SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY, MADURAI
RE-ACCREDITED WITH 'A' GRADE (THIRD CYCLE) BY NAAC WITH CGPA 3.11)

Programme Scheme, Scheme of Examination and Syllabi

(From 2021-2022 Batch onwards)

Department of Mathematics

PG Programme

Approved in the Academic Council – XIII held on 11/08/2021

Curriculum Design and Development Cell

Annexure J

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY, MADURAI
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Curriculum Design and Development Cell

HOD	Dean of Pure Science	Dean of Academic Affairs	Principal

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
MEMBERS OF BOARD OF STUDIES

S.No.	Board Members	Name and Designation
1.	Chairman of the Board	**Ms.K.Lalithambigai** Head & Assistant Professor of Mathematics Sri Kaliswari College (Autonomous), Sivakasi.
2.	University Nominee	**Dr. S.Lalithambigai** Assistant Professor Department of Mathematics Madurai Kamaraj University, Madurai.
3.	Academic Expert 1.	**Dr. C.Parameswaran** Associate Professor and Head Centre for Research and Post Graduate Studies in Mathematics, Ayya Nadar Janaki Ammal College Sivakasi.
4.	Academic Expert 2.	**Dr. M.Jeyaraman** Assistant Professor Department of Mathematics R.D. Government Arts College Sivagangai
5.	Industrialist	**MAPR.Krishnamoorthy** Partner, Palani Industries Virudhunagar.
6.	Alumnus	**Dr.G.Ramkumar** Assistant Professor Department of Mathematics Arul Anandar College Karumathur.
Members		
7.	Dr.A.Subramanian	Senior Faculty in Mathematics
8.	Mrs.M.Kaleeswari	Assistant Professor of Mathematics
9.	Ms.M.Theivanayaki	Assistant Professor of Mathematics
10.	Mrs.M.Andal	Assistant Professor of Mathematics
11.	Mrs.J.Maria Jeya Priya	Assistant Professor of Mathematics
12.	Ms.N.Maheswari	Assistant Professor of Mathematics
13.	Dr.G.Sangeetha	Assistant Professor of Mathematics
14.	Mr.T.Gurunathan	Assistant Professor of Mathematics
15.	Mrs.S.Mahalakshmi	Assistant Professor of Mathematics
16.	Mrs.S.Anubala	Assistant Professor of Mathematics

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI

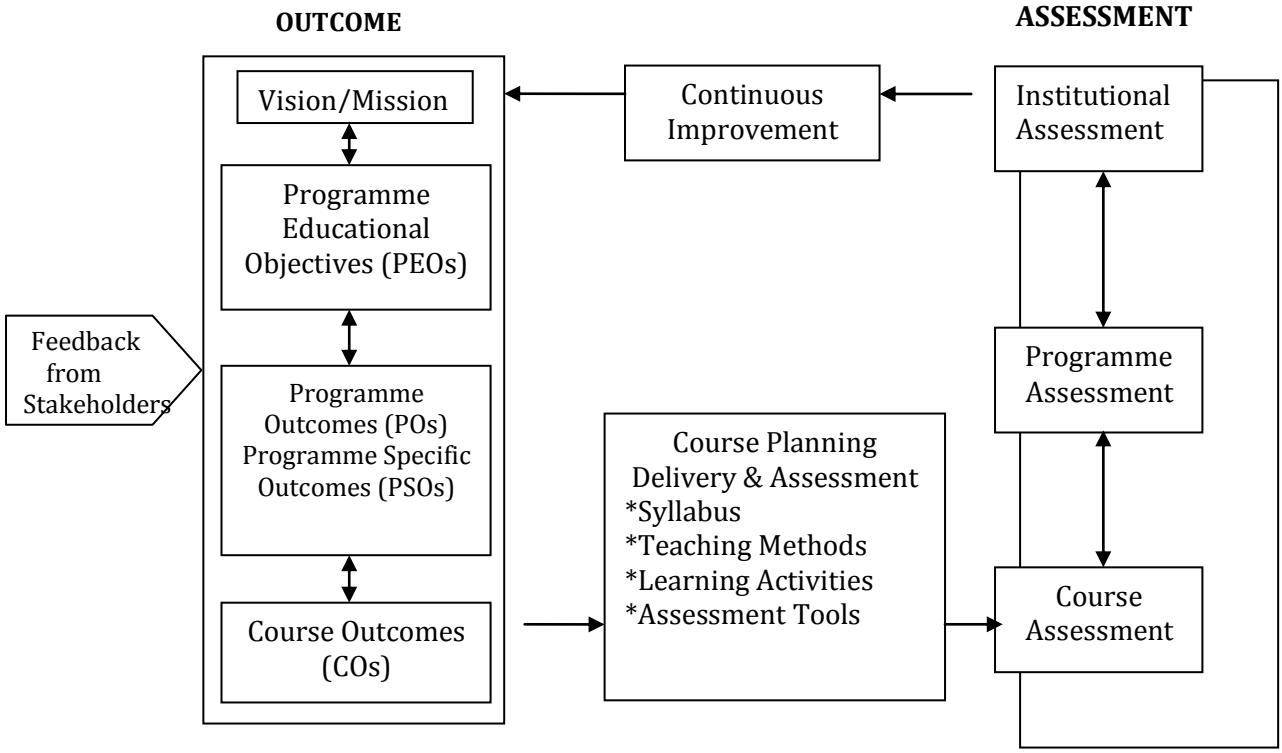
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY, MADURAI
RE-ACCREDITED WITH 'A' GRADE (THIRD CYCLE) BY NAAC WITH CGPA 3.11)
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
GUIDELINES FOR OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM
(From 2021-2022 Batch onwards)

INTRODUCTION

Sri Kaliswari College in its pursuit of imparting quality education has marked a remarkable growth in terms of academic excellence, infrastructure, student strength, ICT facilities, library and placement records since its establishment in 2000-2001.This institution constitutes an academic community that is committed to encourage the student community to experience and share knowledge, identify their potential, enhance the employability skills and enable them to pursue their goals. After the conferment of autonomous status in the year 2012, the college has so far gone for revision of the syllabi three times and is continually updating the syllabi to meet the needs and demands of the student community.

The institution in its success journey of imparting quality education has been Re-Accredited with A grade (CGPA 3.11) in its third cycle of Accreditation by NAAC. As an added feather to its cap, the institution has taken a giant leap to embrace the Outcome-Based Education system to enable the student community to develop their knowledge, skill and attitude simultaneously through a focussed learning and help the graduates to compete with their global counterparts and prepare them for life.

I. OUTCOME-BASED EDUCATION (OBE) FRAMEWORK



II. VISION OF THE INSTITUTION

- To impart quality higher education to produce highly talented youth capable of developing the nation

III. MISSION OF THE INSTITUTION

- Ensuring quality in all aspects of the activities
- Developing the latent skills of the rural youth
- Providing value - based education to instill courage and confidence
- Nurturing the entrepreneurial skills of the rural youth
- Creating competency to meet global challenges
- Imbibing social awareness and social responsibilities

IV. VISION OF THE DEPARTMENT

- To create a sound academic ambience to produce competent youth to excel in research and teaching in Mathematics along with concern for society

V. MISSION OF THE DEPARTMENT

- To impart quality education and inculcate the spirit of research through innovative teaching and research methodologies in Mathematics.
- To empower students with required skills to succeed in the ever-changing world.
- To provide innovative training to apply mathematical and computational skills to model, formulate and solve real life problems.

VI. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Graduates will

PEO1: demonstrate fundamental and systematic knowledge of mathematics and its applications relevant to job trends and employment opportunities.

PEO2: apply knowledge, understanding and skills to identify the difficult and unsolved problems in mathematics and to collect the required information in possible range of sources and try to analyse and evaluate these problems using appropriate methodologies.

PEO3: communicate the fundamental and advanced mathematical concepts in written and oral form and use suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.

PEO4: exhibit codes of conduct and social responsibility in order to behave consistently with personal respect and respect the ethical values, social responsibilities and diversity.

PEO5: identify knowledge and skills in mathematics through independent and life-long learning in the broadest context of technological change.

VII. PROGRAMME OUTCOMES (POs)

PO1: Disciplinary Knowledge

Acquire specialized and Scientific knowledge in the field of Science.

PO2: Critical Thinking, Problem Solving and Analytical Reasoning

Engage in critical investigations through principle approaches or methods and draw realistic conclusions of problems by employing highly developed analytical and quantitative skills.

PO3: Scientific Reasoning and Research Related Skills

Ability to analyze, draw conclusions from qualitative/quantitative data and critically evaluate ideas and also acquire necessary research skills to carry out an experiment or investigation.

PO4: Communication Skills and Digital Literacy

Communicate effectively on scientific achievements, basic concepts and recent developments with society at large and make use of appropriate software to prepare project report.

PO5: Ethics, Values and Multicultural Competence

Embrace ethical principles in all their activities, commit to professional and research ethics and practice tolerance and respect differences.

PO6: Team Work, Leadership and Employability Skills

Recognize the opportunities and contribute positively in collaborative scientific research and acquire the pre - requisite skills required for placements and higher education.

PO7: Self-directed and Life-long Learning

Recognize the need for engaging in independent and lifelong learning in the emerging areas of the field of specialization.

VIII. PROGRAMME SPECIFIC OUTCOMES (PSOs) – M.Sc. MATHEMATICS

On successful completion of M.Sc. Mathematics, the students will

PSO1: acquire in-depth knowledge of algebra, analysis, geometry, differential equations and several other branches of mathematics.

PSO2: develop critical observations, identify challenging problems in mathematics and obtain well-defined solutions for the problems using the principles of mathematics.

PSO3: analyse specific theoretical and applied problems in mathematics and draw conclusion from a range of contemporary research works and their applications in diverse areas of mathematical sciences.

PSO4: obtain ability to communicate various concepts of mathematics effectively using examples and their geometrical visualizations and apply ICT to mathematical investigations and problem solving.

PSO5: apply ethical principles and commit to professional ethics, responsibilities and norms of the scientific and sustainable development and practice tolerance and respect differences in the work place and society.

PSO6: work effectively in government jobs, banking, insurance and investment sectors, various other public and private enterprises by acquiring technical, communicative and leadership skills.

PSO7: acquire knowledge and skills through logical reasoning and to inculcate the habit of self-directed and life-long learning in the broadest context of technological change.

IX. PO-PSO Mapping Matrix – M.Sc. Mathematics

PO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
PO1	✓						
PO2		✓					
PO3			✓				
PO4				✓			
PO5					✓		
PO6						✓	
PO7							✓

X. PO-PEO Mapping Matrix – M.Sc. Mathematics

PO \ PEO	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	✓				
PO2		✓			
PO3		✓			
PO4			✓		
PO5				✓	
PO6	✓				
PO7					✓

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics

REGULATIONS

Duration of the Programme **:** Two years (equivalent to four semesters)

Eligibility

Candidate should have passed B.Sc. Mathematics or any other degree accepted by the Syndicate of the Madurai Kamaraj University, Madurai as its equivalent.

Medium of Instruction : English

Age Limit

Maximum age limit : No Age limit

Transitory Permission

Students joined from 2021 - 2023 may be permitted to write their examinations in this pattern up to April 2026.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics

SCHEME OF EXAMINATION

For both UG and PG Programmes, the Internal and External marks are distributed as follows:

For all Theory Courses : Internal Marks: 40; External Marks: 60

For all Practical Courses and Project : Internal Marks: 50; External Marks: 50

Internal Mark Distribution for Theory Courses

Assessment Type	Marks	Scheme of Assessment
Internal Test	15 marks	Two Internal Tests and 1 Model Exam will be conducted and average of the best two is considered
Written Assignment/ E-Assignment/ Case Studies/ Reviews/ Field Assignments/ Poster Presentations/ Portfolios	5 marks	Any one of the Assignments will be given
Quiz	5 marks	One Quiz Test will be conducted
Viva/ Oral Exam/ Group discussion/ Role Play	10 marks	Test will be conducted in any one of the Oral Mode
Seminar	5 marks	One Seminar for each course

Internal Mark Distribution for Practical Courses

Assessment Type	Marks	Scheme of Assessment
Lab work/Program Execution	40 marks	Two Internal Tests will be conducted and the average of the two will be considered
Observation/Record Notebook	5 marks	Assessment will be done during every practical class
Viva –Voce / Lab Quiz	5 marks	Two Lab Quiz Tests/viva-voce will be conducted and the average of the two will be considered

External Mark Distribution for Practical Courses

Assessment Type	Marks	Scheme of Assessment
Lab work/Program Execution	40 marks	End result of the Practical
Viva –Voce	10 marks	Oral Mode Test

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
QUESTION PAPER PATTERN

Internal Test – 40 Marks - 1 hr 45 mins Duration

S.No	Type of Questions	Marks
1.	Objective type Questions Multiple Choice – 4 questions Answer in a Word/Sentence – 4 questions	 04 04
2.	Short Answer –3 questions – either or type	3x4=12
3.	Long Answer–2 questions – either or type	2x10=20

Summative Examinations – 60 Marks -3 hrs Duration

S.No	Type of Questions	Marks
1.	Objective type Questions: Multiple Choice – 5 questions Answer in a Word/Sentence – 5 questions	 05 05
2.	Short Answer – 5 questions – either or type	5x4=20
3.	Long Answer – 3 questions – either or type	3x10=30

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics

Attainment of Course outcomes

Attainment of Course outcomes is computed using Direct and Indirect assessment methods. Direct Method of Assessment is based on performance of the students in the Continuous Internal Assessment Tests, Summative Examinations and supporting activities such as Seminar, Assignment, Case study, Group Discussion, Quiz, etc and Indirect Method of Assessment is based on periodical feedback from the students at the end of each course.

Weightage of Direct and Indirect Assessment in computation of attainment of each course is 70% for Direct Assessment and 30% for Indirect Assessment.

