribution – Negative binomial and Geometric distribution – Hyper-geometric distribution – Poisson distribution – Multinomial distribution – Multivariate hyper-geometric distribution.

UNIT 4 : Continuous distribution

Uniform distribution – Gamma and Exponential distributions – Chi – square distribution- Beta distribution – Normal distribution – Normal approximation to Binomial distribution – Bi-variate normal distribution.

TEXT BOOK:

Mathematical statistics with applications by Irwin Miller, Marylees Miller – John E.Freund's – 6th edition .

SECTIONS: 3.1 – 3.7, 4.1 – 4.8, 5.1 – 5.9 and 6.1 – 6.7.

REFERENCE BOOKS:

1. V.K. Rohatgi - An introduction to probability theory and mathematical statistics - Wiley Eastern Limited, 1988.

2. S.C. Gupta and V.K. Kapoor - Fundamentals of mathematical statistics - Sultan chand and sons, 2003.

3. Paul G. Hoel - Introduction to mathematical statistics - 5th edition - John wiley and sons, 1984.

4. Sheldon M. Ross - Introduction to probability and statistics for engineers and scientists - 3rd edition - Academic press, 2005.

CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

UNIT I :Variational Problems with fixed boundaries

Concept of Variation of functionals and its Properties – Euler's Equations – Variational problems for functional of the form – functional dependent on higher order derivatives – functional dependent on functions of several independent variables – Variational problems in parametric form.

UNIT II :Variational problems with subsidiary conditions

Constraints of the form isoperimetric problems- Problems of Mayer and Bolza – Equalibrium problem for elastic bodies- Castigliano principals- introduction to direct methods – Euler method of finite difference- Rayliegh Ritz method – Galerkin method

UNIT III :Fredholm and Volterra Equations

Fredholm and Volterra Equations of I and II kinds – Relation between Integral and Differential Equations – Green's Functions (problem).

Unit IV :Fredholm Equations with separable Kernels

Fredholm Equations with separable kernels – Illustrative Examples – Hilbert Schmidt Theory – Iterative Methods for Solving Equation of Second Kind.

TEXT BOOK

1. **Gupta.A.S – Calculus of Variation with applications – Prentice hall of India,1997.**
2. **F.B.Hilderbrand - Methods of Applied Mathematics – Prentice hall of India, (II edition), 1992.**

SECTIONS

Chapter 1: Sec 1.1 – 1.6 (Text book 1)

Chapter 4: Sec 4.1,4.2 (Text book 1)

Chapter 6: Sec 6.1- 6.4 (Text book 1)

Chapter3: Sec 3.1 to 3.3 and 3.6 to 3.9 (Text book 2).

NUMBER THEORY

UNIT I : Divisibility

Introduction – Divisibility – Primes – binomial theorem.

UNIT II : Congruences

Congruences – Solutions of congruences – The Chinese Remainder theorem – public key Cryptograghy- Prime power moduli – Prime modulus.

UNIT III

Primitive roots and power residues – Congrunces of degree two, prime modulus – Quadratic reciprocity: Quadratic residues – Quadratic Reciprocity – The Jacobi symbol.

UNIT IV

Some functions of number theory: Greatest integer functions – Arithmetic functions – The Moebius Inversion formula – Recurrence functions.

TEXT BOOK

An Introduction to the theory of Numbers by Ivan Nivan, Herbert S. Zuckerman and Hugh L. Montgomery – John wiley& Sons (Fifth edition)

SECTIONS

Chapter I Sections: 1.1 – 1.4

Chapter II Sections: 2.1 to 2.3, 2.5 to2.9

Chapter III Sections: 3.1 to 3.3

Chapter IV Sections: 4.1 to 4.4.

REFERENCE BOOKS

1. David M.Burton – Elementary Number Theory – Tata MC Graw Hill Publishing Company Ltd.,(VI edition).
2. Martin Erickson & Anthony Vazzana – Introduction to Number Theory – Chapman & Hall / CRC.
3. TomM.Apostal – Introduction to Analytic Number Theory – Spinger International Student Edition – Narosa Publishing house.`

SCILAB

UNIT – I

Overview of Scilab - How to get started with Scilab - Getting help from Scilab demonstrations and macros – The Console – The Editor – Batch Processing Creating Real Variables - Elementary mathematical functions – Booleans – Complex Numbers – Integers – Floating Points – Strings – Dynamic Variables

UNIT – 2

Matrices – Create Matrices of Real Variables – Accessing Elements of Matrices - Matrices are dynamic – Element wise Operations Conjugate transpose and non-conjugate transpose - Multiplication of two vectors Comparing two real matrices - Issues with floating point integers - More on elementary functions - Higher-level linear algebra features

UNIT – 3

Looping and branching - The if, select, for and while statements The break and continue statements Functions - Function libraries - Managing output arguments Levels in the call stack - The return statement - Debugging functions with pause

UNIT - 4

Plotting - 2D plot - Contour plots - Titles, axes and legends - Export

Text Book: 1.

