GOVERNMENT ARTS COLLEGE (Autonomous),

(Re-accredited with 'A' Grade by NAAC and Affiliated to Bharathidasan University, Tiruchirappalli)

KARUR - 639 005.

PG

COURSE STRUCTURE

Course Structure under CBCS System

(Applicable to the Candidates admitted from the Academic Year 2021 – 2022 onwards)

M.Sc.,

MATHEMATICS

GOVERNMENT ARTS COLLEGE (AUTONOMOUS)

KARUR – 639 005.

Vision

It is our vision to persuade every mind in this temple of learning to tirelessly seek the truth to face the challenges of the times and honestly participate in the establishment of universal peace, progress and love.

Mission

It is our mission to create in everyone an honest searching mind to be ready for value-based creative citizenship for regional, national and global peace and progress.

PG AND RESEARCH DEPARTMENT OF MATHEMATICS.

Vision

To persuade every one's mind in Search of the real meaning of the infinity through hard work.

Mission

To create in everyone a honest and creative Mathematician for regional, national and global progress

ABOUT THE DEPARTMENT

The department of mathematics has been started in the year 1967-68 affiliated to university of Madras. In the year 1981-82 the post graduate course in mathematics was started. From 1984-85 all courses in this department come under Bharathidasan University. In 2009-10 the department upgraded as a research department by admitting M.Phil. and Ph.D. scholars. Currently 10 staff members are working in the department out of which five faculty members with Ph.D. includes Topology, Fuzzy Topology, Algebra, Fuzzy Algebra, Fuzzy Matrix Theory, Operations Research etc., The department organizes workshops and seminars periodically.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

In recent days Mathematics is penetrating all fields of human endeavour and therefore, it is necessary to prepare the students to hope with the advanced developments in various fields of Mathematics. The objectives of this programme are the following:

(a) To impart knowledge in advanced concepts and applications in various fields of Mathematics.

(b) To provide wide choice of elective subjects with updated and new areas invarious branches of Mathematics to meet the needs of all students.

PROGRAMME OUTCOMES (POs)

Upon completion of the Programme, the students will be able to:

PO1– Acquire advanced conceptual knowledge and comprehensive understanding of the fundamental principles in respective discipline.

PO2– Apply knowledge and critically evaluate the concepts and scientific developments to take up any challenge.

PO3– Visualize and work on laboratory multidisciplinary tasks related to current research in the fields of Mathematical, Physical and Life sciences.

PO4– Acquire research based knowledge and design methods to conduct investigations of complex problems in research/ Industrial field and achieve employability /self employment.

PO5– Communicate effectively ideas verbally in English, leading to Entrepreneurship ventures such as consultancy and training.

PO6– Employ innovative and environment friendly methods, novel ideas to solve complex and challenging societal and environmental issues.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Upon completion of the programme M.Sc. Mathematics, the students will be able to:

PSO1- Acquire knowledge and understanding in advanced areas of Mathematics, from the courses offered.

PSO2- Apply knowledge of Mathematics in different field of science, business studies and technology

PSO3- Provide students with advanced mathematical, Latex, R, C Programming and computational skills that prepares them to pursue higher studies and conduct research.

PSO4 -Train students to deal with the problems faced by software and all industrial areas through knowledge of mathematics and scientific computational techniques.

PSO5- Provide students with knowledge and capability in formulating, analysing mathematical models of real-life applications, to develop abstract mathematical thinking and to crack the competitive examinations.

What is Credit system?

Weightage to a course is given in relation to the hours assigned for the course. The following Table shows the correlation between credits and hours. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For PG courses, a student must earn a minimum of **90 (+4)** credits as mentioned in the table below. The total number of minimum courses offered by a department is given in the course pattern.

POST GRADUATE COURSE PATTERN (2021 ONWARDS)

PART	SEMESTER	SPECIFICATION	NO. OF COURSES	HOURS	CREDITS	TOTAL CREDITS
III	I to IV	Core Course Theory	**14**	**84**	**70**	**85**
		Elective Course	**5**	**30**	**15**	
IV	II &III	Internship Programme	**1**	**-**	**2**	**2**
		Massive Open Online Course	**1**	**-**	**2**	**2**
III	IV	Project Work	**1**	**6**	**5**	**5**
TOTAL			**22**	**120**	**90 (+4)**	**90 (+4)**

Course Pattern

The Post graduate degree course consists of two vital components. They are as follows:

Part - III: Core Course (Theory), Project Work

Part - IV: Internship Programme, MOOC's

Core Courses

A core course is the course offered by the parent department related to the major subjects, components like theories, practical's, Project work, field visits and etc.

Core Elective

The core elective course is also offered by the parent department. The objective is to provide choice and flexibility within the department. There are FIVE core electives. They are offered in different semesters according to the choice of the college.

Extra Credit Courses

In order to facilitate the students gaining extra credits, the extra credit courses are given. There are two extra credit courses - Massive Open Online Courses (MOOC) and Internship Programme. According to the guidelines of UGC, the students are encouraged to avail this option of enriching by enrolling themselves in the MOOC provided by various portals such as SWAYAM, NPTEL, etc.

Subject Code Fixation

The following code system (9 characters) is adopted for Post Graduate courses:

Year of Revision	PG Code of the Dept	Semester	Specification of Part	Running number in the part
↓	↓	↓	↓	↓
2021	**P21**	***x***	***x***	***xx***
2021	**PMM**	**1**	**x**	**1**

For example:

I M.Sc. Mathematics - Differential Calculus

The code of the paper is **P21MM1C1.**

Thus, the subject code is fixed for other subjects.

EXAMINATIONS

Continuous Internal Assessment (CIA):

PG - Distribution of CIA Marks	
Passing Minimum: 50 Marks	
THEORY CIA MAXMIMUM = 25	THEORY CIA MINIMUM = 10
PRACTICAL CIA MAXIMUM = 40	PRACTICAL CIA MINIMUM = 16

End - Semester Tests

Centralized - Conducted by the office of Controller of Examinations.

Semester Examination

Testing with Objective and Descriptive questions.

Section - A: 10 Questions x 2 Marks = 20 Marks (No Choice - Two questions from each unit)

Section - B: 5 Questions x 5 Marks = 25 Marks (Either… or Type - One pair from each unit)

Section - C: 3 Questions x 10 Marks = 30 Marks (3 Out of 5 - One question from each unit)

Duration of Examination:

3- Hours examination for courses.

Grading System

1. Grading

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added. The marks thus obtained, will then be graded as per the scheme provided in Table 1.

From the second semester onwards the total performance within a semester and the continuous performance starting from the first semester are indicated by **Semester Grade Point Average (GPA)** and **Cumulative Grade Point Average (CGPA),** respectively. These two are calculated by the following formulae

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{1=1}^{n} C_i} \qquad WAM\,(WeightedAverageMarks) = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{i=1}^{n} C_i}$$

Where, 'C_i' is the Credit earned for the Course-i,

'G_i' is the Grade Point obtained by the student for the Course 'i'.

'M' is the marks obtained for the course 'i', and

'n' is the number of Courses **Passed** in that semester.

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

2. Classification of Final Results

i) For each of the three parts, there shall be separate classification on the basis of the CGPA, as indicated in the following Table - 2.

ii) For the purpose of Classification of Final Results, the Candidates who earn CGPA 9.00 and above shall be declared to have qualified for the Degree as 'Outstanding'. Similarly, the candidates who earn the CGPA between 8.00 - 8.99, 7.00 - 7.99, 6.00 - 6.99 and 5.00 - 5.99 shall be declared to have qualified for their Degree in the respective programmes as 'Excellent', 'Very Good', 'Good' and 'Above Average' respectively.

iii) Absence from an examination shall not be taken as an attempt.

Table - I - Grading of the Courses

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above but below 90	9	A+
70 and above but below 80	8	A
60 and above but below 70	7	B+
50 and above but below 60	6	B
Below 50	NA	RA

Table – 2 – Final Result

CGPA	Classification of Final Results	Corresponding Grade
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
Below 5.00	RA	Re - Appearance

Credit based weighted Mark System is adopted for individual semesters and cumulative semesters in the column 'Marks Secured' (for 100).