Direct Assessment of Course outcome attainment

i) **Rubrics**:

Internal Assessment contributes 60% and Summative Examinations Assessment contributes 40% to the Direct Assessment of a course outcome for Theory Courses. For the Practical Courses, Internal Assessment contributes 70% and Summative Examinations Assessment contributes 30% to the Direct Assessment of a course outcome.

ii) Setting of Target:

50% of the maximum mark is set as target of Internal Assessment tools and the average mark of the class is set as target of Summative Examinations Assessment.

Formula for calculating percentage attainment of each course outcome

Based on the result of Summative Examinations and Internal Assessment tools, the number of students scoring more than the target is found out.

For each Internal Assessment Tools,

$$\text{Percentage attainment of each course outcome} = \frac{\text{No. of. Students who scored more than the target in the concerned course outcome}}{\text{Total Number of Students}} \times 100$$

$$\text{Percentage attainment of each Course outcome for Internal Assessment tools} = \text{Average of percentage attainment of all Internal Assessment tools}$$

For Summative Examinations,

Percentage attainment of each Course outcome = $\frac{\text{No. of. Students who scored more than the target in the concerned CO}}{\text{Total Number of Students}} \times 100$

Formula for calculating Attainment Percentage of Course outcome of a course

Percentage Attainment of Course outcome for Internal Assessment tools	=	Average of percentage attainment of all COs
Percentage Attainment of Course outcome for Summative Examinations	=	Average of percentage attainment of all COs

Final Direct Assessment of Course outcome Attainment

For Theory Courses

Percentage Attainment of Course outcome through Direct Assessment	=	(0.6 x percentage attainment of CO for internal assessment tool) + (0.4 x percentage attainment of CO for summative examinations)

For Practical Courses

Percentage Attainment of Course outcome through Direct Assessment	=	0.7 x percentage attainment of CO for Internal Assessment tools + 0.3 x percentage attainment of CO for Summative Examinations

Indirect Assessment of CO Attainment

The course outcome feedback is conducted at the end of every semester by distributing structured feedback questionnaire to the students. The analysis of this feedback questionnaire is done on the following score. The feedback forms will be sorted with various scores and feedbacks with a score more than 5.5 are considered as satisfactory level for calculations for indirect attainment.

A : 10-8.5 **B :** 8.4-7.0 **C :** 6.9-5.5 **D :** 5.4-4.0 **E :** 3.9-0

Percentage attainment for each CO = $\frac{\text{Satisfaction Number}}{\text{Response Received}} \times 100$

Percentage Attainment of CO of a course = Average of percentage attainment of all COs

Final Assessment of CO attainment

Average course attainment = 0.7 x Direct assessment of CO attainment + 0.3 x Indirect assessment of CO attainment

Expected Level of Attainment for each of the Course Outcomes

CO	Level of Attainment
Above 70%	Excellent
60 -70 %	Very good
50-60 %	Good
40 – 50 %	Satisfactory
Below 40%	Not Satisfactory

Assessment of PO Attainment

At the end of the each programme, the Direct PO Assessment is done from the CO Attainment of all courses. The Direct PO Attainment for a particular course is determined from the attainment values obtained for each course outcome related to that PO and the CO-PO mapping values.

$$\text{Weighted contribution of the course in attainment of each PO} = \frac{\text{Weighted Percentage of contribution of the course in attainmentof each PO}}{\text{average course attainment}} \times 100$$

Expected Level of Attainment for each of the Programme Outcomes

PO	Level of Attainment
Above 70%	Excellent
60 -70 %	Very good
50-60 %	Good
40 – 50 %	Satisfactory
Below 40%	Not Satisfactory

Attainment of Programme Educational Objectives (PEO)

PEOs are assessed after 3 to 4 years of graduation. Attainment is measured based on the Feedback from Stakeholders

1. Alumni
2. Parents
3. Employer

The analysis of this feedback questionnaire is done on the following score. The feedback forms will be sorted with various scores and feedbacks with a score more than 5.5 are considered as satisfactory level for calculations for Indirect Attainment.

A : 10-8.5 **B :** 8.4-7.0 **C :** 6.9-5.5 **D :** 5.4-4.0 **E :** 3.9-0

$$\text{Percentage attainment of PEOs} = \frac{\text{Satisfaction number}}{\text{Response Received}} \times 100$$

Expected Level of Attainment for each of the Programme Educational Objectives

PEO	Level of Attainment
Above 70%	Excellent
60 -70 %	Very good
50-60 %	Good
40 – 50 %	Satisfactory
Below 40%	Not Satisfactory

SRI KALISWARI COLLEGE (AUTONOMOUS), Sivakasi
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
CURRICULUM STRUCTURE
OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM
(From 2021-2022 Batch onwards)

Courses	Sem I	Sem II	Sem III	Sem IV	Credits
Core Courses	6 (4) 6 (4) 6 (4) 6 (4)	6 (5) 6 (5) 6 (4) 6 (4)	6 (5) 6 (4) 6 (4) 6 (4)	6 (5) 6 (5) 6 (4) 6 (4)	69
Elective Courses	6 (4)	-	6 (4)	--	8
Non -Major Elective Course	--	6 (4)	--	--	4
Self-paced Learning (Swayam Course)	--	--	(3)	--	3
Project	--	--	--	6 (6)	6
Total Hours(Per week)/ Credits	30(20)	30(22)	30(24)	30(24)	120 90

SRI KALISWARI COLLEGE (AUTONOMOUS), Sivakasi
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
CURRICULUM PATTERN
OUTCOME-BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM
(From 2021-2022 Batch onwards)
PROGRAMME CODE – PMA

Semester	Course Code	Course Name	Hours	Credits
I	21PMAC11	**Core Course - I:** Abstract Algebra	6	4
	21PMAC12	**Core Course - II:** Real Analysis	6	4
	21PMAC13	**Core Course - III:** Graph Theory and Algorithms	6	4
	21PMAC14	**Core Course - IV:** Mathematical Statistics	6	4
	21PMAO11 21PMAO12 21PMAO13	**Elective Course - I:** 1. Combinatorial Techniques 2. Numerical Computation Techniques 3. Formal Languages and Automata Theory	6	4
		Total	**30**	**20**
II	21PMAC21	**Core Course - V:** Linear Algebra	6	5
	21PMAC22	**Core Course - VI:** Measure Theory	6	5
	21PMAC23	**Core Course - VII:** Ordinary and Partial Differential Equations	6	4
	21PMAC24	**Core Course - VIII:** Differential Geometry	6	4
	21PMAN21	**Non Major Elective Course :** Numerical Computation Methods	6	4
		Total	**30**	**22**
III	21PMAC31	**Core Course - IX:** Functional Analysis	6	5
	21PMAC32	**Core Course - X:** Optimization Techniques	6	4
	21PMAC33	**Core Course - XI:** Topology	6	4
	21PMAC34	**Core Course - XII:** Research Methodology	6	4
	21PMAO31 21PMAO32 21PMAO33	**Elective Course - II:** 1. Functions of Several Variables 2. Fuzzy Mathematics 3. Elements of Stochastic Processes	6	4
	21PMAM31 21PMAM32	**Self-paced Learning** (Swayam Course) 1. Introduction to Methods of Applied Mathematics 2. Regression Analysis		3
		Total	**30**	**24**
IV	21PMAC41	**Core Course - XIII:** Complex Analysis	6	5
	21PMAC42	**Core Course - XIV:** Number Theory and Cryptography	6	5
	21PMAC43	**Core Course - XV:** Integral Equations	6	4
	21PMAC44	**Core Course - XVI:** Mechanics	6	4
	21PMAJ41	**Core Course - XVII:** Project	6	6
		Total	**30**	**24**

SRI KALISWARI COLLEGE (AUTONOMOUS), Sivakasi
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
(From 2021-2022 Batch onwards)

PROGRAMME ARTICULATION MATRIX (PAM)

Semester	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7
I	21PMAC11	**Core Course - I:** Abstract Algebra	15	13	9	8	0	3	2
	21PMAC12	**Core Course - II:** Real Analysis	15	13	9	8	0	3	2
	21PMAC13	**Core Course - III:** Graph Theory and Algorithms	14	10	10	8	3	3	2
	21PMAC14	**Core Course - IV:** Mathematical Statistics	15	13	8	7	3	5	3
	21PMAO11 21PMAO12 21PMAO13	**Elective Course - I:** 1. Combinatorial Techniques 2. Numerical Computation Techniques 3. Formal Languages and Automata Theory	15	14	7	8	1	4	3
II	21PMAC21	**Core Course - V:** Linear Algebra	15	13	9	8	0	3	3
	21PMAC22	**Core Course - VI:** Measure Theory	15	13	9	6	0	3	3
	21PMAC23	**Core Course - VII:** Ordinary and Partial Differential Equations	15	14	8	6	0	5	4
	21PMAC24	**Core Course - VIII:** Differential Geometry	15	13	8	9	0	3	2
	21PMAN21	**Non Major Elective Course :** Numerical Computation Methods	12	8	2	10	0	7	5
III	21PMAC31	**Core Course - IX:** Functional Analysis	15	9	8	8	0	3	3
	21PMAC32	**Core Course - X:** Optimization Techniques	15	11	9	10	1	4	3
	21PMAC33	**Core Course - XI:** Topology	15	13	8	8	0	3	3
	21PMAC34	**Core Course - XII:** Research Methodology	13	4	12	5	9	5	5
	21PMAO31 21PMAO32 21PMAO33	**Elective Course - II:** 1. Functions of Several Variables 2. Fuzzy Mathematics 3. Elements of Stochastic Processes	15	9	8	8	0	3	3
	21PMAM31 21PMAM32	**Self-paced Learning** (Swayam Course) 1. Introduction to Methods of Applied Mathematics 2. Regression Analysis	13	10	10	9	3	2	8
IV	21PMAC41	**Core Course - XIII:** Complex Analysis	15	10	8	12	0	3	3
	21PMAC42	**Core Course - XIV:** Number Theory and Cryptography	15	13	8	8	1	3	3

	21PMAC43	**Core Course - XV:** Integral Equations	15	13	8	7	0	5	3
	21PMAC44	**Core Course - XVI:** Mechanics	15	11	7	7	0	4	3
	21PMAJ41	**Core Course - XVII:** Project	11	10	11	10	5	5	5
Total Weightage of all Courses Contributing to PO			**303**	**237**	**176**	**170**	**26**	**79**	**71**

SRI KALISWARI COLLEGE (AUTONOMOUS), Sivakasi
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
(From 2021-2022 Batch onwards)

PROGRAMME ARTICULATION MATRIX – WEIGHTED PERCENTAGE

Semester	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7
I	21PMAC11	**Core Course - I:** Abstract Algebra	4.95	5.49	5.11	4.71	0	3.8	2.82
	21PMAC12	**Core Course - II:** Real Analysis	4.95	5.49	5.11	4.71	0	3.8	2.82
	21PMAC13	**Core Course - III:** Graph Theory and Algorithms	4.62	4.22	5.68	4.71	11.54	3.8	2.82
	21PMAC14	**Core Course - IV:** Mathematical Statistics	4.95	5.49	4.55	4.12	11.54	6.33	4.23
	21PMAO11 21PMAO12 21PMAO13	**Elective Course - I:** 1. Combinatorial Techniques 2. Numerical Computation Techniques 3. Formal Languages and Automata Theory	4.95	5.91	3.98	4.71	3.85	5.06	4.23
II	21PMAC21	**Core Course - V:** Linear Algebra	4.95	5.49	5.11	4.71	0	3.8	4.23
	21PMAC22	**Core Course - VI:** Measure Theory	4.95	5.49	5.11	3.53	0	3.8	4.23
	21PMAC23	**Core Course - VII:** Ordinary and Partial Differential Equations	4.95	5.91	4.55	3.53	0	6.33	5.63
	21PMAC24	**Core Course - VIII:** Differential Geometry	4.95	5.49	4.55	5.29	0	3.8	2.82
	21PMAN21	**Non Major Elective Course :** Numerical Computation Methods	3.96	3.38	1.14	5.88	0	8.86	7.04
III	21PMAC31	**Core Course - IX:** Functional Analysis	4.95	3.8	4.55	4.71	0	3.8	4.23
	21PMAC32	**Core Course - X:** Optimization Techniques	4.95	4.64	5.11	5.88	3.85	5.06	4.23
	21PMAC33	**Core Course - XI:** Topology	4.95	5.49	4.55	4.71	0	3.8	4.23
	21PMAC34	**Core Course - XII:** Research Methodology	4.29	1.69	6.82	2.94	34.62	6.33	7.04
	21PMAO31 21PMAO32 21PMAO33	**Elective Course - II:** 1. Functions of Several Variables 2. Fuzzy Mathematics 3. Elements of Stochastic Processes	4.95	3.8	4.55	4.71	0	3.8	4.23
		Self-paced Learning (Swayam Course)	4.29	4.22	5.68	5.29	11.54	2.53	11.27

	21PMAM31 21PMAM32	1. Introduction to Methods of Applied Mathematics 2. Regression Analysis							
IV	21PMAC41	**Core Course - XIII:** Complex Analysis	4.95	4.22	4.55	7.06	0	3.8	4.23
	21PMAC42	**Core Course - XIV:** Number Theory and Cryptography	4.95	5.49	4.55	4.71	3.85	3.8	4.23
	21PMAC43	**Core Course - XV:** Integral Equations	4.95	5.49	4.55	4.12	0	6.33	4.23
	21PMAC44	**Core Course - XVI:** Mechanics	4.95	4.64	3.98	4.12	0	5.06	4.23
	21PMAJ41	**Core Course - XVII:** Project	3.63	4.22	6.25	5.88	19.23	6.33	7.04
Total Weighted Percentage of Course Contribution to Pos			**100**	**100**	**100**	**100**	**100**	**100**	**100**

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - I
CORE COURSE - I: ABSTRACT ALGEBRA (21PMAC11)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS :40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the basic ideas of counting principle, Sylow subgroups and some abstract concepts of Ring theory, Field theory, Galois theory.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the general theory and properties of algebraic structures in accordance with abstract algebra

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of abstract algebra

CO3[K4]: investigate different classes of rings

CO4[K5]: evaluate the method of constructing Galois group of a given polynomial

CO5[K5]: determine the suitable extension field in which a given polynomial has roots

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	2	2	1	-	-	-
CO3[K4]	3	3	2	2	-	1	-
CO4[K5]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	-	1	1
Weightage ofthe course	15	13	09	08	-	03	02
Weighted percentage of Course contribution to Pos	4.95	5.49	5.11	4.71	0	3.8	2.82

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Group Theory: A Counting Principle – Another Counting Principle – Sylow's Theorem – Direct Products – Finite Abelian Groups.