1. Introduction to Scilab - Michael BaudinFromScilabConsortiun, 2010 Chapters 1 to 8
2. Plotting Using Scilab – An open Source Document – www.openeering.com

References:

1. Modeling and Simulation in Scilab, Stephen L. Campbell, Jean-Philippe Chancelier and RamineNikoukhah
2. An Introduction to Scilab from a Matlab User's Point of View by Eike Rietsch

DIFFERENCE EQUATIONS and Z- TRANSFORMATION

UNIT 1 : Difference Operator

Difference operator – Definition of difference operator **Δ** and shift operator E -Properties of **Δ** - Formula for differences of particular functions - The falling factorial power and Binomial coefficient - Summation – General properties of indefinite sums - Generating function and approximate summation - Bernoulli polynomials and Bernoulli numbers - Properties of Bernoulli polynomials - Euler summation formula.

UNIT 2 : Linear difference Equations

First order equation – General results for linear equations – A linear equation of n^{th} order - Characterization of general solution of a linear equation of n^{th}order - The matrix of Casorati - Role of Casoratian in the study of linear difference equations - Solving linear equations - Applications.

UNIT 3 : Z- Transform

Z-Transform – Definition of Z-transform of a sequence - Exponentially bounded sequence - Linearity theorem – Shifting theorem - Initial and final value theorem – Convolution theorem - Solution of Volterra summation equation - Solution of Fredholm equation - Eigen pair - Properties of eigen pairs.

UNIT 4 : Stability Theory

Stability theory – Initial value problems for linear system – Cayley Hamilton theorem - The Putzer algorithm - Variation of parameters formula for solving non-homogeneous system.

TEXT BOOK:

Walter G Kelley & Allan C. Peterson : "Difference equations ", Academic press-second edition, 2001.

SECTIONS: 1.1–2.3 , 3.1 – 3.4, 3.7, 4.1

REFERENCE BOOKS:

1. Dr. Sudhir, K.Pundir and Dr.RimplePundir - Difference equations - UGC model curriculum.
2. Ronald E. Mickens - Difference equation - Theory and application - Chapman and Hall , Second edition, London 1990.

GRAPH THEORY

UNIT-I: GRAPHS, SUBGRAPHS AND TREES

Graphs and simple graphs- graph isomorphism – the incidence and adjacency matrices – sub graphs – vertex degrees – paths and connection – cycles – trees – cut edges and bonds – cut vertices.

UNIT – II : CONNECTIVITY, EULER TOURS AND HAMILTON CYCLES

Connectivity – Blocks – Euler tours – Hamilton Cycles.

UNIT-III : MATCHINGS, EDGE COLOURINGS

Matching's – Matching's and Coverings in Bipartite Graphs – Edge Chromatic Number – Vizing's Theorem.

UNIT-IV: INDEPENDENT SETS AND CLIQUES, VERTEX COLOURINGS

Independent sets – Ramsey's Theorem – Chromatic Number – Brook's Theorem

TEXT BOOK

J.A. Bondy and U.S.R. Murthy, Graph Theory and Applications, Macmillan, London, 1976.

SECTIONS

Chapter 1 (section 1.1-1.7)
Chapter 2(section 2.1 - 2.3)
Chapter 3 (Section 3.1 - 3.2)
Chapter 4 (Section 4.1 - 4.2)
Chapter 5 (Section 5.1 – 5.2)
Chapter 6 (Section 6.1 - 6.2)
Chapter 7 (Section 7.1 – 7.2)

REFERENCE BOOKS

1. J. Clark and D.A. Holton, A First Look at Graph Theory, Allied Publishers, New Delhi, 1995.

2. R. Gould. Graph Theory, Benjamin/ Cummings, Menlo Park, 1989.

3. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press, Cambridge, 1989.