Declaration of Result:

Mr./Ms. _____ has successfully completed the Post Graduate in _____ programme. The candidate's Cumulative Grade Point Average (CGPA) in Part - III is _____ and the class secured is _____ by completing the minimum of 90 credits. The candidate has acquired _____ (if any) extra credits offered by the parent department courses.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR – 639 005

(Re-accredited with A Grade by NAAC and Affiliated to Bharathidasan University , Tiruchirappalli)

M.Sc. MATHEMATICS COURSE STRUCTURE UNDER CBCS SYSTEM

(For the candidates admitted from the year 2021- 2022 onwards)

SEMESTER	COURSE	COURSE TITLE	COURSE CODE	INSTR. HOURS WEEK	CREDIT	EXAM HOURS	MARKS		TOTAL
							INT	ESE	
I	Core Course – I	Algebra – I	P21MM1C1	6	5	3	25	75	100
	Core Course – II	Real Analysis – I	P21MM1C2	6	5	3	25	75	100
	Core Course – III	Ordinary Differential Equations	P21MM1C3	6	5	3	25	75	100
	Core Course – IV	Mechanics and Tensor Analysis	P21MM1C4	6	5	3	25	75	100
	Elective Course – I	Numerical Analysis -A Fuzzy sets and their Applications -B	P21MM1E1A/B	6	3	3	25	75	100
				30	23				500
II	Core Course – V	Algebra – II	P21MM2C5	6	5	3	25	75	100
	Core Course – VI	Real Analysis-II	P21MM2C6	6	5	3	25	75	100
	Core Course – VII	Complex analysis	P21MM2C7	6	5	3	25	75	100
	Core Course - VIII	Partial Differential Equations	P21MM2C8	6	5	3	25	75	100
	Elective Course-II	Discrete Mathematics-A Number Theory and Cryptography - B	P21MM2E2A/B	6	3	3	25	75	100
	Extra Credit Course	Internship Programme (It Should be completed in the second semester Holidays)			(2)				
				30	23 (2)				500
III	Core Course – IX	Mathematical Statistics	P21MM3C9	6	5	3	25	75	100
	Core Course – X	Mathematical Methods	P21MM3C10	6	5	3	25	75	100
	Core Course – XI	Topology	P21MM3C11	6	5	3	25	75	100
	Elective Course - III	Optimization Techniques- A Probability and stochastic process - B	P21MM3E3A/B	6	3	3	25	75	100
	Elective Course - IV	Type setting in Latex –A / Programming in C++ - B	P21MM3E4A/B	6	3	3	25	75	100
	Extra Credit Course	Massive Open Online Course (MOOC)			(2)				
				30	21 (2)				500
IV	Core Course – XII	Functional Analysis	P21MM4C12	6	5	3	25	75	100
	Core Course – XIII	Differential Geometry	P21MM4C13	6	5	3	25	75	100
	Core Course – XIV	Graph Theory	P21MM4C14	6	5	3	25	75	100
	Elective Course -V	Fluid Dynamics -A Measure Theory and Integration - B	P21MM4E5A/B	6	3	3	25	75	100
	Project Work	Project work	P21MM4PW	6	5	3	**	**	100
				30	23				500
TOTAL				120	90 (4)				2000

** Project – 80 Marks and Viva Voce Examinations – 20 Marks

CHAIRMAN
BOARD OF STUDIES IN MATHEMATICS

CONTROLLER OF EXAMINATIONS

(i) List of Elective Courses:

Semester	Paper Code	Paper Title
GROUP A		
I	P21MM1E1A P21MM1E1B	Numerical Analysis Fuzzy Sets and Their Applications
GROUP B		
II	P21MM2E2A P21MM3E2B	Discrete Mathematics Number Theory and Cryptography
GROUP C		
III	P21MM3E3A P21MM3E3B	Optimization Techniques Probability and Stochastic Process
GROUP D		
III	P21MM3E4A P21MM3E4B	Type setting in Latex Programming with C++
GROUP E		
IV	P21MM4E5A P21MM4E5B	Fluid Dynamics Measure Theory and Integration

REGULATIONS

1. **COMMENCEMENT OF THIS REGULATION**:

These regulations shall take effect from the academic year 2021-2022, that is, for students who are admitted to the first year of the course during the academic year 2021-2022 and there after.

2. **ELIGIBILITY FOR ADMISSION:**

A candidate who has passed B.Sc., Mathematics / B.Sc., Mathematics (Computer Applications) degree of Bharathidasan University or any of the above degree of any other University accepted by the Syndicate equivalent there to, subject to such condition as may be prescribed therefore are eligible for admission to M.Sc., Degree Programme and shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination in Mathematics of Bharathidasan University.

3. **DURATION OF THE COURSE:**

The course of study of Master of Science in Mathematics shall consist of two academic years divided into four semesters. Each Semester consists of 90 working days.

4. **SYLLABUS:**

The syllabus of the PG degree Programme has been divided into the following types of courses:

i. **Core Courses:**

The core courses related to the programme concerned including project work offered under the programme.

ii. **Elective Courses:**

There are Five Elective Courses offered under the programme related to the major or non-major but are to be selected by the students.

iii. **Extra Credit Course(ECC):**

iv. Under Extra credit course, the students should complete an internship programme (It should be completed in the second semester holidays) with 2 credits and at least one Massive Open Online Course (MOOC) with 2 credits.

7. CREDIT SYSTEM:

The weightage of credits is spread over to four different semesters during the period of study and the cumulative credit point average shall be awarded based on the credits earned by the students. A total of 94 credits are prescribed for the Post Graduate programme.

8. COURSE OF STUDY:

The course of study for the degree shall be in Mathematics (under Choice Based Credit System) with internal assessment according to syllabi prescribed from time to time. The Continuous Internal Assessment (CIA) Mark 25 is distributed to four components viz., Tests, Assignment, Seminar and Attendance as 10, 05, 05 and 05 marks, respectively.

9. EXAMINATIONS:

The examination shall be of Three Hours duration for each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination. At the end of fourth semester viva-voce will be conducted on the basis of the Dissertation/ Project report by one internal and one external examiner.

10. QUESTION PAPER PATTERN AND MARKS DISTRIBUTION:

Question Paper Pattern and Marks Distribution for Theory Examination:

TITLE OF THE PAPER

Time: Three Hours Maximum Marks:75

Part – A (10 X 2 = 20 Marks)

Answer **ALL** Questions

(Two Questions from each unit)

Part – B (5 X 5 = 25 Marks)

Answer **ALL** Questions

(One Question from each unit with internal choice)

Part – C (3 X 10 = 30 Marks)

Answer any **Three** questions out of Five questions (One question from each unit).

11. Project:

(a) Topic:

The topic of the Project shall be assigned to the candidate before the beginning of third semester and a copy of the same should be submitted to the Head of the Department.

(b) No. of copies project:

The students should prepare Four copies of project and submit the same for the evaluation by Examiners. After evaluation one copy is to be retained in the college library, one copy is to be retained in the department library and one copy is to be submitted to the university (through COE) and the student can have the rest.

(c) Format to be followed:

The format of the Project to be prepared and submitted by the students in Semester IV is given below:

Format for the preparation of Project work:

i) Title page:

TITLE OF THE PROJECT

A Project Report Submitted to Government Arts College (Autonomous), Karur affiliated to Bharathidasan University, Tiruchirappalli, in partial fulfilment of the requirement for the award of the Degree of

MASTER OF SCIENCE IN MATHEMATICS

Submitted By

(Student's Name)

(Register Number)
Under the Guidance of
(Guide Name and Project)
(College Logo)
PG & Research Department of Mathematics, Government Arts College (Autonomous), Karur affiliated to Bharathidasan University, Tiruchirappalli,

(Month and Year)

CERTIFICATE

This is to certify that the project work entitled _____ was done and submitted by _____ Roll No. : _____ is a record of work done by candidate under my supervision during the period of her study _____ for the award of MASTER OF SCIENCE IN MATHEMATICS under my guidance and it is the original work of the candidate.