UNIT II **(18 hrs)**

Ring Theory: Ideals and Quotient Rings – More Ideals and Quotient Rings – The Field of Quotients of an Integral Domain –Euclidean Rings – A Particular Euclidean Ring.

UNIT III **(18 hrs)**

Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings over Commutative Rings.

UNIT IV **(18 hrs)**

Fields: Extension Fields – Roots of Polynomials – Construction with Straightedge and Compass–More about Roots.

UNIT V **(18 hrs)**

The Elements of Galois Theory – Solvability by Radicals – Galois Groups over the Rationals.

TEXTBOOK

1. Herstein, I.N. *Topics in Algebra.* New Delhi: John Wiley & Sons, Inc., Second Edition, 2009.

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1. Gopalakrishnan, N.S. *University Algebra.* New Delhi: New Age International (P) Limited Publishers, Revised Second Edition, 2005.
2. Fraleigh, John B. *A First Course in Abstract Algebra.* New Delhi: Narosa Publishing House, Third Edition, 1998.
3. Sharma, S.D. *Modern Algebra.* Meerut: KedarNath Ram Nath& Co Publishers, 1997.

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3. https://sites.math.washington.edu/~smith/Teaching/504/504.pdf
4. https://people.wou.edu/~beaverc/344/W12/SylowDefs.pdf
5. https://nptel.ac.in/courses/111/106/111106098/

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - I
CORE COURSE - II: REAL ANALYSIS (21PMAC12)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the fundamentals of mathematical analysis, the properties continuity, differentiability and integrability of real valued functions.

Course Outcomes (CO)

On Successful completion of the course, the learners will be able to

CO1[K2]: explain the basic concepts of real analysis and proof techniques in analysis

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of real analysis

CO3[K4]: investigate the countability of sets

CO4[K4]: analyze the properties continuity, differentiability, integrability of the functions f_n when transfered to the limit f under uniform convergence

CO5[K5]: evaluate continuity, differentiability, integrability of the functions

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	2	2	1	-	-	-
CO3[K4]	3	3	2	2	-	1	-
CO4[K4]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	-	1	1
Weightage of the course	15	13	09	08	-	03	02
Weighted percentage of Course contribution to POs	4.95	5.49	5.11	4.71	0	3.8	2.82

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Basic Topology: Finite, Countable and Uncountable Sets – Metric Spaces – Compact Sets – Perfect Sets – Connected Sets.

UNIT II **(18 hrs)**

Continuity: Limits of Functions – Continuous Functions – Continuity and Compactness –Continuity and Connectedness – Discontinuities – Monotonic Functions –Infinite Limits and Limits at Infinity.

UNIT III **(18 hrs)**

Differentiation: The Derivative of a Real Function – Mean Value Theorems – The Continuity of Derivatives – L'Hospital's Rule – Derivatives of Higher Order – Taylor's Theorem – Differentiation of Vector Valued Functions.

UNIT IV **(18 hrs)**

The Riemann-Stieltjes Integral: Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector Valued functions – Rectifiable curves.

UNIT V **(18hrs)**

Sequences and Series of Functions: Discussion of Main Problem – Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equicontinuous Families of Functions – The Stone - Weiertrass Theorem.

TEXTBOOK

1. Walter Rudin. *Principles of Mathematical Analysis*. Singapore: Mcgraw Hill Book Company, Third Edition.

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1. Apostol, Tom.M. *Mathematical Analysis*. New Delhi: Narosa Publishing House, Second Edition, 2002.
2. Malik, S.C. *Principles of Real Analysis.* New Delhi: New Age International (P) Limited, 2004.
3. Kar, B.K. *An Introduction to Modern Analysis Volume I*. Kolkata: Books and Allied (P) LTD, 2013.

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3. https://youtu.be/H2H02Hklr8k
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SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - I
CORE COURSE - III: GRAPH THEORY AND ALGORITHMS (21PMAC13)
(From 2021-2022 Batch onwards)

HOURS/ WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to some basic topics in graph theory and algorithms to solve graph optimization problems.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the basic concepts and definitions of graph theory

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of graph theory

CO3[K4]: investigate the characteristic features of various types of graphs

CO4[K5]: determine the efficient algorithm to solve graph optimisation problems

CO5[K6]: construct a graph theoretical model for the given practical problem

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	2	1	-	-	-
CO2[K3]	3	2	1	1	-	-	-
CO3[K4]	3	2	2	2	1	-	-
CO4[K5]	3	2	3	2	1	1	1
CO5[K6]	2	2	2	2	1	2	1
Weightage of the course	14	10	10	08	03	03	02
Weighted percentage of Course contribution to POs	4.62	4.22	5.68	4.71	11.54	3.8	2.82

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Trees and Connectivity: Definitions and Simple Properties – Bridges Spanning Trees – Connector Problems – Shortest Path Problems – Cut Vertices

and Connectivity.

UNIT II **(18 hrs)**

Euler Tours and Hamiltonian Cycles: Euler Tours – The Chinese Postman Problem – Hamiltonian Graphs – The Travelling Salesman Problem.

UNIT III **(18 hrs)**

Matchings: Matchings and Augmenting Paths – The Marriage Problem – The Personnel Assignment Problem – The Optimal Assignment Problem – A Chinese Postman Problem Postscript.

UNIT IV **(18 hrs)**

Planar Graphs: Plane and Planar Graphs – Euler's formula – The Platonic Bodies – Kuratowski's Theorem – Non-Hamiltonian Plane Graphs – The Dual of a Plane Graph.

UNIT V **(18 hrs)**

Colouring: Vertex Colouring – Vertex Colouring Algorithms – Critical Graphs – Cliques – Edge Colouring – Map Colouring.

TEXTBOOK

1. John Clark and Derek Allan Holton. *A First Look at Graph Theory.* Bombay: Allied Publishers Limited, 1995.

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1. Bondy, J.A. and Murty, U.S.R. *Graph theory with Applications.* Great Britain: The Macmillan press Ltd, 1982.
2. Narsingh Deo. *Graph Theory with Applications to Engineering and Computer Science.* Printice-Hall, Inc.
3. Kumaravelu, S. and Susheela Kumaravelu. *Graph Theory.* Sivakasi: Janaki Calendar Corporation.

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3. https://www.edutechlearners.com/download/Graphtheory.pdf
4. https://www.youtube.com/watch?v=28x7AGXJTa
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SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - I
CORE COURSE - IV: MATHEMATICAL STATISTICS (21PMAC14)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the various methods of finding the distribution of a function of random variables and the various techniques to find estimators of a parameter.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the basic concepts and techniques in sampling theory and theory of statistical inference

CO2[K3]: find the distribution of a function of random variables using different methods

CO3[K4]: investigate the methods of finding estimator of a parameter

CO4[K5]: determine the appropriate sufficient statistics for a parameter

CO5[K5]: determine the effective method of finding distribution function of random variables and estimator of a parameter

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	2	1	1	-	1	-
CO3[K4]	3	3	2	1	1	1	1
CO4[K5]	3	3	2	2	1	1	1
CO5[K5]	3	3	2	2	1	2	1
Weightage of the course	15	13	08	07	03	05	03
Weighted percentage of Course contribution to POs	4.95	5.49	4.55	4.12	11.54	6.33	4.23

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low ,'-' No Correlation)

UNIT I **(18 hrs)**

Distributions of Functions of Random Variables: Sampling Theory – Transformations of Variables of the Discrete Type – Transformations of Variables of the Continuous Type – The Beta, t, and F Distributions – Extensions of the Change-of-Variable Technique – Distributions of Order Statistics – The Moment-Generating-Function Technique – The Distributions of $\overline{X}$ and nS^2/σ^2 – Expectations of Functions of Random Variables.

UNIT II **(18 hrs)**

Limiting Distributions: Convergence in Distribution – Convergence in Probability – Limiting Moment-Generating Functions – The Central Limit Theorem – Some Theorems on Limiting Distributions.

UNIT III **(18 hrs)**

Introduction to Statistical Inference: Point Estimation – Confidence Intervals for Means – Confidence Intervals for Differences of Means – Tests of Statistical Hypotheses – Additional Comments about Statistical Tests – Chi-Square Tests.

UNIT IV **(18 hrs)**

Sufficient Statistics: Measures of Quality of Estimators – A Sufficient Statistic for a Parameter – Properties of a Sufficient Statistic – Completeness and Uniqueness.

UNIT V **(18 hrs)**

The Exponential Class of Probability Density Functions – Functions of a Parameter – The Case of Several Parameters – Minimal Sufficient and Ancillary Statistics – Sufficiency, Completeness, and Independence.

TEXTBOOK

1. Hogg, Robert V. and Craig, Allen T. *Introduction to Mathematical Statistics*. New Delhi: Pearson Education, Fifth Edition, 2005.

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Books

1. Kadarkarai Thangam, K. and Subas Chandra Bose, A. *Probability and Statistics*. Tuticorin: Jeyalakshmi Publishers, First Edition, 1995.
2. Irwin Miller and Marylees Miller. *John E.Freund's Mathematical Statistics with Applications*. Singapore: Pearson Education Inc., Eighth Edition, 2014.
3. Sharma, J.K. *Fundamentals of Business Statistics.* Noida: Vikas Publishing House Pvt Ltd, Second Edition, 2014.

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SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - I
ELECTIVE COURSE - I: COMBINATORIAL TECHNIQUES (21PMAO11)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to some basic techniques to enumerate combinatorial structures and analyze the solution of recurrence relations of sequence of numbers.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: recognize the techniques of enumerating combinatorial structures
CO2[K3]: apply the techniques to solve enumeration problems
CO3[K4]: analyze the principle of inclusion and exclusion
CO4[K5]: evaluate the solution of recurrence relations of sequence of numbers
CO5[K5]: determine the appropriate techniques to solve enumeration problems

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	3	1	1	-	1	-
CO3[K4]	3	3	1	2	-	1	1
CO4[K5]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	1	1	1
Weightage of the course	15	14	07	08	01	04	03
Weighted percentage of Course contribution to POs	4.95	5.91	3.98	4.71	3.85	5.06	4.23

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low,'-' No Correlation)

UNIT I **(18 hrs)**

Permutations and Combinations : Introduction – The Rules of Sum and Product – Permutations – Combinations – Distributions of Distinct Objects – Distributions of Nondistinct Objects.

UNIT II **(18 hrs)**

Generating Functions : Introduction – Generating Functions for Combinations –Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells – Partitions of Integers – Elementary Relations.

UNIT III **(18 hrs)**

Recurrence Relations : Introduction – Linear Recurrence Relations with Constant Coefficients – Solution by the Technique of Generating Functions – Recurrence Relations with Two Indices.

UNIT IV **(18 hrs)**

The Principle of Inclusion and Exclusion : Introduction – The Principle of Inclusion and Exclusion – The General Formula – Derangements – Permutations with Restrictions on Relative Positions.

UNIT V **(18 hrs)**

Polya's Theory of Counting : Introduction – Equivalence Classes under a Permutation Group – Equivalence Classes of Functions – Weights and Inventories of Functions – Polya's Fundamental Theorem – Generalization of Polya's Theorem.

TEXTBOOK

1. Liu, C.L. *Introduction to Combinatorial Mathematics*. New York: McGraw – Hill Book Company, 1968.

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1. David Guichard. *An Introduction to Combinatorics and Graph Theory*. California: Creative Commons Attribution, 2017.
2. Harris, John M., Hirst, Jeffry L., Michael and Mossinghoff, J. *Combinatorics and Graph Theory*. New York: Science + Business Media, Second Edition, 2008.
3. Brualdi, Richard A. *Introductory Combinatorics*. South Asia: Pearson India Education Services Pvt Ltd, Fourth Edition, 2008.

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SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - I
ELECTIVE COURSE - I: NUMERICAL COMPUTATION TECHNIQUES
(21PMAO12)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course familiarizes the learners with some basic techniques for the efficient numerical solution of problems in science and analyze approximation errors in the process of computation.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: recognize the methods of solving numerically the problems of computational mathematics

CO2[K3]: apply the methods to solve problems of computational mathematics numerically

CO3[K4]: analyze the errors caused by approximating the process of computation

CO4[K5]: evaluate the rate of convergence of the iterative methods

CO5[K5]: determine the choice of method applied for finding the solution of the problem

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	3	1	1	-	1	-
CO3[K4]	3	3	1	2	-	1	1
CO4[K5]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	1	1	1
Weightage of the course	15	14	07	08	01	04	03
Weighted percentage of Course contribution to POs	4.95	5.91	3.98	4.71	3.85	5.06	4.23

Based on the level of contribution ('3'-High,'2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Transcendental and Polynomial Equations: Introduction – Bisection method – Iteration Methods Based on First Degree Equation – Iteration Methods Based on Second Degree Equation – Rate of Convergence – General Iteration Methods – Methods for Complex Roots – Polynomial Equations – Choice of an Iterative Method and Implementation .

UNIT II **(18 hrs)**

System of Linear Algebraic Equations and Eigenvalue Problems: Introduction – Direct Methods – Error Analysis for Direct Methods – Iteration Methods.