4. R.J. Wilson and J.J. Watkins, Graphs : An Introductory Approach, John Wiley and Sons, New York, 1989.

5. R.J. Wilson, Introduction to Graph Theory, Pearson Education, 4th Edition, 2004, Indian Print.

6. S.A. Choudum, a First Course in Graph Theory, MacMillan India Ltd. 1987.

STOCHASTIC PROCESSES

Unit 1: **Introduction to Stochastic process**

Introduction- Specification of Stochastic Processes – Markov process - Second order processes - Stationary – weakly stationary - Strictly stationary - Evolutionary - Gaussian processes - Martingales - Definition and examples - Martingale convergence theorem.

Unit 2 : Markov Chains

Markov chains - Definition and Examples – Transition matrix - order of a Markov chain - Higher Transition probabilities - Generalisation of Independent Bernoulli Trials - Sequence of Chain Dependent Trials - Classification of States and chain - Determination of higher transition probabilities – Stability of a Markov system – Graph Theoretic Approach.

Unit 3 : Poisson process

Poisson process - Postulates for Poisson process - Properties of Poisson Process - Poisson process and related distribution - Generalisation of poison process – Pure birth process , Birth - Immigration process -Time dependent Poisson process - Birth and Death process.

Unit-4 : Queueing systems

Concepts of queueing system - Queueing process and notation - Steady state distribution - Little formula - M/M/1 Queueing model - Steady State Behaviour and solution - Waiting time distribution - M/M/1/K queueing model - Transient Behaviour of M/M/1 model - Multi channel queueing model - M/M/∞ queueing model - M/M/s/s loss system- Model with Finite input source.

TEXT BOOK: J. Medhi - Stochastic Processes -2nd edition .

SECTIONS:

Chapter 2: Sec. 2.1 – 2.4

Chapter 3: Sec. 3.1 – 3.7

Chapter 4: Sec. 4.1 – 4.4

Chapter 10 : Sec . 10.1 - 10.4

Reference books:

1. Athanasios Papoulis and S. Unnikrishnapillai - Probability, Random variables and Stochastic processes - Tata Mcgraw hill edition - 4th edition,2002.

2. S.K. Srinivasan and K.M. Mehata - Stochastic processes - Tata McGraw hill publishing company limited, New delhi, 1976.

3. Kishor S. Trivedi - Probability and Statistics with Reliability, Queueing and Computer science applications - Prentice hall of India, New Delhi 2000.

AUTOMATA THEORY

Unit 1 : Grammar and Language

Languages - Star-closure of a language - Definition of a Grammars - Language generated by a grammar Automata – Transition function - deterministic automata - non-deterministic automata - Some application.

Unit 2 : Finite state machine

Deterministic finite accepters – Non deterministic finite accepters – Equivalences of deterministic and Non- deterministic finite accepters – Reduction of the number of states in finite automata.

Unit 3 : Regular Languages and Regular grammar

Regular expression – Formal dentition and examples - Languages associated with Regular expressions - Connection between regular expression and regular language – Regular grammar - Right and Left Linear Grammars - Right linear Grammars Generate Regular Languages - Right Linear Grammars for regular Languages - Equivalence between Regular Language and Regular Grammars

Unit 4 :Properties of regular languages

Closure properties of regular languages – Closure under Simple set operations - Closure under other operations - Elementary problems in regular languages.

Text book:

Peter linz - An Introduction to formal languages and Automata - 3rd edition, 2004.

Sections: 1.2, 1.3, 2.1 – 2.4, 3.1 – 3.3, 4.1 and 4.2

Reference book:

1. John C.Martin - Introduction to languages and the theory of computation –3rd edition, 2004.

2. S.F.B. Nasir and P.K. Srimani - A textbook on Automata theory - 2010.

3. Ullmann - Introduction to Automata theory, Languages and Computation - 1998.

DIFFERENTIAL GEOMETRY

UNIT I

Graphs and level sets-vector fields-the tangent space

UNIT II

Surfaces-vector fields on surfaces-Orientation-The Gauss map

UNIT III

Geodesics-Parallel transport

UNIT IV

The Weingantten map-Curvature of plane curves

Text book:

J.A.Thorpe: Treatment as in Elementary Topics in Differential Geometry,springer,2004

Chapters 1 to 12.

INTRODUCTION TO R PROGRAMMING

UNIT I

R language Essentials: Expressions and Objects, Assignments, Creating Vectors, Vectorized arithmetic, Creating matrices, operations on matrices, lists, data frames – creation, indexing, sorting and conditional selection; examples.

UNIT II

R Programming; conditional Statements – if and if else; loops-for, while, do-while; functions-built-in and user defined; Data entry – reading from text file, data editor; examples.