Date:

Place: Signature of the Guide

Signature of the Head of the Department.

Viva-Voce Examination held on .....

INTERNAL EXAMINER EXTERNAL EXAMINER

(ii) Acknowledgement:
(Drafted by the student)

(iii) Table of contents:

TABLE OF CONTENTS

Chapter No.	Title	Page No.
1.	Introduction	
2.	Review of Literature	
3.	Results	
4.	Summary / Conclusion	
5.	References	

12. MINIMUM MARKS FOR PASSING:

i) Theory Papers: The candidate shall be declared to have passed the examination if the candidate secures not less than 50 marks in total (CIA mark + Theory Exam mark) with minimum of 38 marks in the Theory Exam conducted by the COE, GAC(A), Karur- 5.

ii) Project Work & Viva-Voce: A candidate should secure 50% of the marks for pass. The candidate should attend viva-voce examination to secure a pass in that paper.

Candidate who does not obtain the required minimum marks for a pass in a Paper / Project/Dissertation shall be declared Re-Appear (RA) and he / she has to appear and pass the same at a subsequent appearance.

13.CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidate shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in the First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance. Candidates who pass all the examinations prescribed for the course in the first instance and within a period of two academic years from the year of admission to the course only are eligible for University Ranking.

14. MAXIMUM DURATION FOR THE COMPLETION OF THE PG PROGRAMME:

The maximum duration for completion of the PG Programme shall not exceed Four years from the year of admission.

15. TRANSITORY PROVISION:

Candidates who were admitted to the PG course of study before 2021-2022 shall be permitted to appear for the examinations under those regulations for a period of three years, that is, upto end inclusive of the examination of April/May 2024. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

CREDIT: 5 **COURSE CODE: P21MM1C1**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – I SEMESTER - CORE COURSE – I

(For the candidates admitted from the year 2021-2022 onwards)

ALGEBRA – I

COURSE OBJECTIVES:

1. To introduce the basic ideas of counting principle, Sylow subgroups, finite abelian groups, field theory and Galois Theory
2. To see its application to the solvability of polynomial equations by radicals.

UNIT – I	**Group Theory:** Another Counting Principle –Sylow's Theorem.
UNIT – II	**Group Theory:** – Direct Products - Finite Abelian Groups.
UNIT – III	**Ring Theory** – Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings over Commutative Rings.
UNIT – IV	**Fields: Extension** Fields - The Transcendence of e – Roots of Polynomials – More About Roots.
UNIT – V	**Fields:** The Elements of Galois Theory – Solvability by Radicals – Galois Groups over the Rationals.

TEXT BOOK:

I.N. Herstein, Topics in Algebra, 2nd Edition, John Wiley and Sons, New York, 1975

Unit	Chapters	Sections
1	2	2.11,2.12
2	2	2.13,2.14
3	3	3.9 to 3.11
4	5	5.1 to 5.3&5.5
5	5	5.6 to 5.8

REFERENCE BOOKS:

1. S. Lang, Algebra, 3rd Edition, Addison-Wesley, Mass, 1993.
2. J. B. Fraleigh, A First Course in Abstract Algebra, Addison Wesley, Mass, 1982.
3. M. Artin, Algebra, Prentice-Hall of India, New Delhi, 1991.
4. V. K. Khanna and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt Limited, 1993.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Analyse counting principle and Sylow's theorems and apply them for describing structures of finite groups.

CO 2 Applying the concept of a group action to real life problems such as Counting.

CO 3 Understand a large class of commutative rings by regarding them as quotients of polynomial rings by suitable ideals.

CO 4 Identify the greatest common factor of a polynomial expression.

CO 5 Check whether the given polynomial is solvable by radicals or not.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**		**2**	
CO 2	**3**	**3**	**2**	**3**	**3**
CO 3	**3**	**3**	**2**	**1**	
CO 4	**3**	**3**	**2**	**2**	**1**
CO 5	**3**	**3**	**2**		

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY

1. Lecture (Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type) x 5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: Dr. A. VADIVEL

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM1C2**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – I SEMESTER - CORE COURSE – II

(For the candidates admitted from the year 2021-2022 onwards)

REAL ANALYSIS – I

COURSE OBJECTIVES:

1. To enable the students to learn the basic concepts of real analysis and proof techniques in Analysis.
2. To well prepared for the advanced courses like Functional Analysis and Advanced Analysis.

UNIT – I	**The Real and Complex Number Systems:** Introduction – Ordered sets – Fields–The Real Field – Extended Real Number system–The Complex Field – Euclidean Spaces.
UNIT – II	**Basic topology:** Finite, countable and uncountable sets – Metric Spaces – Compact sets – Perfect sets – Connected sets.
UNIT – III	**Numerical Sequences:** Convergent Sequences – Sub-sequences – Cauchy Sequences – Upper and Lower Limits – Some Special Sequences – Series– Series of Non-Negative Terms.
UNIT – IV	**Numerical Series:** The Number e – The Root and Ratio Test – Power Series – Summation by Parts – Absolute Convergence- Addition and Multiplication of Series - Rearrangements. The Number e – The Root and Ratio Test – Power Series – Summation by Parts – Absolute Convergence- Addition and Multiplication of Series - Rearrangements.
UNIT – V	**Continuity:** Limits of Functions - Continuous Functions – Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic Functions – Infinite Limits and Limits at Infinity.

TEXT BOOK:

Walter Rudin, Principles of Mathematical Analysis, 3rd Edition Tata McGraw-Hill 1985.

Unit	Chapters	Sections
1	1	1.1 to 1.38
2	2	2.1 to 2.47
3	3	3.1 to 3.29
4	3	3.30 to 3.55
5	4	4.1 to 4.34

REFERENCE BOOKS:

1. Tom. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
2. R. G. Bartle, D. R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, NewYork, 1982.
3. Kenneth A. Ross, Elementary Analysis: The Theory of Calculus, Springer NewYork, 2004.
4. N. L.Carothers, Real Analysis, Cambridge University Press, UK, 2000.
5. S.C.Malik, Mathematical Analysis,Willey Eastern Ltd, NewDelhi, 1985.
6. K.R.Stromberg, An Introduction to Classical Real Analysis, Wadsworth, 1981.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Describe fundamental properties of the real numbers that lead to the formal development of real analysis.

CO 2 Demonstrate an understanding of limits ad how that are used in sequences.

CO 3 Demonstrate an understanding of limits ad how that are used in series.

CO 4 Demonstrate an understanding of limits ad how that are used in sequences Examine and recognize the continuity of real functions.

CO 5 Demonstrate an intuitive and computational understanding of set theory, continuity and solving application problems. This will be assessed through homework, class quizzes and tests, and a final exam.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**		**3**	**2**
CO 2	**3**	**3**		**3**	**2**
CO 3	**3**	**3**		**3**	**2**
CO 4	**3**	**3**		**3**	**2**
CO 5	**3**	**3**		**3**	**2**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: Dr. S. BALASUBRAMANIAN

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM1C3**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – I SEMESTER - CORE COURSE – III

(For the candidates admitted from the year 2021-2022 onwards)

ORDINARY DIFFERENTIAL EQUATIONS

COURSE OBJECTIVE:

1. To develop a strong background on finding solutions to linear differential equations with constant and variable coefficients and also with regular singular points.

UNIT – I	**Linear Equations with Constant Coefficients:** Introduction - The second order homogenous equation - Initial value problems for second order equations - Linear dependence and independence - A formula for the Wronskian.
UNIT – II	**Linear Equations with Constant Coefficients:** The non-homogeneous equation of order two – The homogenous equation of order n – Initial value problems for n^{th} order equations – Equations with real constants – The non-homogeneous equation of order n – A special method for solving the non-homogeneous equation.
UNIT – III	**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 homogenous equation - The non-homogenous equation - Homogenous equations with analytic coefficients - The Legendre equation.
UNIT – IV	**Linear Equations with Regular Singular Points:** Introduction **–** The Euler equation– Second order equations with regular singular points: An example, the general case – The exceptional cases - The Bessel equation – The Bessel equation continued – Regular singular points at infinity.
UNIT – V	**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.