UNIT III **(18 hrs)**

Eigenvalues and Eigenvectors – Bounds on Eigenvalues – Jacobi Method for Symmetric Matrices – Givens Method for Symmetric Matrices – Householder's Method for Symmetric Matrices – Rutishauser Method for Arbitrary Matrices – Power Method – Inverse Power Method – Choice of a Method.

UNIT IV **(18 hrs)**

Interpolation and Approximation : Introduction – Lagrange and Newton Interpolations – Finite Difference Operators – Interpolating Polynomials Using Finite Differences – Hermite Interpolation – Piecewise and Spline Interpolation – Choice of the Method.

UNIT V **(18 hrs)**

Differentiation and Integration: Introduction – Numerical Differentiation – Extrapolation Methods – Partial Differentiation – Numerical Integration – Methods Based on Interpolation – Composite Integration Methods – Romberg Integration.

TEXTBOOK

1. Jain, M.K., Iyengar, S.R.K. and Jain, R.K. *Numerical Methods for Scientific and Engineering Computation*. New Delhi: New Age International (P) Limited, Publishers, Sixth Edition, 2015.

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1. Devi Prasad. *An Introduction to Numerical Analysis*. New Delhi : Narosa Publishing House, Third Edition, 2006.
2. Sastry, S.S. *Introductory Methods of Numerical Analysis*. New Delhi : Prentice Hall of India Private Limited, 1999.

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SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - I
ELECTIVE COURSE - I: FORMAL LANGUAGES AND AUTOMATA THEORY
(21PMAO13)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course familiarizes the learners with the methods to describe and analyze the dynamic behavior of discrete systems in which signals are sampled periodically.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: recognize the techniques, mathematical properties of automata and the relations between various languages and kinds of formalized logics

CO2[K3]: apply the techniques to identify regular languages, context - free languages

CO3[K4]: analyze the relationship between derivation trees and derivation, the equivalence of PDA's and CFL's

CO4[K5]: determine the equivalence of two finite automata

CO5[K5]: determine the efficient algorithm to design abstract self propelled computing device that follow a predetermined sequence of operations automatically

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	3	1	1	-	1	-
CO3[K4]	3	3	1	2	-	1	1
CO4[K5]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	1	1	1
Weightage of the course	15	14	07	08	01	04	03
Weighted percentage	4.95	5.91	3.98	4.71	3.85	5.06	4.23

of Course contribution to POs							

Based on the level of contribution ('3'-High,'2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Finite Automata and Regular Expressions : Finite State Systems – Basic Definitions – Nondeterministic Finite Automata – Finite Automata with ε–moves – Regular Expressions.

UNIT II **(18 hrs)**

Properties of Regular Sets : The Pumping Lemma for Regular Sets – Closure Properties of Regular Sets – Decision Algorithms for Regular Sets – The Myhill–Nerode Theorem and Minimization of Finite Automata.

UNIT III **(18 hrs)**

Context–Free Grammars : Motivation and Introduction – Context–Free Grammars – Derivation Trees – Simplification of Context-Free Grammars – Chomsky Normal Form – Greibach Normal Form.

UNIT IV **(18 hrs)**

Pushdown Automata : Informal Description – Definitions – Pushdown Automata and Context-Free Languages.

UNIT V **(18 hrs)**

Properties of Context – Free Languages : The Pumping Lemma for CFL's – Closure Properties of CFL's – Decision Algorithms for CFL's.

TEXTBOOK

1. Hopcroft, John E. and Ullman, Jeffery D. *Introduction to Automata Theory, Languages and Computation*. New Delhi : Narosa Publishing House, 2002.

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1. Peter Linz. *An Introduction to Formal Languages and Automata*. Burlington : Jones & Bartlett Learning, Fifth Edition, 2012.
2. Tremblay, J.P. and Manohar, R. *Discrete Mathematical Structure with Applications to Computer Science*. New Delhi : Tata McGraw – Hill Publishing Company Limited, 2008.
3. Sharma, J.K. *Discrete Mathematics.* New Delhi : Macmillan India Ltd, Second Edition, 2005.

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SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - II
CORE COURSE - V: LINEAR ALGEBRA (21PMAC21)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS: 40**
CREDITS : 5 **EXT. MARKS: 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the properties of matrices and determinants and the different canonical forms of matrix of linear transformation which are useful in analyzing linear systems.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the general theory and properties of algebraic structures in accordance with linear algebra

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of linear algebra

CO3[K4]: analyze the basis of a vector space

CO4[K4]: investigate different canonical forms of matrix of a linear transformation

CO5[K5]: determine the similarity of linear transformations

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	2	2	1	-	-	-
CO3[K4]	3	3	2	2	-	1	1
CO4[K4]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	-	1	1
Weightage of the course	15	13	09	08	-	03	03
Weighted percentage of Course contribution to POs	4.95	5.49	5.11	4.71	0	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Vector Spaces and Modules: Elementary Basic Concepts – Linear Independence and Bases.

UNIT II **(18 hrs)**

Dual Spaces – Inner Product Spaces – Modules.

UNIT III **(18 hrs)**

Linear Transformations: The Algebra of Linear Transformations – Characteristic Roots – Matrices.

UNIT IV **(18 hrs)**

Canonical Forms: Triangular Form – Canonical Forms: Nilpotent Transformations – Canonical Forms: A Decomposition of V: Jordan Form – Canonical Forms: Rational Canonical Form.

UNIT V **(18 hrs)**

Trace and Transpose – Determinants – Hermitian, Unitary, and Normal Transformations.

TEXTBOOK

1. Herstein, I.N. *Topics in Algebra.* New Delhi: John Wiley & Sons, Inc., Second Edition, 2009.

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Books

1. Gopalakrishnan, N.S. *University Algebra.* New Delhi: New Age International (P) Limited Publishers, Revised Second Edition, 2005.
2. Kenneth Hoffman and Ray Kunze. *Linear Algebra.* New Delhi: Pearson Education, Inc., Second Edition, 2006.
3. Sharma, S.D. *Modern Algebra.* Meerut: KedarNath Ram Nath& Co., Publishers, 1997.

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1. https://books.google.co.in/books/about/TOPICS_IN_ALGEBRA_2ND_ED.html?id=6N2aoMYbYQMC&printsec=frontcover&source=kp_read_button&redir_esc=y
2. https://www.cin.ufpe.br/~jrsl/Books/Linear%20Algebra%20-%20Kenneth%20Hoffman%20&%20Ray%20Kunze%20.pdf
3. https://www.math.pku.edu.cn/teachers/anjp/textbook.pdf
4. https://link.springer.com/chapter/10.1007%2F3-7643-7350-4_4
5. https://www.youtube.com/watch?v=ijdG7JK1CuE

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - II
CORE COURSE - VI: MEASURE THEORY (21PMAC22)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 5 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the abstract concept measure on Euclidean space and the general theory of integral of a function with respect to Lebesgue measure.

Course Outcomes (CO)

On Successful completion of the course, the learners will be able to

CO1[K2]: explain measurable set, measurable function, Lebesgue integrable of functions, measurable spaces and the properties of Lebesgue measure and Lebesgue Integration

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of Lebesgue measure and Lebesgue Integration

CO3[K4]: appraise the concept of measure and integration in measure spaces

CO4[K5]: determine the convergence of sequence of measurable functions

CO5[K5]: recommend the appropriate way of defining a measure on a σ- algebra

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	-	-	-	-	
CO2[K3]	3	2	1	-	-	-	-
CO3[K4]	3	3	2	1	-	1	1
CO4[K5]	3	3	3	2	-	1	1
CO5[K5]	3	3	3	3	-	1	1
Weightage of the course	15	13	09	06	-	03	03
Weighted percentage of Course contribution to POs	4.95	5.49	5.11	3.53	0	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Lebesgue Measure: Introduction - Outer Measure – Measurable Sets and Lebesgue Measure – Measurable Functions – Littlewood's Three Principles.

UNIT II **(18 hrs)**

The Lebesgue Integral: The Riemann Integral – The Lebesgue Integral of a Bounded Function over a Set of Finite Measure – The Integral of a Non-negative Function – The General Lebesgue Integral.

UNIT III **(18 hrs)**

Differentiation and Integration: Differentiation of Monotone Functions – Functions of Bounded Variation – Differentiation of an Integral – Absolute Continuity – Convex Functions.

UNIT IV **(18 hrs)**

Measure and Integration: Measure Spaces **–** Measurable Functions – Integration – General Convergence Theorems – Signed Measures – The Radon-Nikodym Theorem.

UNIT V **(18 hrs)**

Measure and Outer Measure: Outer Measure and Measurability – The Extension Theorem – The Lebesgue-Stieltjes Integral.

TEXTBOOK

1. Royden, H.L. *Real Analysis.* New Delhi: Prentice-Hall of India Private Limited, Third Edition, 2005.

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Books

1. Barra, G.de. *Measure Theory and Integration.* New Delhi: New Age International (P) Limited, Publishers, 2011.
2. Jain, P.K., Gupta, V.P. and Pankaj Jain. *Lebesgue Measure and Integration*. New Delhi: New Age International (P) Limited, Publishers, Second Edition, 2014.
3. Mofidul Islam. *Concepts in Measure Theory.* New Delhi: Anmol Publications Pvt. Ltd, First Edition, 2013.

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1. https://www.scribd.com/document/435437184/H-L-Royden-Real-Analysis-pdf
2. https://www.scribd.com/doc/80976463/De-Barra-Measure-Theory-and-Integration
3. https://www.scribd.com/document/407401212/P-K-Jain-V-P-Gupta-Lebesgue-measure-and-integration-1986-Wiley-Halsted-Press-pdf
4. https://youtu.be/dNaMC1pZSVE?list=PLtKWB-wrvn4mbGE2XeUbnVw1cwAj4-f0C

5. https://youtu.be/JOvne7aC5bU?list=PLtKWB-wrvn4mbGE2XeUbnVw1cwAj4-f0C

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - II
CORE COURSE - VII: ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS
(21PMAC23)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the fundamental concepts of ordinary and partial differential equations and the solution methods to solve it.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the general form of linear ordinary differential equation of first order, second order, partial differential equation of first order and the method of finding solutions

CO2[K3]: solve linear ordinary differential equations with variable coefficients, linear equations with regular singular points

CO3[K3]: compute the successive approximations to the solution of initial value problems and the limit of its convergence

CO4[K4]: examine the linear independence of solutions of linear homogeneous ordinary differential equations with variable coefficients

CO5[K5]: evaluate the complete integrals of partial differential equations of the first order

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1 [K2]	3	2	1	2	-	1	-
CO2 [K3]	3	3	1	1	-	1	1
CO3 [K3]	3	3	2	1	-	1	1
CO4 [K4]	3	3	2	1	-	1	1
CO5 [K5]	3	3	2	1	-	1	1
Weightage of the course	15	14	08	06	-	05	04
Weighted percentage of Course contribution to POs	4.95	5.91	4.55	3.53	0	6.33	5.63

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low ,'-' No Correlation)

UNIT I **(18 hrs)**

Linear Equations with Variable Coefficients: Introduction – Initial Value Problems for the Homogeneous Equation – Solutions of the Homogeneous Equation – The Wronskian and Linear Independence – Reduction of the Order of a Homogeneous Equation – The Non- Homogeneous Equation – Homogeneous Equations with Analytic Coefficients – The Legendre Equation.

UNIT II **(18 hrs)**

Linear Equations with Regular Singular Points: Introduction – The Euler Equation – Second Order Equations with Regular Singular Points-an Example – Second Order Equations with Regular Singular Points-The General Case – A Convergence Proof – The Exceptional Cases – The Bessel Equation – The Bessel Equation (Continued).

UNIT III **(18 hrs)**

Existence and Uniqueness of Solutions to First Order Equations: Introduction – Equations with Variables Separated – Exact Equations – The Method of Successive Approximations – The Lipschitz Condition – Convergence of the Successive Approximations – Non-Local Existence of Solutions – Approximations to, and Uniqueness of, Solutions.

UNIT IV **(18 hrs)**

Partial Differential Equations of the First Order: Partial Differential Equations – Origins of First-order Partial Differential Equations – Cauchy's Problem for First-order Equations – Linear Equations of the First Order – Integral Surfaces Passing Through a Given Curve.

UNIT V **(18 hrs)**

Surfaces Orthogonal to a Given System of Surfaces – Nonlinear Partial Differential Equations of the First Order – Cauchy's Method of Characteristics – Compatible Systems of First-order Equations – Charpit's Method – Special Types of First-order Equations.

TEXTBOOKS

1. Coddington, Earl.A. *An Introduction to Ordinary Differential Equations*. New Delhi: Prentice-Hall of India Private Limited., 2006. **(UNITS I, II & III)**
2. Sneddon, IAN N. *Elements of Partial Differential Equations*. New Delhi: McGraw Hill Book Company, International Edition, 1957. **(UNITS IV & V)**

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Books

1. Raisinghania, M.D. *Ordinary and Partial Differential Equations.* New Delhi: S.Chand & Company LTD, Fifteenth Revised Edition, 2013.
2. Somasundaram, D. *Ordinary Differential Equations A First Course*. New Delhi: Narosa Publishing House, 2001.
3. Parashar, B.P. *Differential and Integral Equations.* New Delhi: CBS Publishers & Distributors Pvt. Ltd, Second Edition, 2008.

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1. https://fdocuments.in/document/earl-coddington-an-introduction-to-ordinary-differential-equations-5672f451685dd.html
2. https://www.academia.edu/35768905/ Dover Books on Mathematics Ian N Sneddon Elements of partial differential equations Dover Publications 2006
3. https://www.google.co.in/books/edition/Ordinary and Partial Differential Equati/vaorDAAAQBAJ?hl=en&gbpv=1&dq=M.D.Raisinghania.+Ordinary+and+Partial+Differential+Equations.&printsec=frontcover
4. https://www.google.co.in/books/edition/Ordinary Differential Equations/PduY2CjJ1zEC?hl=en&gbpv=1&dq=Dr.D.Somasundaram.+Ordinary+Differential+Equations.&printsec=frontcover
5. https://www.google.co.in/books/edition/Differential Equations with Applications/VqWKDQAAQBAJ?hl=en&gbpv=1&dq=B.P.Parashar.+Differential+and+Integral+Equations&printsec=frontcover

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - II
CORE COURSE - VIII: DIFFERENTIAL GEOMETRY (21PMAC24)
(From 2021-2022 Batch onwards)

HOURS/WEEK : 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the classical theory of curves and surfaces and its properties.