UNIT III

Descriptive Statistics and Graphics; Obtaining summary statistics; generating tables; Bar plots, pie charts, Box plots, Histogram; exercises. Correlation and Regression.

UNIT IV

One and two sample tests for mean and variance- One way and two way ANOVA, CRD, RBD, LSD, 2^2, 2^3, 3^2 factorial design.

BOOKS FOR STUDY

1. **Michael J.Crawley (2007), The R Book, John Wiley and Sons Ltd.**
2. **Peter Dalgaard (2008), Introductory Statistics with R, 2nd edition, Springer**.

PRACTISE EXERCISES:

1. Bar and Pie charts, Box plots for single and multiple groups.Checking Normality using Histogram and Q-Q plot.
2. Finding of measures, Dispersion.
3. Correlation coefficient –Person's ,Spearman and Kendall's Tau.
4. Fitting simple linear and multiple linear regressions.
5. One sample and two sample t test.
6. One way and two way ANOVA
7. CRD, RBD, LSD, 2^2, 2^3, 3^2 factorial design.

INTRODUCTION TO PYTHON PROGRAMMING

OBJECTIVES:

- To introduce object oriented programming using an easy-to-use language.
- To use iterators and generators.
- To test objects and handle changing requirements.
- To be exposed to programming over the web.
- To learn how to read and write files in Python.

UNIT I INTRODUCTION TO PYTHON

Function Declaration - Import - Objects - Indenting as Requirement - Exceptions - Unbound Variables - Case Sensitive - Scripts - Native Data Types - Booleans - Numbers - Lists - Tuples - Sets - Dictionaries - Comprehensions - List Comprehensions - Dictionary Comprehensions - Set Comprehensions

UNIT II STRINGS

Strings - Unicode - Formatting - String Methods - Bytes - Encoding - Regular Expressions - Verbose - Case Studies

UNIT III CLASSES

Closures - List of Functions - List of Patterns - File of Patterns - Generators - Defining Classes - Instantiating Classes - Instance Variables - Iterators – Itertools - Assert - Generator Expressions

UNIT IV TESTING AND FILES

Test Case - Testing Invalid Inputs - Refactoring - Handling Changing Requirements - Reading and Writing Text Files - Binary Files - Stream Objects - Standard Input, Output and

TEXT BOOKS:

1. **Mark Pilgrim,"Dive into Python 3", Apress, 2009.**

2. Allen Downey, Jeffrey Elkner, Chris Meyers, "How to Think Like a Computer Scientist - Learning with Python", Green Tea Press, 2002.

REFERENCES:

1. John V. Guttag, "Introduction to Computation and Programming using Python", Prentice Hall of India, 2014.

2. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", Fifth Edition, O'Reilly, Shroff Publishers and Distributors, 2013.

INVENTORY AND REPLACEMENT MODELS

UNIT -1

Inventory – types of inventories – Inventory decisions – Cost involved in inventory – Variables in inventory models – lead time – characteristics of inventory system – classification of inventory models – Average Inventory – EOQ – Derivation of EOQ models without Shortages – Instantaneous replenishment – finite rate Replenishment – simple problems

UNIT-2

Deterministic inventory problem with Shortages – Derivation for Instantaneous production - Finite Replenishment - EOQ problem with price break – Simple problems

UNIT-3

Replacement of equipment that deteriorates gradually with time – Replacement policy when value of money does not change with time – Replacement policy when value of money changes with time

UNIT-4

Replacement of equipment that fails suddenly – Group and individual replacement

Text book

Operations Research by Kanti swarup , P.K.Gupta and Man Mohan – Sultan Chand and sons

REFERENCE BOOKS:

1. Hamdy A.Taha, Operations Research An Introduction. Phi Learning Private Ltd. New Delhi, 8th Edition
2. S.D.Sharma, Operations Research, Kedarnath,14th edition
3. P.R. Vittal, Introduction to Operations Research, Margham Publications, Chennai, 2nd Edition.
4. P.K. Gupta, D.S. Hira, Problems in Operations Research, Principles and Solutions, S. Chand & Company Ltd., New Delhi.
5. R. Pannerselvam, Operations Research,Prentice Hall of India, 2nd Edition, 2006
6. S.D.Sharma, Operations Research, Kedarnath,14th edition

COMBINATORIAL MATHEMATICS

UNIT I : Permutations and combinations.

UNIT II : Generating functions.

UNIT III : Recurrence relations.