TEXT BOOK:

Earl A. Coddington, An Introduction to Ordinary Differential Equations – Prentice – Hall of India Private Limited, New Delhi2008.

Unit	Chapters	Sections
1	2	1 to 5
2	2	6 to 11
3	3	1 to 8
4	4	1 to 4, 6 to 9
5	5	1 to 8

REFERENCE BOOKS:

1. Williams E. Boyce and Richard C. Diprima, Elementary Differential Equations and Boundary Value Problems, 10^{th} Edition, John Wiley and Sons, New York,2012.
2. M.D. Raisinghania, Advanced Differential Equations, S. Chand & Company Ltd., New Delhi,2012.
3. George F. Simmons, Differential Equations with Application and Historical Notes, Tata McGrawHill, NewDelhi, 1974.
4. B. Rai, D.P. Choudhury and H.I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House Pvt. Ltd, New Delhi, 2012.
5. Ravi P. Agarwal and Ramesh C. Gupta, Essentials of Ordinary Differential Equations, McGrawHill, NewYork,1991.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME:

At the end of the course, students will be able to

CO 1 Obtain the solutions of second order homogeneous and nonhomogeneous linear differential equations with constant coefficients.

CO 2 Determine solutions of equations in higher order derivatives of a variable function with variable coefficients in general and constant coefficients

CO 3 Learn how to solve homogeneous and nonhomogeneous differential equations with variable coefficients and homogenious equation with analytic co-efficients

CO 4 Understand the concepts regular singular points and solve the Euler equation and the Bessel equation

CO 5 Understand the concepts of successive approximations, The Lipschitz condition and prove local and Nonlocal existence theorems.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**2**	**2**	**2**
CO 2	**3**	**3**	**2**	**2**	**2**
CO 3	**3**	**3**	**2**	**2**	**2**
CO 4	**3**	**3**	**2**	**1**	**1**
CO 5	**3**	**3**	**2**	**1**	**1**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

TEMPLATE – END SEMESTER EXAMINATION

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER : R. VIJAYALAKSHMI

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM1C4**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – I SEMESTER - CORE COURSE – IV

(For the candidates admitted from the year 2021-2022 onwards)

MECHANICS AND TENSOR ANALYSIS

COURSE OBJECTIVES:

1. To create a foundation for understanding basic principles of mechanics and some classical problems.
2. To learn Lagrangian and Hamiltonian formulations of classical mechanics and the importance and consequences of canonical transformations.
3. To know the idea of Tensor Analysis to perceive the knowledge of Christoffel's Symbols.

UNIT – I	**Introductory Concepts:** The Mechanical System – Generalized Coordinates – Constraints – Virtual work – Energy and momentum.
UNIT – II	**Lagrange's Equations:** Derivation of Lagrange's Equations – Examples – Integrals of the motion – Small oscillations.
UNIT – III	**Hamilton's equations:** Hamilton's principle – Hamilton's equations – Other variational principles – Phase space.
UNIT – IV	**Hamilton-Jacobi Theory:** Hamilton's principal function – The Hamilton-Jacobi Equation, **Canonical Transformations:** Special Transformations-Legendre and Poisson brackets.
UNIT – V	**Tensor Theory:** Scope of tensor analysis, Invariance – Transformation of coordinates – Properties of admissible transformations of coordinates – Transformation by invariance – Transformation by covariance and contra variance – The tensor concept, Contra variant and Covariant tensors – Tensor character of covariant and contra variant laws – Algebra of tensors – Quotient laws – Symmetric and skew-symmetric tensors – Relative tensors – The Metric tensor - The fundamental and associated Tensors - Christoffel's Symbols - Transformation of Christoffel's. Symbols.

TEXT BOOKS:

1. Donald T. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi 1977.
2. I. S. Sokolnikoff, Tensor Analysis, John Wiley and Sons, Inc. New York, 1964.

Unit	Chapters	Sections
1	1 of [1]	1.1 to 1.5
2	2 of [2]	2.1 to 2.4
3	4 of [1]	4.1 to 4.4
4	5 & 6 of [1]	5.1, 5.2 & 6.2, 6.3
5	2 of [2]	18 to 32

REFERENCE BOOKS:

1. A. S. Eddington, The Mathematical Theory of Relativity, Cambridge University Press, 1930.
2. P. G. Bergman, An Introduction to Theory of Relativity, New York, 1942.
3. Tensor Calculus, U.C. De, Absos Ali Shaikh and Joydeep Sengupta, Narosa Publishing House, New Delhi, 2004.
4. J. L. Synge and A. Schild, Tensor Calculus, Toronto, 1949.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 State and apply the introductory concepts.

CO 2 Explain about the conservation principles and Lagrangian of Classical Mechanics.

CO 3 Use the knowledge of the Hamilton's principle and Hamilton's equations.

CO 4 Compute Canonical Transformations and special transformations

CO 5 Explain the concepts of tensors and algebra of tensors.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented		Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**		**3**	
CO 2	**3**	**3**		**2**	
CO 3	**3**	**3**	**2**	**2**	
CO 4	**3**	**3**	**2**	**2**	**1**
CO 5	**3**	**3**		**2**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER : A. PRIYA

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM1E1A**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – I SEMESTER - ELECTIVE COURSE – I

(For the candidates admitted from the year 2021-2022 onwards)

NUMERICAL ANALYSIS

COURSE OBJECTIVE:

To a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering. The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods, along with a rudimentary understanding of finite precision arithmetic and the conditioning and stability of the various problems and methods. This will help you choose, develop and apply the appropriate numerical techniques for your problem, interpret the results, and assess accuracy.

UNIT – I	**Numerical solutions to ordinary differential equation**: Numerical solutions to ordinary differential equation – Power series solution – Pointwise method – Solution by Taylor's series– Taylor's series method for simultaneous first order differential equations – Taylor's series method for Higher orderDifferentialequations–Predictor–Correctormethods– Milne'smethod–Adam–Bashforthmethod.
UNIT – II	**Picard and Euler Methods:** Picard's Method of successive approximations – Picard's method for simultaneous first order differential equations – Picard's method for simultaneous second order differential equations – Euler's Method – Improved Euler's method – Modified Euler's Method.
UNIT – III	**Runge – Kutta Method:** Runge's method – Runge-Kutta methods – Higher order Runge-Kutta methods - Runge-Kutta methods for simultaneous first order differential equations – Runge - Kutta methods for simultaneous second order differential equations.
UNIT – IV	**Numerical Solutions to Partial Differential Equations:** Introduction Difference Quotients – Geometrical representation of partial differential quotients – Classifications of partial differential equations – Elliptic equation – Solution to Laplace's equation by Liebmann's iteration process.
UNIT – V	**Numerical Solutions to Partial Differential Equations (Contd.):**Poisson equation – its solution – Parabolic equations – Bender – Schmidt method – Crank – Nicholson method – Hyperbolic equation – Solution to partial differential equation by Relaxation method.

TEXT BOOK:

V.N Vedamurthy and Ch. S.N.Iyengar, Numerical Methods, Vikas PublishingHouse Pvt Ltd.,1998.

Unit	Chapters	Sections
1	11	11.1 to 11.6, 11.8 to 11.20
2	11	11.7 to 11.12
3	11	11.13 to 11.17
4	12	12.1 to 12.6
5	12	12.7 to 12.10

REFERENCE BOOKS:

1. S.S. Sastry, Introductory methods of Numerical Analysis, Printice of India, 1995.
2. C.F. Gerald, and P.O. Wheathy, Applied Numerical Analysis, Fifth Edition, Addison Wesley, 1998.
3. M.K. Venkatraman, Numerical methods in Science and technology, National Publishers Company, 1992.
4. P. Kandasamy, K. Thilagavathy, K. Gunavathy, Numerical Methods, S. Chand &Company,2003.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME:

At the end of the course, students will be able to

CO 1 Apply the knowledge of mathematics, science, arts and management principles to the solution of complex problems.