Course Outcomes (CO)

On Successful completion of the course, the learners will be able to

CO1[K2]: explain the theory of plane and space curves and surfaces in the three dimensional Euclidean space

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of surface theory

CO3[K4]: differentiate local intrinsic and non- intrinsic properties of a surface

CO4[K4]: investigate different types of curvature of curves and surfaces

CO5[K5]: evaluate the characteristics of developable surfaces

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	2	1	1	-	-	-
CO3[K4]	3	3	2	2	-	1	-
CO4[K4]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	3	-	1	1
Weightage of the course	15	13	08	09	-	03	02
Weighted percentage of Course contribution to POs	4.95	5.49	4.55	5.29	0	3.8	2.82

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

The Theory of Space Curves : Introductory Remarks about Space Curves – Definitions– Arc Length – Tangent, Normal and Binormal– Curvature and

Torsion of a Curve Given as the Intersection of Two Surfaces –Contact between Curves and Surfaces– Tangent Surface, Involutes and Evolutes.

UNIT II **(18 hrs)**

Intrinsic Equations, Fundamental Existence Theorem for Space Curves– Helices.**The Metric: Local Intrinsic Properties of a Surface:** Definition of a Surface – Curves on a Surface– Surfaces of Revolution – Helicoids.

UNIT III **(18 hrs)**

Metric– Direction Coefficients– Families of Curves – Isometric Correspondence – Intrinsic Properties – Geodesics –Canonical Geodesic Equations– Normal Property of Geodesics.

UNIT IV **(18 hrs)**

The Second Fundamental Form: Local Non-intrinsic Properties of a Surface: The Second Fundamental Form– Principal Curvature – Lines of Curvature–Developables– Developables Associated with Space Curves– Developables Associated with Curves on Surfaces.

UNIT V **(18 hrs)**

Minimal Surfaces – Ruled Surfaces– The Fundamental Equations of Surface Theory – Parallel Surfaces– Fundamental Existence Theorem for Surfaces.

TEXTBOOK

1. Willmore, T.J. *An Introduction to Differential Geometry.* New Delhi: Oxford University Press, 2006.

REFERENCES

Books

1. Sharma, J.N. and Vasishtha, A.R. *Differential Geometry*. Delhi: Published by Kedar Nath, Ram Nath, 2006.
2. Mittal, B.C. and Agarwal, D.C. *Differential Geometry*. Delhi: Krishna Prakashan Media (P). Ltd, Thirty Second Edition, 2016.
3. Somasundaram, D. *Differential Geometry*. New Delhi: Narosa Publishing House, 2017.

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1. https://www.scribd.com/book/271605482/An-Introduction-to-Differential-Geometry
2. https://youtu.be/6js84WA8f58?list=PLq-Gm0yRYwTiFb-dfmrz4E8g6v6tg-x3j
3. https://www.youtube.com/watch?v=VHPkHa-5iF0
4. https://youtu.be/rw-tjXLzmRY?list=PLZKJ6AHbApB8UQiZRvp0snnYIs9DcyCOl

5. https://mei.org.uk/files/conference08/A5%282008%29.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme
SEMESTER - II
NON MAJOR ELECTIVE COURSE : NUMERICAL COMPUTATION METHODS
(21PMAN21)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to some basic techniques for efficient numerical solution of problems in science and analyze approximation errors in the process of computation.

Course Outcomes (CO)

On Successful completion of the course, the learners will be able to

CO1[K1]: state the elementary concepts of numerical methods

CO2[K2]: explain the methods for solving mathematical problems numerically

CO3[K3]: apply numerical methods to solve algebraic, transcendental, simultaneous and difference equations and to compute numerical differentiation and integration of functions that are defined by its numerical values

CO4[K4]: analyze the finite difference operators

CO5[K4]: analyze the method of interpolation for finding the unknown data value between known data values

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K1]	2	1	-	2	-	-	1
CO2[K2]	3	2	-	2	-	1	1
CO3[K3]	3	2	2	2	-	2	1
CO4[K4]	2	2	-	2	-	2	1
CO5[K4]	2	1	-	2	-	2	1
Weightage of the course	12	08	02	10	-	07	05
Weighted percentage of Course contribution to POs	3.96	3.38	1.14	5.88	0	8.86	7.04

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

The Solution of Numerical Algebraic and Transcendental Equations: The Bisection Method – Iteration Method – The condition for the Convergence of the Method – Order of convergence of an iterative process – Regula Falsi Method – Geometrical interpretation – Newton- Raphson Method – Geometrical meaning of Newton's Method – Criterion for the Convergence in Newton-Raphson Method – Order of Convergence of Newton's Method – Generalised Newton's Method – Horner's method – Graeffe's Root Squaring Method.

UNIT II **(18 hrs)**

Solution of Simultaneous Linear Algebraic Equations Direct methods: Introduction – Gauss - Elimination Method – Gauss – Jordan elimination Method – Inversion of a matrix using Gauss - Elimination Method – Method of Triangularization – Crout's method – Crout's method for finding the inverse of matrix – Iterative methods – Jacobi method of iteration or Gauss Jacobi method – Gauss - Seidel method of iteration - Relaxtion methods.

UNIT III **(18 hrs)**

Finite Differences: Finite difference – Express any value of y in term of y_n and the backward differences of y_n– Differences of a polynomial – Factorial polynomial –Error propagation in a difference table – Finite integration (or Inverse operator Δ^{-1}) – Summation of Series – Monmort's Theorem. **Interpolation for equal intervals :** Introduction – Linear Interpolation or method of proportional parts – Gregory-Newton Forward Interpolation Formula or Newton's Forward Interpolation Formula– Gregory-Newton Backward Interpolation Formula – Error in polynomial interpolation – Error in Newton's forward interpolation formula – Error in Newton's backward interpolation formula – Equidistant terms with one or more missing values.

UNIT IV **(18 hrs)**

Numerical Differentiation and Integration: Introduction – Newton's forward difference formula to get the derivative – Newton's backward difference formula to compute the derivative. **Numerical Integration** : Introduction – A general quadrature formula for equidistant ordinates – Trapezoidal rule – Geometrical interpretation – Truncation error in Trapezoidal rule – Romberg's Method – Simpson's one-third rule – Simpson's three-eights rule – Weddle's rule – Truncation error in Simpson's formula.

UNIT V **(18 hrs)**

Difference Equations: Definition – order and degree of a difference equation – Linear difference equations – To find complementary function of f(E).

$y_x = \phi(x)$ – To find particular integral of f(E). $y_x = \phi(x)$ – Solution of homogeneous linear equation.

TEXTBOOK

1. Kandasamy, D., Thilagavathy, K. and Gunavathi, K. *Numerical methods.* New Delhi: S.Chand and Company Ltd, 2012.

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1. Arumugam, S., Thangapandi Issac, A. and Somasundran, A. *Numerical Analysis*. Palayamkottai: New Gamma Publishing house, November 2003.
2. Devi Prasad. *An Introduction to Numerical Analysis*. New Delhi : Narosa Publishing House, 2006.
3. Conte, S.D. and Carl de Boor. *Elementary Numerical Analysis - An Algorithmic Approach.* New Delhi : Tata Mc Graw - Hill Publishing Company Limited, 2006.

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2. https://theengineeringmaths.com/wp-content/uploads/2017/11/num-solutions.pdf
3. https://nptel.ac.in/content/storage/111/107/111107105/MP4/mod02lec08.mp4
4. https://youtu.be/oY1F9QGLdTY
5. https://youtu.be/f_EqOpgRwRM

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
CORE COURSE - IX: FUNCTIONAL ANALYSIS (21PMAC31)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 5 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course familiarizes the learners with the basic structure of a normed space and the continuous linear operators defined on Banach spaces.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the basic concepts, principles and methods of Functional Analysis

CO2[K3]: apply the analytical techniques and theoretical knowledge to produce the proofs of results that arise in the context of Functional Analysis

CO3[K4]: interpret spectrum of a bounded operator

CO4[K4]: examine the reflexivity of Banach spaces

CO5[K5]: determine the weak and weak* convergence of sequences in a normed space

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1 [K2]	3	1	1	1	-	-	-
CO2 [K3]	3	2	1	1	-	-	-
CO3 [K4]	3	2	2	2	-	1	1
CO4 [K4]	3	2	2	2	-	1	1
CO5 [K5]	3	2	2	2	-	1	1
Weightage of the course	15	09	08	08	-	03	03
Weighted percentage of Course contribution to POs	4.95	3.8	4.55	4.71	0	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

UNIT I **(18 hrs)**

Fundamentals of Normed Spaces: Normed Spaces – Continuity of Linear Maps.

UNIT II **(18 hrs)**

Hahn-Banach Theorems – Banach Spaces.

UNIT III **(18 hrs)**

Bounded Linear Maps on Banach Spaces: Uniform Boundedness Principle - Closed Graph and Open Mapping Theorems.

UNIT IV **(18 hrs)**

Bounded Inverse Theorem – Spectrum of a Bounded Operator. **Spaces of Bounded Linear Functionals:** Duals and Transposes.

UNIT V **(18 hrs)**

Duals of L^p ([a,b]) and C ([a,b]) – Weak and weak* Convergence – Reflexivity.

TEXTBOOK

1. Limaye, Balmohan V. *Functional Analysis*. New Delhi: New Age International (P) Limited, 2017.

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1. Ponnusamy, S. *Foundations of Functional Analysis*. New Delhi: Narosa Publishing House, 2002.
2. Chandrasekhara Rao, K. *Foundations of Functional Analysis*. New Delhi: Narosa Publishing House, 2002.
3. Walter Rudin. *Functional Analysis*. New Delhi: McGraw Hill Education (India) Private Limited, 2013.

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2. https://www.google.com/url?sa=t&source=web&rct=j&url=http://link.springer.com/content/pdf/10.1007%252F978-981-10-0972 3_4.pdf&ved=2ahUKEwi83eub36_vAhVQzjgGHddVB9AQFjACegQICxAC&usg=AOvVaw3nhvnExqsrwWgTcxq_xDM1
3. https://www.google.com/url?sa=t&source=web&rct=j&url=https://faculty.etsu.edu/gardnerr/Func/notes/6-4.pdf&ved=2ahUKEwiQ-_zD36_vAhVF4zgGHX39D80QFjABegQIAhAG&usg=AOvVaw1oXcbB8gutNEGCyc1N2Hvf&cshid=1615723629875

4. https://youtu.be/pd3jUcTA5pA
5. https://youtu.be/M1h9l5p95Yk

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
CORE COURSE - X: OPTIMIZATION TECHNIQUES (21PMAC32)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the problem solving techniques and methods that can be applied in the pursuit of improved decision making.

Course Outcomes (CO)

On Successful completion of the course, the learners will be able to

CO1[K2]: explain the techniques and methods of finding the optimum solution to decision making problems

CO2[K3]: solve the various optimization problems

CO3[K4]: categorize the various types of queuing models

CO4[K4]: examine the functions for extreme points

CO5[K5]: determine the appropriate method of solving the decision making problem

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	2	-	-	-
CO2[K3]	3	2	1	2	-	1	-
CO3[K4]	3	2	2	2	-	1	1
CO4[K4]	3	2	2	2	-	1	1
CO5[K5]	3	3	3	2	1	1	1
Weightage of the course	15	11	09	10	01	04	03
Weighted percentage of Course contribution to POs	4.95	4.64	5.11	5.88	3.85	5.06	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Network Models: Network Definitions – Minimal Spanning Tree Algorithm – Shortest - Route Problem – Maximal Flow Model – Minimum-Cost Capacitated Flow Problem – CPM and PERT.

UNIT II **(18 hrs)**

Queuing Systems: Why Study Queues? – Elements of a Queuing Model – Role of Exponential Distribution – Pure Birth and Death Models (Relationship between the Exponential and Poisson Distributions) – Generalized Poisson Queuing Model.

UNIT III **(18 hrs)**

Specialized Poisson Queues – (M/G/1): (GD/ ∞/ ∞) – Pollaczek-Khintchine (P-K) Formula – Other Queuing Models – Queuing Decision Models.

UNIT IV **(18 hrs)**

Classical Optimization Theory: Unconstrained Problems – Constrained Problems.

UNIT V **(18 hrs)**

Non - Linear Programming Algorithms: Unconstrained Algorithms – Constrained Algorithms.

TEXTBOOK

1. Taha, Hamdy A. *Operations Research An Introduction*. New Delhi: Prentice Hall of India Private Limited, Seventh Edition, 2004.

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1. Kanti Swarup, Gupta, P.K. and Man Mohan. *Operations Research*. New Delhi: Sultan Chand & Sons, Sixteenth Edition, 2012.
2. Premkumar Gupta, Er. and Kira, D.S. *Problems in Operations Research.* New Delhi: S.Chand and Company Ltd, 2012.
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2. www.brainkart.com/article/Classical -optimaztion theory - 11259/
3. https://www.pdfdrive.com/introduction-to-operations-research-e34458313.html
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5. https://youtu.be/xGkpXk-AnWU

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
CORE COURSE - XI: TOPOLOGY (21PMAC33)
(From 2021-2022 Batch onwards)

HOURS/ WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the elementary concepts associated with topological spaces and some properties of a topological space.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the basic concepts of general topology

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of general topology

CO3[K4]: analyze different topologies on the same set

CO4[K4]: explore the properties of separation axioms

CO5[K5]: determine the topology in which the given space is metrizable

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	-	-	-
CO2[K3]	3	2	1	1	-	-	-
CO3[K4]	3	3	2	2	-	1	1
CO4[K4]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	-	1	1
Weightage of the course	15	13	08	08	-	03	03
Weighted percentage of Course contribution to POs	4.95	5.49	4.55	4.71	0	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Topological spaces and Continuous Functions: Topological Spaces – Basis for a Topology – The Order Topology – The Product Topology on $X \times Y$ – The Subspace Topology – Closed Sets and Limit Points – Continuous Functions.