UNIT IV : Principle of inclusion and exclusion and Polya's theory of counting

TEXT BOOK:

1. **C.L. Liu, Introduction to Combinatorial Mathematics, Tata McGraw Hill, Book Co., New York, 1968. (Chapters: 1 to 5.)**

BOOKS FOR REFERENCE:

1. C.L. Liu, M. Eddberg, Solutions to problems in Introduction to Combinatorial Mathematics, MC Grow-Hill Book & Co., New York, 1968.

2. J.H. Van Lint, R.M. Wilson, A Course in Combinatorics, 2nd Edition, Cambridge University Press, Cambridge, 2001.

3. R.P. Stanley, Enumerative Combinatory, Volume I, Cambridge Studies inAdvanced Mathematics, Volume 49, Cambridge University Press, 1997.

4. P.J. Cameron, Combinatorics: Topics, Techniques, Algorithms, CambridgeUniversity Press,

MATHEMATICAL MODELING

UNIT I

Mathematical Modelling through Ordinary Differential Equations of First order- Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamics problems – Geometrical problems.

UNIT II

Mathematical Modelling through Systems of Ordinary Differential Equations of First Order - Population Dynamics – Epidemics – Compartment Models – Economics – Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III

Mathematical Modelling through Ordinary Differential Equations of Second Order- Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modelling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models.

UNIT IV

Mathematical Modelling through Difference Equations -Simple Models

– Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

TEXT BOOK

J.N. Kapur, Mathematical Modelling, Wiley Eastern Limited, New Delhi, 1988.

REFERENCES

J. N. Kapur, Mathematical Models in Biology and Medicine, Affiliated East –West Press Pvt Limited, New Delhi

RESEARCH METHODOLOGY

AIM:

The main purpose of this course is to help researchers and students of the sciences in our discipline to prepare manuscripts that will have a high probability of being accepted for publication and of being completely understood when they are published.

OBJECTIVES:

A scientific experiment, no matter how spectacular results, is not completed until the results are published. In fact, the cornerstone of the philosophy of science is based on the fundamental assumption that original research must be published.

UNIT I :

Meaning and Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Research process, Selecting the problem, Necessity of defining the problem, Techniques involved in defining a problem.

UNIT II :

Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Preparation of the Title, Listing of the Authors and Addresses, Preparation of the Abstract, Writing the Introduction, Writing the Materials and Methods Section, Writing the Results, Writing the Discussion, Stating the Acknowledgements, Citing the References.

UNIT III :

Rights and Permissions, Submission of the Manuscript, The Review Process (How to Deal with Editors), The Publishing Process (How to Deal with Proofs), Writing a Review Paper, Writing Opinion (Book Reviews, Editorials, and Letters to the Editor), Writing a Book Chapter or a Book, Writing for the Public.

UNIT IV :

Tools and Facilities Available with Computer Technology, Use of Computer Technology in carrying out Specific Research Functions, Use in the Selection of the Research Problem, Use in carrying out Search for the Related Literature, Use in Drawing Samples for the Study, Use in Data Collection, Use in Data Analysis, Use in Quantitative Data Analysis.

References

1. Kothari C. R. and Gaurav Garg (2014 – Third Edition), Research Methodology – Methods and Techniques, New Age International Publishers.
2. Mangal S.K. and Shubhra Mangal (2013), Research Methodology in Behavioural Sciences, PHI Learning Private Limited.
3. Robert A. Day and Barbara Gastel (Sixth Edition), How to Write and Publish a Scientific Paper, Cambridge University Press.

Additional References

4. Das. M. N. and Giri. N. (1979) Design and Analysis of Experiments, Wiley Eastern Ltd.
5. John. W. C. (2009) Research Design, Qualitative, Quantitative and Mixed Methods Approaches, Sage Publication.
6. Kumar. R. (1996) Research Methodology: A Step-by-Step Guide for Beginners, Stage Publication.
7. Zina O'Leary (2010) The Essential Guide to Doing Your Research Project, Sage Publication

GENERAL MATHEMATICS

Unit 1:

Average – Problems on Numbers – Problem on ages –Percentage

Unit 2:

Profit and Loss – Ratio and Proportion – Simple and compound interest

Unit 3:

Time and work – Time and distance – Problems on train

Unit 4:

Linear and quadratic equations – Arithmetic and Geometric Progression

Text Book:

Objective Arithmetic – R S Agarwal – S Chand Publication -2011 Edition

Chapters: 6,7,8,10,11,12,15,16,18,21,22,31,32,33

Reference Book:

1. Quantitative Aptitude by R S Agarwal
2. Quantitative Aptitude by Abhijith Gupta
3. Quick Arithmetic by R S Agarwal