CO 2 Use innovation-based knowledge and creative methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

CO 3 Communicate effectively on various activities and make effective presentations.

CO 4 Devise solutions for intricate problems and plan system components or processes that meet the specified needs with appropriate consideration for the society, health, safety, cultural, societal and environmental considerations

CO 5 Be familiar with the need for and have the training and skill to engage in self-regulating and life-long learning in the broadest perspective of hi-tech change

Nature of Course			
Knowledge and Skill	✓	Employability oriented	
Skill oriented	✓	Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**2**	**3**	
CO 2	**3**	**3**		**3**	
CO 3	**3**	**3**	**2**	**3**	
CO 4	**3**	**3**	**3**	**3**	
CO 5	**3**	**3**	**2**	**3**	**2**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
Total				75

COURSE DESIGNER: R. VIJAYALAKSHMI

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM1E1B**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – I SEMESTER - ELECTIVE COURSE – I

(For the candidates admitted from the year 2021-2022 onwards)

FUZZY SETS AND THEIR APPLICATIONS

COURSE OBJECTIVES:

Fuzzy is one of the latest topics in Mathematics that has real life applications. Hence it is essential for the students to learn this topic. This topic introduces the concept of uncertainty and fuzziness in logic that will enable the student to develop their intuitive mind further. The two years M.Sc. program is to prepare every student to face the competitive world outside. It will help them to acquire sufficient knowledge and skill in the subject that will make them competent in various areas of Mathematics.

UNIT – I	**From Classical (Crisp) Sets to Fuzzy Sets: A Grand Paradigm Shift:** Introduction – Crisp sets: An overview – Fuzzy set: Basic types – Fuzzy sets: Basic concepts – Characteristics and significance of the paradigm shift, Fuzzy Sets Versus Crisp sets: Additional properties of α cuts – Representations of fuzzy sets – Extension principle for fuzzy sets.
UNIT – II	**Operations on Fuzzy Sets:** Types of operations – Fuzzy complements – Fuzzy intersections: t-norms – Fuzzy unions: t-conorms – Combinations of operations – Aggregation operations.
UNIT – III	**Fuzzy Relations:** Crisp versus 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 – Sup-i compositions of fuzzy relations – Inf-ω_i compositions of fuzzy relations.
UNIT – IV	**Fuzzy Decision Making:** General Discussion – Individual Decision making –Multi-person decision making – Multi criteria decision making – Multistage decision making–Fuzzy ranking methods–Fuzzy linear programming.
UNIT – V	**Miscellaneous Applications:** Introduction – Medicine – Economics – Fuzzy systems and genetic algorithms – Fuzzy regression – Interpersonal communication – Other applications.

TEXT BOOK:

George J. Klirand Bo Yuan, Fuzzy sets and Fuzzy Logic Theory and Applications, PHI Private Limited, NewDelhi, 2008.

Unit	Chapters	Sections
1	1,2	1.1 to 1.5, 2.1 to 2.3
2	3	3.1 to 3.6
3	5	5.1 to 5.10
4	15	15.1 to 15.7
5	17	17.1 to 17.7

REFERENCE BOOKS:

1. A. K. Bhargava, Fuzzy Set Theory, Fuzzy Logic and their Applications, S. Chand Pvt. Limited (2013).
2. K. Pundir and R. Pundir, Fuzzy sets and their application, Published by A Pragati edition(2012)
3. H.J.Zimmermann, Fuzzy set theory and its applications, Springer (2012).

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Determine the difference between crisp relations, fuzzy relations and understand the concepts of fuzzy compatibility relations, fuzzy ordering relations and fuzzy morphisms.

CO 2 Develop analytical mind so that the students can sharpen their mind better.

CO 3 Provide with sufficient practical oriented application thus the students can face the competitive world.

CO 4 Enable the students to have a thorough exposure to the different branches of Mathematics so as to gain a comprehensive knowledge of Mathematics.

CO 5 Construct the appropriate fuzzy numbers corresponding to uncertain and imprecise collected data and also determine the concepts of fuzzy compatibility relations, fuzzy ordering relations and fuzzy morphisms.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	
Skill oriented	✓	Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**2**	**3**	
CO 2	**3**	**3**		**3**	
CO 3	**3**	**3**	**2**	**3**	
CO 4	**3**	**3**		**3**	
CO 5	**3**	**3**	**2**	**3**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: R. VIJAYALAKSHMI

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM2C5**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – II SEMESTER - CORE COURSE –V

(For the candidates admitted from the year 2021-2022 onwards)

ALGEBRA – II

COURSE OBJECTIVE:

To introduce the basic ideas of canonical forms, finite fields, Frobenius theorem, integral quaternions and four-square theorem and to see its applications.

UNIT – I	**Linear transformations:** Matrices – Canonical Forms: Triangular Form – Nilpotent Transformations.
UNIT – II	**Linear transformations:** Canonical Forms: Decomposition of V : Jordan Form – Rational Canonical Form – Trace and Transpose.
UNIT – III	**Linear transformations:** Determinants – Hermitian, Unitary and Normal Transformation – Real Quadratic Forms.
UNIT – IV	**Selected Topics:** Finite Fields – Wedderburn Theorem on Finite Division Rings.
UNIT – V	**Selected Topics:** A theorem on Frobenius – Integral Quaternions and the Four Square Theorem.

TEXT BOOK:

I.N. Herstein, Topics in Algebra, 2nd Edition, John Wiley and Sons, New York, 1975

S.no.	**Chapters**	**Sections**
1	6	6.3 to 6.5
2	6	6.6 to 6.8
3	6	6.9 to 6.11
4	7	7.1 to 7.2
5	7	7.3 to 7.4

REFERENCE BOOKS:

1. S. Lang, Algebra, 3rd Edition, Addison-Wesley, Mass, 1993.
2. J. B. Fraleigh, A First Course in Abstract Algebra, Addison Wesley, Mass, 1982.
3. M. Artin, Algebra, Prentice-Hall of India, New Delhi, 1991.
4. V. K. Khanna and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt Limited, 1993.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Discuss the concepts of Canonical Forms and Triangular Form.

CO 2 Explain the applications of Nilpotent Transformations.

CO 3 Compute the problems under Hermition, Unitary and Normal Transformations.

CO 4 Discuss all possible finite fields with important properties.

CO 5 Explain Frobenius theorem , Integral Quaternions and Four-Square theorem and its applications.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**2**	**3**	**2**
CO 2	**3**	**3**		**3**	
CO 3	**3**	**3**	**3**	**2**	**2**
CO 4	**3**	**3**			
CO 5	**3**	**3**		**3**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: Dr. A. VADIVEL

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM2C6**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – II SEMESTER - CORE COURSE – VI

(For the candidates admitted from the year 2021-2022 onwards)

REAL ANALYSIS – II

COURSE OBJECTIVES:

1. To enable the students to learn the basic concepts of real analysis and proof techniques in Analysis.
2. To well prepared for the advanced courses like Functional Analysis and Advanced Analysis.

UNIT – I	**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 – II	**The Riemann-Stieltjes Integral:** Definition and existence of the integral – Properties of the Integral – Integration and Differentiation – Integration and vector valued functions – Rectifiable curves.
UNIT– III	**Sequence and Series of Functions:** Sequence of Functions – Discussion of Main Problem–Uniform Convergence and Continuity –Uniform Convergence and Integration – Uniform Convergence and Differentiation.
UNIT – IV	**Families of Functions:** Equi continuous Families of Functions – The Stone – Weierstrass Theorem.
UNIT – V	**Functions of several variables:** Linear transformations – Differentiation – The contraction principle – The inverse function theorem – The implicit function theorem. Determinants – Derivatives of higher order- Differentiation of integrals.