UNIT II **(18 hrs)**

The Product Topology – The Metric Topology – The Metric Topology (Continued). **Connectedness and Compactness:** Connected Spaces – Connected Subspaces of the Real Line – Components and Local Connectedness.

UNIT III **(18 hrs)**

Compact Spaces – Compact Subspaces of the Real Line – Limit Point Compactness – Local Compactness.

UNIT IV **(18 hrs)**

Countability and Separation Axioms: The Countability Axioms – The Separation Axioms – Normal Spaces – The Urysohn Lemma.

UNIT V **(18 hrs)**

The Urysohn Metrization Theorem – The Tietze Extension Theorem – The Tychonoff Theorem.

TEXTBOOK

1. Munkres, James R. *Topology*. New Delhi: Prentice Hall of India Private Limited, Second Edition.

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1. Gamelin, Theodore W., Robert Everist Greene. *Introduction to Topology*. Canada: General Publishing Company Limited, Second Edition, 1999.
2. Simmons, George F. *Introduction to Topology and Modern Analysis.* New Delhi: Tata Mc Graw - Hill Publishing Company Limited, 2006.
3. Joshi, K.D. *Introduction to General Topology*. New Delhi: New Age International (P) Ltd., 2006.

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1. https://editorialdinosaurio.files.wordpress.com/2012/03/topology 2ed - james munkres.pdf
2. https://www.pdfdrive.com/introduction-to-topology-and-modern-analysis-d176226233.html
3. https://www.scribd.com/book/271615365/Introduction-to-Topology-Second-Edition
4. https://proofwiki.org/wiki/Sequence Lemma
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SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
CORE COURSE - XII: RESEARCH METHODOLOGY (21PMAC34)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS: 40**
CREDITS : 4 **EXT. MARKS: 60**
DURATION : 90hrs **MAX.MARKS: 100**

Preamble

This course introduces the students to the different essential elements in writing a research paper and the essential LaTex techniques needed for documentations.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the essential components in writing a research paper
CO2[K3]: apply the LaTex techniques in preparing a research document
CO3[K4]: analyse the different elements in writing a research paper
CO4[K5]: assess the method of preparing the list of works cited and sources in the text
CO5[K1]: identify the research ethics in documentations

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	2	-	2	1	2	1	1
CO2[K3]	2	-	2	1	-	1	1
CO3[K4]	3	2	3	1	2	1	1
CO4[K5]	3	2	3	1	2	1	1
CO5[K1]	3	-	2	1	3	1	1
Weightage of the course	13	04	12	05	09	05	05
Weighted percentage of Course contribution to POs	4.29	1.69	6.82	2.94	34.62	6.33	7.04

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Research Methodology: An Introduction: Meaning of Research – Objectives of Research – Motivation in Research – Types of Research – Research

Approaches – Significance of Research - Research Methods versus Methodology – Research and Scientific Method – Importance of Knowing How Research is Done - Research Process – Criteria of Good Research.

UNIT II **(18 hrs)**

Research Ethics, Plagiarism and Impact of Research: Research Ethics - Codes and Policies for Research Ethics – Responsibilities as a researcher – Plagiarism – Plagiarism Detection Softwares. **Funding Agencies and Research Grants:** Research Funding – Department of Science and Technology (DST) –All India Council for Technical Education (AICTE) – University Grants Commission (UGC) – Council of Scientific and Industrial Research (CSIR). **Citations : An Overview:** Why Cite? - The Basics of Citation.

UNIT III **(18 hrs)**

Creating Tables and Inserting Pictures: Writing in columns – Typesetting Tables – Drawing Lines in Tables – Understanding Formatting Arguments – Increasing Row Height – Beautifying Tables – Spanning Entries over Multiple Columns – Inserting Code Column-Wise – Spanning Entries over Multiple Rows – Adding Captions to Tables – Placing Captions Above – Auto-Fitting Columns to the Table Width – Generating Multi-Page Tables – Coloring Tables – Using Landscape Orientation – Aligning Columns at the Decimal Point – Handling Narrow Columns – Inserting Pictures – Scaling Pictures – Choosing the Optimal File Type – Including Whole Pages – Putting Images behind the Text – Managing Floating Environment – Understanding Float Placement Options – Forcing the Output of Floats – Limiting Floating – Avoiding Floating at All – Spanning Figures and Tables over Text Columns – Letting Text Flow around Figures– Breaking Figures and Tables into Pieces.

UNIT IV **(18 hrs)**

Typing Math Formulas: Writing basic formulas - Embedding Math Expressions within Text – Displaying Formulas – Numbering Equations – Adding Subscripts and Superscripts – Extracting Roots – Writing Fractions – Greek Letters – Script Letters – Producing an Ellipsis – Comparing in-line Formulas to Displayed Formulas – Changing the Font, Style, and Size – Customizing Displayed Formulas – Aligning Multi-Line Equations – Numbering Rows in Multi-Line Formulas – Inserting Text into Formulas – Fine-Tuning Formulas – Using Operators – Exploring the Wealth of Math Symbols – Writing Units – Building Math Structures –Stacking Expressions – Writing Theorems and Definitions. **Using Fonts:** Preparing the encoding – Installing Additional Fonts – Choosing the Main Font – Loading Font Packages – Serif Fonts – Sans-Serif Fonts – Typewriter Fonts Exploring the World of LaTex Fonts.

UNIT V **(18 hrs)**

Technical Writing and Reporting of Research: Research Report – Types of Reports – Technical Report – Popular Report – Dissertation and Thesis – Research Paper – Review Articles – Short Communication – Conference – Meeting Report – Structure of a Research Paper – Reference Management Software – Impact Factor – Calculation of Impact Factor – Journal Citation Report – Indexing of Journal.

TEXTBOOKS

1. Kothari, C.R. *Research Methodology (Methods and Techniques).* New Delhi: New Age International (P) Ltd Publishers, 2006. **(UNITS I & V)**
2. Shanti Phushan Mishra and Shashi Alok. *Handbook of Research Methodology (A Compendium for Scholars and Researchers).* New Delhi: Educreation Publishing, 2019. **(UNIT II)**
3. Charles Lipson. *Cite Right.* London: The University of Chicago Press, Ltd, 2006. **(UNIT II)**
4. Stefan Kottwitz. *LaTeX (Beginner's Guide).* UK: Packt Publishing Ltd, 2011. **(UNITS III & IV)**

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1. Bindrawan Lal. *Research Methodology*. Jaipur: ABD Publishers, 2002.
2. George Gratzer. *More Math into LATEX.* Springer Science + Business Media LLC, 4th Edition, 2007.
3. Wilkins, David R. *Getting Started with LATEX*. Canada: The University of Manitoba, 1995.

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1. https://www.modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf
2. https://www.researchgate.net/publication/319207471_HANDBOOK_OF_RESEARCH_METHODOLOGY
3. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjJmM65g6rvAhXOWisKHcyNCi8QFjAAegQIAhAD&url=https%3A%2F%2Fpress.uchicago.edu%2Fdam%2Fucp%2Fbooks%2Fpdf%2Fcourse_intro%2F978-0-226-43110-9-chapter_one.pdf&usg=AOvVaw0NEMRB-7A0NsTQQnv0koQN
4. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiXlr3jg6rvAhXTbn0KHTrtDVYQFjAAegQIARAD&url=http%3A%2F%2Fstatic.latexstudio.net%2Fwp-content%2Fuploads%2F2015%2F03%2FLaTeX_Beginners_Guide.pdf&usg=AOvVaw2hZD3u5i6wWdHkkdcO5emI
5. https://libguides.tru.ca/mathstats/citation

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
ELECTIVE COURSE - II: FUNCTIONS OF SEVERAL VARIABLES (21PMAO31)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the methodology to extend the concepts and ideas of a function of real variables to several variables.

Course Outcomes (CO)

On Successful completion of the course, the learners will be able to

CO1[K2]: explain the basic concepts and algebraic facts related to sets of vectors in Euclidean n - space

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of several variables

CO3[K4]: investigate the differentiability and continuity of functions of several variables

CO4[K4]: analyze integration of the differential forms – Closed forms and Exact forms

CO5[K5]: evaluate the integrals of 1-forms, 2-forms in R^3

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	1	1	-	-	-
CO2 [K3]	3	2	1	1	-	-	-
CO3[K4]	3	2	2	2	-	1	1
CO4[K4]	3	2	2	2	-	1	1
CO5[K5]	3	2	2	2	-	1	1
Weightage of the course	15	09	08	08	-	03	03
Weighted percentage of Course contribution to POs	4.95	3.8	4.55	4.71	0	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Functions of Several Variables : Linear Transformations – Differentiation – The Contraction Principle.

UNIT II **(18 hrs)**

The Inverse Function Theorem – The Implicit Function Theorem – The Rank Theorem.

UNIT III **(18 hrs)**

Determinants – Derivatives of Higher order –Differentiation of Integrals – **Integration of Differential Forms:** Integration.

UNIT IV **(18 hrs)**

Primitive Mapping – Partitions of Unity – Change of Variables – Differential Forms – Simplexes and Chains.

UNIT V **(18 hrs)**

Stokes' Theorem – Closed Forms and Exact Forms – Vector Analysis.

TEXTBOOK

1. Walter Rudin. *Principles of Mathematical Analysis*. Singapore: Mcgraw Hill Book Company, Third Edition.

REFERENCES

Books

1. Somasundaram, D. and Choudhary, B. *A first Course in Mathematical Analysis*. New Delhi: Narosa Publishing House, Second Edition, 2005.
2. Malik, S.C. *Principles of Real Analysis.* New Delhi: New Age International (P) Limited, 2004.
3. Kar, B.K. *An Introduction to Modern Analysis Volume I.* Kolkata: Books and Allied (P) LTD, 2013.

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1. https://www.scribd.com/doc/314331939/Principles-of-Mathematical-Analysis-Walter-Rudin
2. https://www.youtube.com/watch?v=cY6YSZsCR5A&list=RDCMUC640y4UvDAlya_WOj5U4pfA&start_radio=1&t=6s
3. https://www.youtube.com/watch?v=X6kp2o3mGtA&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy&index=12
4. https://books.google.co.in/books?id=FyybL1ma4twC&lpg=PP4&pg=PA229#v=onepage&q&f=false
5. https://www.youtube.com/watch?v=msIZz8ydzcM

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
ELECTIVE COURSE - II: FUZZY MATHEMATICS (21PMAO32)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the mathematical representation of fuzziness by means of fuzzy set theory.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to
CO1[K2]: explain the basic concepts and main components of fuzzy set theory
CO2[K3]: solve fuzzy equations using fuzzy numbers
CO3[K4]: analyze the different standard fuzzy operations
CO4[K4]: investigate the different classes of fuzzy measures
CO5[K5]: evaluate the properties of crisp and fuzzy relations

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	1	1	-	-	-
CO2[K3]	3	2	1	1	-	-	-
CO3[K4]	3	2	2	2	-	1	1
CO4[K4]	3	2	2	2	-	1	1
CO5[K5]	3	2	2	2	-	1	1
Weightage of the course	15	09	08	08	-	03	03
Weighted percentage of Course contribution to POs	4.95	3.8	4.55	4.71	0	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low ,'-' No Correlation)

UNIT I **(18 hrs)**

From Ordinary (Crisp) Sets to Fuzzy Sets: A Grand Paradigm Shift: Introduction **–**Crisp Sets: An Overview **–** Fuzzy Sets: Basic Types – Fuzzy Sets: Basic Concepts. **Fuzzy Sets Versus Crisp Sets:** Additional Properties of α-Cuts – Representations of Fuzzy Sets – Extension Principle for Fuzzy Sets.

UNIT II **(18 hrs)**

Operations on Fuzzy Sets: Types of Operations – Fuzzy Complements – Fuzzy Intersections: t-Norms – Fuzzy Unions: t-Conorms – Combinations of Operations.

UNIT III **(18 hrs)**

Fuzzy Arithmetic: Fuzzy Numbers – Linguistic Variables – Arithmetic Operations on Intervals – Arithmetic Operations on Fuzzy Numbers – Lattice of Fuzzy Numbers – Fuzzy Equations.

UNIT IV **(18 hrs)**

Fuzzy Relations: Crisp and Fuzzy Relations – Projections and Cylindric Extensions – Binary Fuzzy Relations – Binary Relations on a Single Set – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Ordering Relations – Fuzzy Morphisms.

UNIT V **(18 hrs)**

Possibility Theory: Fuzzy Measures – Evidence Theory – Possibility Theory – Fuzzy Sets and Possibility Theory – Possibility Theory versus Probability Theory.

TEXTBOOK

1. Klir, George J. and Bo Yuan. *Fuzzy Sets & Fuzzy Logic*. Chennai: Pearson India Education Services Private Limited, 2016.

REFERENCES

Books

1. Nguyen, Hung T. and Walker, Elbert A. *A First Course in Fuzzy Logic*. New York: Chapman and Hall/CRC, Taylor and Francis Group, 2006.
2. Meenakshi, A.R. *Fuzzy matrix Theory and Applications*. Chennai: MJP Publishers, 2008.
3. Klir, George J. and Folger, George J. *Fuzzy Sets, Uncertainty and Information*. New Delhi: PHI Learning Private Limited, 2013.

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2. https://www.google.com/url?sa=t&source=web&rct=j&url=http://osp.mans.edu.eg/elbeltagi/AI%2520FuzzyRelations.pdf&ved=2ahUKEwjM15Tn4q_vAhVZOSsKHSurD18QFjABegQIGBAC&usg=AOvVaw17H5aSGE4I_b502gp14X6T

3. https://www.google.com/url?sa=t&source=web&rct=j&url=https://link.springer.com/content/pdf/10.1007/978-3-540-76290-4_10.pdf&ved=2ahUKEwjxnfGs46_vAhVNlEsFHSF9ApgQFjACegQIBxAC&usg=AOvVaw024xB7Nde1gWbgXiw-wkSO
4. https://youtu.be/H9SikB7HbSU
5. https://youtu.be/n9eNXs76VVM

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
ELECTIVE COURSE - II: ELEMENTS OF STOCHASTIC PROCESSES (21PMAO33)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS: 40**
CREDITS : 4 **EXT. MARKS: 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the most important random processes namely Martingale, Markov processes, Wiener processes, Random walk, Poisson processes and their mathematical properties.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the general theory and properties of probability distributions and random processes

CO2[K3]: compute the probability distribution of various random processes

CO3[K4]: classify random processes according to state space and parameter space

CO4[K4]: investigate the statistical inference of various processes

CO5[K5]: evaluate the statistical properties of random processes

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	1	1	-	-	-
CO2[K3]	3	2	1	1	-	-	-
CO3[K4]	3	2	2	2	-	1	1
CO4[K4]	3	2	2	2	-	1	1
CO5[K5]	3	2	2	2	-	1	1
Weightage of the course	15	09	08	08	-	03	03
Weighted percentage of Course contribution to POs	4.95	3.8	4.55	4.71	0	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Probability Distributions: Generating Functions – Laplace Transforms – Laplace (Stieltjes) Transform of a Probability Distribution or of a Random Variable – Classification of Distributions.

UNIT II **(18 hrs)**

Stochastic Processes: Some Notions – Introduction – Specification of Stochastic Processes – Stationary Processes – Martingales. **Markov Chains:** Definition and Examples – Higher Transition Probabilities.

UNIT III **(18 hrs)**

Classification of States and Chains – Determination of Higher Transition Probabilities – Stability of a Markov System – Statistical Inference for Markov Chains - Markov Chains with Continuous State Space – Non-homogeneous Chains.

UNIT IV **(18 hrs)**

Markov Processes with Discrete State Space: Poisson Process and its Extensions: Poisson Process – Poisson Process and Related Distributions – Generalisations of Poisson Process – Birth and Death Process – Markov Processes with Discrete State Space (Continuous Time Markov Chains) – Erlang Process.

UNIT V **(18 hrs)**

Markov Processes with Continuous State Space: Introduction: Brownian Motion - Wiener Process –Differential Equations for a Wiener Process – Kolmogorov Equations – First Passage Time Distribution for Wiener Process.

TEXTBOOK

1. Medhi, J. *Stochastic Processes.* Chennai: New age international (P) Limited, Publishers, Second Edition, 2004.

REFERENCES

Books

1. Basu, A.K. *Introduction to Stochastic Process.* New Delhi: Narosa Publishing House, 2007.
2. Srinivasan, S.K. and Mehata, K.M. *Stochastic Processes.* New Delhi: Tata McGraw-Hill Publishing Company Limited, 1976.
3. Kai Lai Chung. *Elementary Probability Theory with Stochastic Processes*. New Delhi: Narosa Publishing House, Third Edition, 1998.

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5. https://www.google.com/url?sa=t&source=web&rct=j&url=http://www.columbia.edu/~ks20/stochastic-I/stochastic-I-MCI.pdf&ved=2ahUKEwi8maiN8K_vAhWXaCsKHVVkD9gQFjAEegQIFxAC&usg=AOvVaw1c6VLUhoTLSs21Qf-Avle4

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
SELF PACED LEARNING - SWAYAM COURSE - INTRODUCTION TO METHODS OF APPLIED MATHEMATICS (21PMAM31)
(From 2021-2022 Batch onwards)

CREDITS : 3 **EXT. MARKS : 100**
DURATION : 12 Weeks **MAX. MARKS: 100**

Preamble

This course provides the learners with an opportunity for a lifelong learning by meeting the demand in terms of knowledge, skills, and competencies.

Course outcomes (CO)

On successful completion of this course learners will be able to

CO1[K1]: identify the background and the key words in Methods of Applied Mathematics

CO2[K2]: demonstrate independent and self-paced learning for clear understanding of the concept

CO3[K3]: develop computer and communication skills to broaden their knowledge in the course

CO4[K3]: use high quality reading resources, communication tools and technology to send assignments and to take up test

CO5[K4]: analyse critically and apply technical skills to comprehend the ideas or theories in the video lectures

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K1]	3	2	2	2	-	-	2
CO2[K2]	3	2	2	2	-	-	2
CO3[K3]	3	2	2	2	1	1	2
CO4[K3]	2	2	2	1	1	1	1
CO5[K4]	2	2	2	2	1	-	1
Weightage of the course	13	10	10	09	03	02	08
Weighted percentage of Course contribution to POs	4.29	4.22	5.68	5.29	11.54	2.53	11.27

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

WEEK 1

Introduction to First Order Linear and Non-Linear Ordinary Differentia Equations (ODE) – Riccati Equation.

WEEK 2

Solving Second Order ODE.

WEEK 3

Introductions to Green's Functions for Second Order Linear ODE.

WEEK 4

Introduction to Adjoint Operators and their Green's Functions.

WEEK 5

Laplace Transforms and its Properties.

WEEK 6

Application of Laplace Transforms to Solve ODE.

WEEK 7

Introduction to Fourier Series.

WEEK 8

Fourier Integrals and Fourier Transform and Properties .

WEEK 9

Riesz Bases – Frames and Orthonormal Bases and Shortcoming of Fourier Series.

WEEK 10

Shortcomings of Fourier Transforms – Gabor Transform – Window Fourier Transform – Multi resolution Analysis.

WEEK 11

Daubechies Wavelet – Wavelet Series and Wavelet Transform and Different Properties of Wavelets.

WEEK 12

Revision and Problem – Solving Sessions.

REFERENCES

Books

1. Gilbert strang wellesly. *Introduction to Applied Mathematics*. cambridge Press.
2. Sudhakar Nair. *Advanced topics in Applied Mathematics*. Cambridge Press,.
3. Mani Mehra. *Wavelets theory and its applications*. Springer.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - III
SELF PACED LEARNING - SWAYAM COURSE - REGRESSION ANALYSIS
(21PMAM32)
(From 2021-2022 Batch onwards)

CREDITS : 3 **EXT. MARKS : 100**
DURATION : 12 Weeks **MAX. MARKS: 100**

Preamble

This course provides the learners with an opportunity for a lifelong learning by meeting the demand in terms of knowledge, skills, and competencies.

Course outcomes (CO)

On successful completion of this course learners will be able to

CO1[K1]: identify the background and the key words in Regression Analysis
CO2[K2]: demonstrate independent and self-paced learning for clear understanding of the concept
CO3[K3]: develop computer and communication skills to broaden their knowledge in the course
CO4[K3]: use high quality reading resources, communication tools and technology to send assignments and to take up test
CO5[K4]: analyse critically and apply technical skills to comprehend the ideas or theories in the video lectures

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K1]	3	2	2	2	-	-	2
CO2[K2]	3	2	2	2	-	-	2
CO3[K3]	3	2	2	2	1	1	2
CO4[K3]	2	2	2	1	1	1	1
CO5[K4]	2	2	2	2	1	-	1
Weightage of the course	13	10	10	09	03	02	08
Weighted percentage of Course contribution to POs	4.29	4.22	5.68	5.29	11.54	2.53	11.27

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

WEEK 1

Simple Linear Regression (Part A, B, C)

WEEK 2

Simple Linear Regression (Part D, E)

WEEK 3

Multiple Linear Regression (Part A, B, C)

WEEK 4

Multiple Linear Regression (Part D) - Selecting the best regression equation (Part A, B)

WEEK 5

Selecting the best regression equation (Part C, D)

WEEK 6

Multi collinearity (Part A, B, C)

WEEK 7

Model Adequacy Checking (Part A, B, C)

WEEK 8

Test for influential observations – Transformations and weighting to correct model inadequacies (Part A)

WEEK 9

Transformations and weighting to correct model inadequacies (Part B, C)

WEEK 10

Dummy variables (Part A, B, C)

WEEK 11

Polynomial Regression Models (Part A, B, C)

WEEK 12

Generalized Linear Model (Part A, B) - Non-Linear Estimation.

REFERENCES

Books

1. Draper, N. R., and Smith, H. *Applied Regression Analysis.* New York: Wiley, 3rd ed, 1998.
2. Montgomery, D. C., Peck, E. A., and Vining, G. *Introduction to Linear Regression Analysis*. Hoboken, NJ: Wiley. 3rd ed , 2001.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - IV
CORE COURSE - XIII: COMPLEX ANALYSIS (21PMAC41)
(From 2021-2022 Bsatch onwards)

HOURS/ WEEK: 6 **INT. MARKS : 40**
CREDITS : 5 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the properties of analytic functions, series representations of elementary transcendental functions with the use of complex integration.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the basic concepts, theories, properties of functions of a complex variable

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of analytic functions

CO3[K4]: analyze the general properties of analytic functions

CO4[K4]: interpret the several forms of Cauchy's theorem and examine the series and product expansions of analytic functions

CO5[K5]: evaluate the definite integrals by the method of residues

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	3	-	-	-
CO2[K3]	3	2	1	3	-	-	-
CO3[K4]	3	2	2	2	-	1	1
CO4[K4]	3	2	2	2	-	1	1
CO5[K5]	3	2	2	2	-	1	1
Weightage of the course	15	10	08	12	-	3	3
Weighted percentage of Course contribution to POs	4.95	4.22	4.55	7.06	0	3.8	4.23

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low '-' No Correlation)

UNIT I **(15 hrs)**

Complex Integration: Fundamentals Theorems – Line Integrals– Rectifiable Arcs– Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk – Cauchy's Integral Formula – The Index of a Point with Respect to a Closed Curve – The Integral Formula – Higher Derivatives.

UNIT II **(15 hrs)**

Local Properties of Analytic Functions – Removable Singularities. Taylor`s Theorem – Zeros and Poles–The Local Mapping –The Maximum Principle – The General Form of Cauchy's Theorem – Chains and Cycles –Simple Connectivity – Homology –The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem.

UNIT III **(15 hrs)**

The Calculus of Residues –The Residue Theorem –The Argument Principle – Evaluation of Definite Integrals – Harmonic Functions – Definition and Basic Properties – The Mean-value Property –Poisson's Formula – Schwarz's Theorem –The Reflection Principle.

UNIT IV **(15 hrs)**

Series and Product Developments: Power Series Expansions – Weierstrass's Theorem –The Taylor Series – The Laurent Series – Partial Fractions and Factorization – Partial Fractions – Infinite Products – Canonical Products– The Gamma Function.

UNIT V **(15 hrs)**

Entire Functions – Jensen's Formula – Hadmard's Theorem – The Riemann Zeta Function – The Product Development – Extensions of (s) to the whole plane – The Functional Equation – The Zeros of the Zeta Functions.

TEXTBOOK

1. Ahlfors, Lars V. *Complex Analysis.* New Delhi: McGraw Hill Book Company,Third Edition.

REFERENCES

Books

1. Ponnusamy, S. *Foundations of Complex Analysis.* New Delhi: Narosa Publishing House, 2000.
2. Karunakaran, V. *Complex Analysis.* New Delhi: Narosa Publishing House, Second Edition, 2006.
3. Walter Rudin. Real and Complex Analysis. New York: McGraw - Hill Book Company, Third Edition.

Web Sources

1. https://editorialdinosaurio.files.wordpress.com/2012/03/ahlfors_-_complex_analysis.pdf
2. https://nptel.ac.in/courses/111/103/111103070/
3. https://drive.google.com/file/d/1ZT8uUucEzivOriwfXeGAkezik-8Mo6do/view
4. https://namitatiwaridotorg.files.wordpress.com/2017/10/ponnusamy-s-silverman-h-1-complex-variables-with-applications.pdf
5. https://www.youtube.com/watch?v=vq2oaeQbXmQ

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - IV
CORE COURSE - XIV: NUMBER THEORY AND CRYPTOGRAPHY (21PMAC42)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS: 40**
CREDITS : 5 **EXT. MARKS: 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course familiarizes the learners with the basic concepts of elementary number theory and application of number theory in cryptology.

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1[K2]: explain the general theory and properties of arithmetical functions, congruence and different types of ciphers in cryptography

CO2[K3]: apply the abstract concepts to produce proofs of results that arise in the context of number theory

CO3[K4]: analyze the averages of arithmetical functions

CO4[K4]: analyze the theory of quadratic residues

CO5[K5]: determine the existence and non-existence of primitive roots mod p

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	1	1	-	-
CO2[K3]	3	2	1	1	-	-	-
CO3[K4]	3	3	2	2	-	1	1
CO4[K4]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	-	1	1
Weightage of the course	15	13	08	08	01	03	03
Weighted percentage of Course contribution to POs	4.95	5.49	4.55	4.71	3.85	3.8	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNITI **(18 hrs)**

The Fundamental Theorem of Arithmetic: Introduction – Divisibility – Greatest Common Divisor – Prime Numbers – The Fundamental Theorem of

Arithmetic – The Series of Reciprocals of the Primes – The Euclidean Algorithm – The Greatest Common Divisor of more than Two Numbers. **Arithmetical Functions and Dirichlet Multiplication**: Introduction – The Mobius Function $\mu(n)$ – The Euler Totient Function $\varphi(n)$ – A Relation Connecting φ and μ – A Product Formula for $\varphi(n)$ – The Dirichlet Product of Arithmetical Functions – Dirichlet Inverses and the Mobius Inversion Formula – The Mangoldt Function $\Lambda(n)$ – Multiplicative Functions – Multiplicative Functions and Dirichlet Multiplication – The Inverse of a Completely Multiplicative Function – Liouville's Function $\lambda(n)$ – The Divisor Function $\sigma_\alpha(n)$ – Generalized Convolutions.