TEXT BOOK:

1. Tom. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
2. Walter Rudin, Principles of Mathematical Analysis, 3rd Edition Tata McGraw-Hill 1985.
3. H. L. Royden, Real Analysis, Third Edition, Macmillan Publishing Company, New Delhi, 1988.

Unit	Chapters	Sections
1	5	5.1 to 5.19
2	6	6.1 to 6.27
3	7	7.1 to 7.17
4	7	7.18 to 7.33
5	9	9.1 to 9.43

REFERENCE BOOKS:

1. G. de Barra, Measure Theory and Integration, Wiley Eastern Ltd., New Delhi 1981.
2. Inder K. Rana, An Introduction to Measure and Integration, 2nd Edition, Narosa Publishing House, 2015.
3. Burkill. J. C , The Lebesgue Integral, Cambridge University Press, 1951.
4. Gelbaum, B. R. and J. Olmsted, Counter Examples in Analysis, Holden day, San Francisco, 1964.
5. Munroe. M. E, Measure and Integration, Addison- Wesley, Mass, 1971.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Acquire knowledge functions of bounded variation and Riemann Stieltjes integral.

CO 2 Understand the concepts in functions of several variables and determinants.

CO 3 Emphasize the aspects of Lebesgue Measure.

CO 4 Import knowledge on the Lebesgue integral.

CO 5 Construct rigorous mathematical proofs of basic results in real analysis

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**		**2**	
CO 2	**3**	**3**			
CO 3	**3**	**3**		**2**	
CO 4	**3**	**3**		**2**	
CO 5	**3**	**3**	**2**	**3**	**2**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: Dr. S. BALASUBRAMANIAN

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM2C7**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – II SEMESTER - CORE COURSE – VII

(For the candidates admitted from the year 2021-2022 onwards)

COMPLEX ANALYSIS

COURSE OBJECTIVES:

1. To know Complex analysis, in particular the theory of conformal mappings, has many physical applications and is also used throughout analytic number theory.
2. In modern times, it has become very popular through a new boost from complex dynamics and the pictures of fractals produced by iterating holomorphic functions and another important.
3. To the applications of complex analysis is in string theory which studies conform a invariants in quantum field theory.

UNIT – I	**Complex Integration:** Fundamental Theorems: 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. Local Properties of analytical Functions: Removable Singularities. Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.
UNIT – II	**Complex Integration:** 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 – Locally exact differentials – Multiply connected regions – 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.
UNIT – III	**Series and Product Developments:** Partial Fractions and Factorization: Partial fractions – Infinite products – Canonical products – The Gamma Function – Entire functions: Jensen's formula – Hadamard's Theorem – The Riemann Zeta Function: The product development – Extension of $\varsigma(s)$ to the whole plane – The zeros of zeta function – Normal Families: Equicontinuity – Normality and compactness –Arzela's theorem – Families of analytic functions – The Classical Definition.
UNIT – IV	**Conformal Mappings. Dirichlet's Problem:** The Riemann mapping Theorem: Statement and Proof – Boundary Behavior – Use of the Reflection Principle – Conformal mappings of polygons: The behavior at an angle – Schwarz-Christoffel formula – Mapping on a rectangle – A closer look at Harmonic Functions: Functions with the mean value property – Harnack's principle.
UNIT – V	**Elliptic Functions:** Simply Periodic Functions: Representation by Exponentials – The Fourier development – Functions of finite order – Doubly Periodic Functions: The Period Module – Unimodular transformations – The canonical basis – General properties of elliptic Functions – The Weierstrass Theory: The Weierstrass ρ-function – The functions $\varsigma(z)$ and $\sigma(z)$ – The differential equation – The modular function $\lambda(\tau)$ – The Conformal mapping by $\lambda(\tau)$.

TEXT BOOK:

Lars V. Ahlfors, Complex Analysis, (3rd Edition) McGraw Hill Book Company, New York,1979.

Unit	Chapters	Sections
1	4	1 to 3
2	4	4 to 6
3	5	2 to 5
4	6	1 to 3
5	7	1 to 3

REFERENCE BOOKS:

1. H.A. Presfly, Introduction to complex Analysis, Clarendon Press, oxford,1990.
2. J.B. Corway, Functions of one complex variables, Springer - Verlag, International student Edition, Narosa Publishing Co.
3. E.Hille,Analytic function Theory(2vols.),Gonm&Co,1959.
4. M.Heins, Complex function Theory, Academic Press, New York, 1968.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Effectively locate and use the information needed to prove theorem and establish mathematical results.

CO 2 Evaluate Complex integrals by applying Cauchy integral formula.

CO 3 Understand Residue theorem, the argument principle and Rouche's theorem, and Compute integrals using residues.

CO 4 Define and analyze limits and continuity for functions of complex variables, Cauchy Riemann equations, analytic functions, and entire function.

CO 5 Recognize simple periodic and doubly periodic functions.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Entrepreneurships oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**3**	**2**	**1**
CO 2	**3**	**3**	**3**	**2**	
CO 3	**3**	**3**	**2**	**2**	
CO 4	**3**	**3**	**2**	**2**	
CO 5	**3**	**3**			

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)
2.Quiz Seminar
3.Pear Learning
4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
Total				75

COURSE DESIGNER : A.PRIYA

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM2C8**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – II SEMESTER - CORE COURSE – VIII

(For the candidates admitted from the year 2021-2022 onwards)

PARTIAL DIFFERENTIAL EQUATIONS

COURSE OBJECTIVES:

1. To Familiarize the students with the fundamental concepts of Partial differential equations which will be used as background knowledge for the specialized courses in any field.
2. To the study and solution methods of solving
   - Heat, Wave, Laplace, and Diffusion Equations
   - Integral Transforms and to increase self confidence in conducting research independently or within a team.

UNIT – I	**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 – Nonlinear partial differential equations of the first order – Cauchy's method of characteristics – Compatible system of first-order equations – Charpit's method – Special types of first-order equations – Solutions satisfying given condition – Jacobi's method.
UNIT – II	**Partial Differential Equations of The Second Order:** The origin of second-order equations – Linear partial differential equations with constant coefficients – Equations with variable coefficients–Separation of variables –The method of integral transforms – Nonlinear equations of the second order.
UNIT – III	**Laplace's Equation:** Elementary solutions of Laplace's equation – Families of equipotential surfaces – Boundary value problems – Separation of variables – Problems with axial symmetry–The theory of Green's function for Laplace's equation.
UNIT – IV	**The Wave Equation:** The occurrence of the wave equation in physics – Elementary solutions of the one-dimensional wave equation – Vibrating membranes: Application of the calculus of variations – Three dimensional problems – General solutions of the wave equation.
UNIT – V	**The Diffusion Equation:** Elementary solutions of the diffusion equation – Separation of variables – The use of integral transforms – The use of Green's functions.

TEXT BOOK:

Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, Inc. 1957.

Unit	Chapters	Sections
1	2	1 to 4, 7 to 13
2	3	1,4,5 & 9 to 11
3	4	2 to 6, 8
4	5	1,2 & 4 to 6
5	6	3 to 6

REFERENCE BOOKS:

1. M.D. Raisinghania Advanced Differential Equations S. Chand and Company Ltd., New Delhi,2001
2. K. Sankara Rao, Introduction to Partial Differential Equations, Second edition–Prentice–Hall of India, NewDelhi 2006.
3. J.N. Sharma & K. Singh Partial Differential Equations for Engineers & Scientists, Narosa Publishing House,2001
4. R. Dennemeyer, Introduction to Partial Differential Equations and Boundary value Problems, McGraw Hill Book Company, New York, 1968.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Classify first order partial differential equations and their solutions and solve them using different methods.

CO 2 Classify second order partial differential equations and solve one dimensional wave equations using different analytic methods.

CO 3 Solve Laplace equations using various analytical methods demonstrate uniqueness of solutions of certain kinds of these equations.

CO 4 Compute solutions of heat equations using certain analytic methods and verify uniqueness of solutions of some types of these equations.