UNIT II **(18 hrs)**

Averages of Arithmetical Functions: Introduction – The Big Oh Notation. Asymptotic Equality of Functions – Euler's Summation Formula – Some Elementary Asymptotic Formulas – The Average Order of d(n) – The Average Order of the Divisor Functions $\sigma_\alpha(n)$ – The Average Order of $\varphi(n)$ – An Application to the Distribution of Lattice Points Visible from the Origin – The Average Order of $\mu(n)$ and $\Lambda(n)$ – The Partial Sums of a Dirichlet Product – Applications to $\mu(n)$ and $\Lambda(n)$ – Another Identity for the Partial Sums of a Dirichlet Product. **Congruences**: Definition and Basic Properties of Congruences – Residue Classes and Complete Residue Systems – Linear Congruences – Reduced Residue Systems and Euler–Fermat Theorem – Polynomial Congruences modulo p. Lagrange's Theorem – Applications of Lagrange's Theorem – Simultaneous Linear Congruences.TheChinese Remainder Theorem – Applications of the Chinese Remainder Theorem – Polynomial Congruences with Prime Power Moduli.

UNIT III **(18 hrs)**

Quadratic Residues and the Quadratic Reciprocity Law: Quadratic Residues – Legendre's Symbol and its Properties – Evaluation of (-1|p) and (2|p) – Gauss' Lemma – The Quadratic Reciprocity Law – Applications of the Reciprocity Law – The Jacobi Symbol – Applications to Diophantine Equations – Gauss Sums and the Quadratic Reciprocity Law – The Reciprocity Law for Quadratic Gauss Sums – Another Proof of the Quadratic Reciprocity Law.

UNIT IV **(18 hrs)**

Primitive Roots:The Exponent of a Number mod m. Primitive Roots – Primitive Roots and Reduced Residue Systems – The Nonexistence of Primitive Roots mod 2^α for $\alpha \geq 3$ – The Existence of Primitive Roots mod p for Odd Primes p – Primitive Roots and Quadratic Residues – The Existence of Primitive Roots mod p^α - The Existence of Primitive Roots mod $2p^\alpha$ – The Nonexistence of Primitive Roots in the Remaining Cases – The Number of Primitive Roots mod m – The Index Calculus – Primitive Roots and Dirichlet Characters – Real-valued Dirichlet Characters mod p^α – Primitive Dirichlet Characters mod p^α.

UNIT V **(18 hrs)**

Cryptology: Introduction – Character Ciphers – Block Ciphers – One-Time Pads: Exponential Ciphers – Public-Key Cryptography.

TEXTBOOKS

1. Apostol, Tom M. *Introduction to Analytic Number Theory.* New Delhi: Narosa Publishing House, Eighth Reprint, 1998. **(UNITS I, II, III & IV)**
2. Neville Robbins. *Beginning Number Theory*. New Delhi: Jones & Bartlett India Pvt. Ltd., Second Edition, 2017. **(UNIT V)**

REFERENCES

Books

1. Ivan Niven, Zuckerman, Herbert S. and Montgomery, Hugh L. *An Introduction to the Theory of Numbers*. Singapore: John Wiley & Sons Inc., Fifth Edition, 2006.
2. Burton, Hugh L. *Elementary Number Theory*. Chennai: McGraw Hill Education Private Limited, Seventh Edition, 2019.
3. Thomas Koshy. *Elementary Number Theory with Applications*, New Delhi: Academic Press, 2005.

Web Resources

1. https://www.pdfdrive.com/introduction-to-analytic-number-theory-d187462955.html
2. https://books.google.co.in/books?id=TtLMrKDsDuIC&printsec=frontcover&dq=beginning+number+theory+pdf&hl=en&sa=X&ved=2ahUKEwiO_5PrkZnvAhUszDgGHTkTDJkQ6AEwA3oECAAQAw#v=onepage&q&f=false
3. https://www.pdfdrive.com/niven-i-an-introduction-to-the-theory-of-numbers-d19435701.html
4. https://1lib.in/book/447861/b4c7fa
5. https://www.pdfdrive.com/koshy-elementary-number-theory-with-applicati-d47052510.html

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG PROGRAMME - M.Sc. Mathematics
SEMESTER - IV
CORE COURSE - XV: INTEGRAL EQUATIONS (21PMAC43)
(From 2021-2022 Batch onwards)

HOURS/WEEK : 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS : 100**

Preamble

This course introduces the students to the methods and techniques of solving integral equations.

Course Outcomes [CO]

On successful completion of the course, the learners will be able to

CO1[K2]: explain the basic types of integral equation and methods of solving integral equations

CO2[K3]: solve integral equations using various methods and transformations

CO3[K4]: analyze the properties and different kinds of kernels

CO4[K4]: examine the solution of Boundary value problems

CO5[K5]: determine the extremals of the given functional by variational methods

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	2	1	2	-	-	-
CO2[K3]	3	2	1	2	-	-	-
CO3[K4]	3	3	2	1	-	1	1
CO4[K4]	3	3	2	1	-	2	1
CO5[K5]	3	3	2	1	-	2	1
Weightage of the course	15	13	08	07	-	05	03
Weighted percentage of Course contribution to POs	4.95	5.49	4.55	4.12	0	6.33	4.23

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low,'-' No Correlation)

UNIT I **(18 hrs)**

Linear Integral Equations: Introduction – Classification – Conversion of Differential equations into Integral equations – Finite Difference Approximations

– Fredholm Equations with Degenerate Kernel – Fredholm Equations with Green's Function Kernel – Fredholm Equations – Method of Resolvent Kernel.

UNIT II **(18 hrs)**

Hermitian Kernel – The Fredholm Alternative – Volterra Integral Equation – Approximate Methods – Symmetric Kernels : Hilbert - Schmidt Theory.

UNIT III **(18 hrs)**

Laplace Transform: Definition – Riemann – Lebesgue Lemma – Dirichlet Integral –Rules of Transform – Transforms of Some Elementary Functions – Applications – Other Integral Transforms.

UNIT IV **(18 hrs)**

The Fourier Transform (F.T.) – The Mellin Transform – Hankel Transforms – Dual Integral Equations – Fractional Integrals.

UNIT V **(18 hrs)**

Variational Methods: Introduction **–** Basic Notions – Extrema of Functionals – Euler's Equation – Extremals with Fixed Boundaries – Illustrative Examples – Moving Boundaries: Transversality Conditions – Approximation of Extrema: The Rayleigh – Ritz Method – Variational Methods in Eigenvalue Problems : Rayleigh's Principles.

TEXTBOOK

1. Parashar, B.P. *Differential and Integral Equations*. New Delhi: CBS Publishers& Distributors Pvt. Ltd., Second Edition, 2008.

REFERENCES

Books

1. Lokenath Debnath, Dambaru Bhatta. *Integral Transforms and Their Applications*. New York: Chapman & Hall/CRC, Second Edition, 2007.
2. Kazumi Watanabe*. Integral Transform Techniques for Green's Function.* Switzerland: Springer International Publishing, Second Edition, 2015.
3. Baidyananth Patra. *An Introduction to Integral Transforms.* Boca Raton: CRC Press, Taylor & Francis Group, 2018.

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1. https://youtu.be/Z_i5ibKjSAg
2. https://youtu.be/Ccng6vYW-i0
3. https://youtu.be/K0t53t7RLWY
4. https://www.efunda.com/math/laplace_transform/rules.cfm
5. https://apps.dtic.mil/dtic/tr/fulltext/u2/a031947.pdf

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - IV
CORE COURSE - XVI: MECHANICS (21PMAC44)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS : 40**
CREDITS : 4 **EXT. MARKS : 60**
DURATION : 90 hrs **MAX. MARKS: 100**

Preamble

This course introduces the students to the behavior of motion of bodies under the influence of a system of forces.

Course Outcomes (CO)

On Successful completion of the course, the learners will be able to

CO1[K2]: explain the mathematical laws and principles at the core of classical mechanics

CO2[K3]: demonstrate the equation of motion for complicated mechanical system through Lagrangian and Hamiltonian formulation

CO3[K4]: classify the orbits under central force motion in space dynamics

CO4[K5]: evaluate the law of momentum conservation under various mechanical system

CO5[K5]: determine the curve for which some given line integral has a stationary value

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K2]	3	1	-	1	-	-	-
CO2[K3]	3	2	1	1	-	1	-
CO3[K4]	3	2	2	1	-	1	1
CO4[K5]	3	3	2	2	-	1	1
CO5[K5]	3	3	2	2	-	1	1
Weightage of the course	15	11	07	07	-	04	03
Weighted percentage of Course contribution to POs	4.95	4.64	3.98	4.12	0	5.06	4.23

Based on the level of contribution('3'-High, '2'-Medium, '1'-Low, '-' No Correlation)

UNIT I **(18 hrs)**

Survey of the Elementary Principles : Mechanics of a Particle – Mechanics of a System of Particles – Constraints.

UNIT II **(18 hrs)**

D'Alembert's Principle and Lagrange's Equations – Velocity - Dependent Potentials and the Dissipation Function. **Variational Principles and Lagrange's Equations:** Hamilton's Principle – Some Techniques of the Calculus of Variations.

UNIT III **(18 hrs)**

Derivation of Lagrange's Equations from Hamilton's Principle – Extension of Hamilton's Principle to Non-holonomic Systems – Advantages of a Variational Principle Formulation – Conservation Theorems and Symmetry Properties.

UNIT IV **(18 hrs)**

The Two – Body Central Force Problem : Reduction to the Equivalent one- Body Problem – The Equations of Motion and First Integrals – The Equivalent one - Dimensional Problem and Classification of Orbits – The Virial Theorem.

UNIT V **(18 hrs)**

The Differential Equation for the Orbit and Integrable Power – law Potentials– Conditions for Closed Orbits (Bernard's theorem) – The Kepler Problem: Inverse Square Law of Force – The Motion in Time in the Kepler Problem – The Laplace – Runge - Lenz Vector.

TEXTBOOK

1. Herbert Goldstein. *Classical Mechanics*. New Delhi: Narosa Publishing House Second Edition, 2001.

REFERENCES

Books

1. DuraiPandian, P. and Laxmi Duraipandian Muthamizh Jayapragasam. *Mechanics*, NewDelhi: S. Chand and Company Ltd., 2014.
2. Gupta, A.B. *Fundamentals of Classical Mechanics*. Kolkata: Book and Allied (P) Ltd., First Edition, 2015.
3. Upadhyaya, J.C. *Classical Mechanics*. Mumbai: Himalaya Publishing House, 2014.

Web Sources

1. https://physicscatalyst.com/graduation/constraints-in-physics-classical-mechanics-with-examples/
2. https://byjus.com/physics/dalemberts-principle/
3. https://phys.libretexts.org/Bookshelves/Classical_Mechanics/Book%3A_Variational_Principles_in_Classical_Mechanics_(Cline)/06%3A_Lagrangian_Dyna

mics/6.03%3A_Lagrange_Equations_from_dAlemberts_Principle

4. https://www.youtube.com/watch?v=cUyAoCU4l0s
5. https://www.youtube.com/watch?v=kmSTigu8nCQ

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
DEPARTMENT OF MATHEMATICS
PG Programme - M.Sc. Mathematics
SEMESTER - IV
CORE COURSE - XVII: PROJECT- (21PMAJ41)
(From 2021-2022 Batch onwards)

HOURS/WEEK: 6 **INT. MARKS: 50**
CREDITS : 6 **EXT. MARKS: 50**
DURATION : 90 Hrs **MAX. MARKS: 100**

Preamble

This course familiarizes the students with the objectives and stages in formulating a Research Project .

Course Outcomes (CO)

On successful completion of the course, the learners should be able to

CO1 [K1]: identify the unexplored areas of research

CO2 [K2]: outline the objectives in formulating a research paper

CO3 [K2]: explain the stages in writing a thesis – collecting and evaluating sources and drafting documentation

CO4 [K3]: apply the latest rules of documentation to cite Print, non-print and Web Publications in a research paper

CO5 [K6]: prepare a rightly documented research project with adequate discussion, interpretations and evaluation

CO-PO Mapping table (Course Articulation Matrix)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1[K1]	3	2	2	2	1	1	1
CO2[K2]	2	2	2	2	1	1	1
CO3[K2]	2	2	2	2	1	1	1
CO4[K3]	2	2	2	2	1	1	1
CO5[K6]	2	2	3	2	1	1	1
Weightage of the course	11	10	11	10	05	05	05
Weighted percentage of Course contribution to POs	3.63	4.22	6.25	5.88	19.23	6.33	7.04

Based on the level of contribution ('3'-High, '2'-Medium, '1'-Low,'-' No Correlation)

Guidelines

1. Students are required to submit a project at the end of the IV semester. The student will work under a faculty member as the research guide.
2. Depending on the interest of the students, project research areas will be chosen.
3. Students must meet the guide periodically.
4. The project carries 100 marks of which 50 marks for Internal Assessment and 50 Marks for External Examination.
5. There will be two project review sessions.
6. Each student must either present paper or participate in Conferences/Seminars related to his Project work.
7. A draft of the final project report should be submitted to the Project Guide for review atleast two weeks prior to the end of the semester.
8. The project report should be of minimum 40 pages (excluding bibliography & appendices).
9. Three copies of the final project report should be submitted.
10. The Head of the department and the Project Guide will evaluate the final Project Report.
11. The viva voce board shall consist of the External Examiner, the Head of the Department and the Internal Examiner (Research Project Guide).

The following rubrics will be taken into account for the evaluation of Project work and viva-voce:

Internal Assessment (50 Marks)		**External Examination (50 Marks)**	
Project Report & Review	: 40 Marks	Project Report	: 20 Marks
Powerpoint Presentation	: 5 Marks	Viva Voce	: 30 Marks
Participation/Publications in Conferences or Seminars	: 5 Marks		