CO 5 Examine and select the suitable method of solving to find the approximate solutions

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**3**	**3**	
CO 2	**3**	**3**	**3**	**3**	
CO 3	**3**	**3**	**3**	**3**	
CO 4	**3**	**3**	**3**	**3**	**2**
CO 5	**3**	**3**	**2**	**2**	**2**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)
2.Quiz Seminar
3.Pear Learning
4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: A. PRIYA

CHAIRMAN – BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM2E2A**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – II SEMESTER - ELECTIVE COURSE – II

(For the candidates admitted from the year 2021-2022 onwards)

DISCRETE MATHEMATICS

COURSE OBJECTIVES:

1. To demonstrate their understanding of Discrete Mathematics.
2. To Use mathematically correct terminology, notation and apply logical reasoning to solve a variety of problems.

UNIT – I	**Computability and Formal Languages:** Introduction – Russell's Paradox and Noncomputability - Ordered sets – Languages –Phrase structure grammars – Type of grammars and languages.
UNIT – II	**Permutations, Combinations, and Discrete Probability:** Introduction – The rules of sum and product – Permutations – Combinations – Discrete probability.
UNIT – III	**Relations and Functions:** Introduction – A relation model for data bases – Properties of binary relations – Equivalence relations and partitions – Partial ordering relations and lattices – Chains and antichains – A job-scheduling problem – Functions and the pigeonhole principle.
UNIT – IV	**Finite State Machines:** Introduction – Finite state machines – Finite state machines as models of physical systems – Equivalent Machines – Finite state machines as language recognizers – Finite state languages and type-3 languages.
UNIT – V	**Discrete Numeric Functions and Generating Functions:** Introduction – Manipulation of numeric functions – Generating functions – Combinatorial problems.

TEXT BOOK:

1. Liu, C.L., "Elements of Discrete Mathematics", McGraw-Hill Book co.

Unit	Chapters	Sections
1	2	2.1 to 2.6
2	3	3.1 to 3.4, 3.6, 3.9
3	4	4.1 to 4.8
4	7	7.1 to 7.6
5	9	9.1 to 9.5

REFERENCE BOOKS:

1. Trembly. J.P & Manohar. P., "Discrete Mathematical Structures with Applications to Computer Science" McGraw- Hill.
2. K.D Joshi, "Foundations of Discrete Mathematics", Wiley Eastern Limited
3. Kolman, Busy & Ross, "Discrete Mathematical Structures", PHI.
4. Alan Doer: "Applied Discrete Structure for Computer Science", Galgotia Publications Pvt. Ltd.
5. Seymour Lipschutz, M. Lipson: "Discrete Mathematics", McGraw-Hill Edition.
6. Kenneth G. Roden: "Discrete Mathematics and its Applications", McGraw- Hill international editions, Mathematics Series.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able

CO 1 Assimilate the notions of limit of a sequence and convergence of a series of real numbers.

CO 2 Calculate the limit and examine the continuity of a function at a point.

CO 3 Understand the consequences of various mean value theorems for differentiable functions.

CO 4 Sketch curves in Cartesian and polar coordinate systems.

CO 5 Apply derivative tests in optimization problems appearing in social sciences, physical sciences, life science and a host of other disciplines.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**3**	**3**	**2**
CO 2	**3**	**3**	**3**	**3**	**2**
CO 3	**3**	**3**	**2**	**1**	
CO 4	**3**	**3**	**2**	**2**	**1**
CO 5	**3**	**3**		**1**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture (Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: A. PRIYA

CHAIRMAN – BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM2E2B**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – II SEMESTER - ELECTIVE COURSE – II

(For the candidates admitted from the year 2021-2022 onwards)

NUMBER THEORY AND CRYPTOGRAPHY

COURSE OBJECTIVES:

Number Theory was studied for its long and rich history, its wealth of easily accessible and fascinating questions, and its intellectual appeal. But, in recent years Number Theory has been studied for both for the traditional reasons and for the compelling reason that number theory has become essential for graphy.

UNIT – I	**Divisibility:** Divisibility - Primes – **Congruences:** Congruences – Solutions of congruences – The Chinese Remainder Theorem – Techniques of Numerical calculation – Primitive roots and power residues.
UNIT – II	**Quadratic Reciprocity and Quadratic Forms:** Quadratic residues – Quadratic reciprocity – The Jacobi symbol.
UNIT – III	**Some Functions of Number Theory:** Greatest integer function – Arithmetic functions – The Moebius inversion formula.
UNIT – IV	**Some Diophantine Equations:** The equation ax+by=c – Simultaneous linear equations – Pythagorean triangles – Assorted examples – Ternary quadratic forms – Rational points on curves – Elliptic curves.
UNIT – V	**Public key Cryptography and RSA:** Principles of public-key cryptosystems – The RSA algorithm – **Other Public-Key Cryptosystems**: Elliptic curve arithmetic – Elliptic curve Cryptography.

TEXT BOOKS:

1. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An introduction to the theory of numbers, 5th Edition, John Wiley & Sons, Inc. NewYork, 1960.
2. William Stallings, Cryptography and Network Security Principles and Practice, 5th Edition, Prentice Hall, New York, 2011.

Unit	Chapters	Sections
1	1, 2[1]	1.2,1.3 & 2.1 to 2.4, 2.8
2	3[1]	3.1 to 3.3
3	4[1]	4.1 to 4.3
4	5[1]	5.1 to 5.7
5	9,10[2]	9.1, 9.2 & 10.3, 10.4

REFERENCE BOOKS:

1. Tom Apostol, Introduction to Analytic Number theory, Narosa Publications, New Delhi
2. David M. Burton, Elementary Number Theory, Wm. C. Brown Publishers, Dubuque, Iowa,1989.
3. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, NewYork,1987.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able

CO 1 Analyse the concept of divisibility, congruence, GCD & LCM.

CO 2 Evaluate GCD by Euclid Algorithm.

CO 3 Solve Diophantine equations of two or three variables.

CO 4 Apply the law of quadratic reciprocity and their methods to classify numbers as primitive roots, quadratic residues and non-residues.

CO 5 Acquire knowledge of Cryptography and data encryption.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	2
CO 3	3	3	2	1	
CO 4	3	3	3	2	1
CO 5	3	3		1	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: A. PRIYA

CHAIRMAN – BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM3C9**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – III SEMESTER - CORE COURSE – IX

(For the candidates admitted from the year 2021-2022 onwards)

MATHEMATICAL STATISTICS

COURSE OBJECTIVE:

To study probability mass/density functions, mathematical expectations, moment generating functions, marginal and conditional distributions, some special distributions, limiting distribution and the Central Limit Theorem.

UNIT – I	**Distributions of Random Variables:** The probability set function – Random variables – The probability density function – The distribution function – Mathematical expectation – Some special mathematical expectations – Chebyshev's inequality.
UNIT – II	**Conditional Probability and Stochastic Independence:** Conditional probability – Marginal and conditional distributions – Stochastic independence – **Some Special Distributions:** The Binomial, Trinomial and Multinomial distributions – The Poisson distribution.
UNIT – III	**Some Special Distributions:** The Gamma and Chi-Square Distributions – The Normal distribution- The Bivariate normal distribution – **Distributions of Functions of Random Variables:** Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type.
UNIT – IV	**Distributions of Functions of Random Variables:** The t and F distributions – Distributions of order statistics – The moment generating function technique – The distributions of X and $nS^2/$ $sigma^2$ – Expectations of functions of random variables.
UNIT – V	**Limiting Distributions:** Limiting distributions – Stochastic convergence- Limiting moment generating functions – The central limit theorem – Some theorems on limiting distributions.

TEXT BOOK:

Robert V. Hogg and Allen T. Craig, Introduction to Mathematical Statistics (Fourth Edition), Macmillan Publishing Co., Inc. New Yark, 1970.

Unit	Chapters	Sections
1	1	1.4 to 1.11
2	2,3	2.1, 2.2, 2.4, 3.1, 3.2
3	3	3.3 to 3.5, 4.1 to 4.3
4	4	4.4, 4.6 to 4.9
5	5	5.1 to 5.5

REFERENCE BOOKS:

1. M. Fisz, Probability theory and Mathematical statistics, John Wiley & sons, New York, 1963.
2. E.J. Dudewiczn and S.N. Mishra, Modern Mathematical Statistics, John Wiley & sons, New York, 1988.
3. V.N. Rohatgi, An introduction to Probability theory and Mathematical statistics, Wiley Eastern Limited, New Delhi, 1988.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Investigate mathematical expectations.

CO 2 Analyse marginal and conditional distributions, the gamma and chi-square distributions, the t & distributions.

CO 3 Explain moment generating function technique.

CO 4 Apply the Central Limit Theorems in problems.

CO 5 Recognize and appreciate the connections between theory and applications.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**		**2**	**2**
CO 2	**3**	**3**		**3**	
CO 3	**3**	**3**		**3**	
CO 4	**3**	**3**		**3**	
CO 5	**3**	**3**		**3**	**1**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER : Dr. A. VADIVEL

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM3C10**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – III SEMESTER - CORE COURSE – X

(For the candidates admitted from the year 2021-2022 onwards)

MATHEMATICAL METHODS

COURSE OBJECTIVE:

To know about Fourier Transforms, Fourier Sine Transforms, Fourier Cosine Transforms, Hankel Transforms, Integral Equations, Fredholm Integral Equations, Volterra Integral Equations, Singular Integral Equations and Calculus of variations.

UNIT – I	**Introduction:** Definition – Regularity Conditions – Special kinds of kernels – Eigen values and Eigen functions – Convolution integral – The inner or scalar product of two functions – **Integral Equations with Separable Kernels:** Reduction to a system of algebraic equations – Examples – Fredholm alternative – Examples – An approximate method.
UNIT – II	**Applications to Ordinary Differential Equations:** Initial value problems – Boundary value problems – Examples – **Singular Integral Equations:** The Abel integral equation – Examples.
UNIT – III	**Fourier Transforms and their Applications:** Definition of the Fourier transform and examples – Fourier transforms of generalised functions – Basic properties of Fourier transforms – Poisson's summation formula – Solutions of partial differential equations – Fourier Cosine and Sine transforms with example -Properties of Fourier Cosine and Sine transforms.
UNIT – IV	**Hankel Transforms and their Applications:** Introduction – The Hankel transform and examples – Operational properties of the Hankel transform – Applications of Hankel transforms to Partial Differential Equations.
UNIT – V	**The Calculus of Variations:** The method of Variations in Problems with fixed boundaries: Variation and its properties – Euler's equation – Functionals dependent on the functions of several independent variables – Variational problems in parametric form– Some applications.

TEXT BOOKS:

1. Ram P. Kanwal, Linear Integral Equations Theory and Technique, Academic Press, New York, 1971.
2. Lokenath Debnath and Dambaru Bhatta, Integral Transforms and their Applications, 2nd Edition, Taylor& Francis Group, London, 2007.
3. L. Elsgolts, Differential Equations and Calculus of Variations, Mir Publishers, Moscow, 1970.

Unit	Chapters	Sections
1	1, 2[1]	1.1 to 1.6, 2.1 to 2.5
2	5, 8[1]	5.1 to 5.3, 8.1 to 8.2
3	2[2]	2.3 to 2.6, 2.12 to 2.14
4	7[2]	7.1 to 7.4
5	6[3]	1,2,5,6,7

REFERENCE BOOKS:

1. I.N.Sneddon, The Use of Integral Transforms, McGraw-Hill, NewYork, 1972.
2. Shanti Swarup, Integral Equations, Krishna Prakashan Media Ltd,Meerut, 1982.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able

CO 1 Apply Euler-Lagrange equation or its first integral to find differential equations for stationary paths

CO 2 Demonstrate a depth of understanding in advanced mathematical topics in relation to geometry of curves and surfaces

CO 3 Find the extremal of a functional.

CO 4 Acquire sound knowledge of different types of Integral equations: Fredholm and Volterra integral equations and represent integral equations to algebraic system of equations

CO 5 Evaluates the solution to an integral equation using successive approximation.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**		**2**	**2**
CO 2	**3**	**3**		**3**	
CO 3	**3**	**3**			
CO 4	**3**	**3**	**2**	**2**	
CO 5	**3**	**3**	**3**	**2**	**1**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER : A. PRIYA

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **SUBJECT CODE: P21MM3C11**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – III SEMESTER - CORE COURSE – XI

(For the candidates admitted from the year 2021-2022 onwards)

TOPOLOGY

COURSE OBJECTIVES:

1. Mathematics is the fundamental subject for all science. Therefore, every student is expected to have basic.
2. To prepare every student to face the competitive world.
3. To stimulate the analytical mind of the students, enable them to acquire sufficient knowledge and skill in the subject that will make them competent in various areas of Mathematics.

UNIT – I	**METRIC SPACES:** The Definition and some Examples – Open sets – Closed sets – Convergence, Completeness and Baire's theorem, Continuous mappings – Spaces of continuous functions – Euclidean and Unitary Spaces.
UNIT – II	**TOPOLOGICAL SPACES**: The Definition and some Examples – elementary concepts – open bases and open subbases – weak topologies – The function algebra ✔(X, R) and ✔(X, C)
UNIT – III	**COMPACTNESS:** Compact spaces – Product of spaces – Tychnoff's theorem and locally compact spaces – Compactness for Metric spaces – Ascoli's theorem.
UNIT – IV	**SEPARATION:** T_1-spaces and Hausdorff spaces – Completely regular spaces and normal spaces - The Urysohn lemma and Tietze Extension Theorem - ,The Urysohn imbedding theorem – The Stone-Cech compactification.
UNIT – V	**CONNECTEDNESS AND APPROXIMATION:** Connected spaces – The components of a space – Totally disconnected spaces - Local connected spaces – The Weierstrass approximation theorem – The Stone-Weierstrass theorem.

TEXT BOOK:

George F. Simmons, **"Introduction to Topology and Modern Analysis"**, McGraw Hill Book Company 1963.

Unit	Chapters	Page Numbers
1	2	9-15
2	3	16-20
3	4	21-25
4	5	26-30
5	6,7	31-36

REFERENCE BOOKS:

1. James. R. Munkres, **"Topology"**, second Edition, Prentice Hall of India Pvt., Ltd., New Delhi2005
2. J. Dugundji, **"Topology"** Prentice hall of India, New Delhi 1975.
3. J.L. Kelly, **"General topology"**, Van Nostrand Reinhold Co., New York.
4. M. G. Murdeswar **"General Topology"**, Academic press, 1964
5. K. D. Joshi **"Introduction to General Topology"**, Addison-Wesley, 1994.
6. S. Kumaresan, "**Topology of Metric Spaces**" Alpha Science International Ltd. Harrow, U.K

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

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COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Study and Understand the concepts of metric spaces, topological spaces

CO 2 Understand the concepts of open bases and open sub bases

CO 3 Understand the concepts of Compactness, connectedness and separation axioms

CO 4 Understand the concepts of Compactness, connectedness and separation axioms

CO 5 Provide patience to grapple with life outside the campus.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**		**2**	**2**
CO 2	**3**	**3**		**2**	**1**
CO 3	**3**	**3**		**1**	
CO 4	**3**	**3**		**1**	
CO 5	**3**	**3**			

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER : Dr. S. BALASUBRAMANIAN

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM3E3A**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – III SEMESTER - ELECTIVE COURSE – III

(For the candidates admitted from the year 2021-2022 onwards)

OPTIMIZATION TECHNIQUES

COURSE OBJECTIVES:

This course will enable the students to use integer programming problem to solve system of linear equations, provide the depth knowledge about inventory control theory and make students to solve the inventory problems, introduce the concept of non–linear programming problems, use optimization techniques to solve many practical problems

UNIT – I	**Integer Programming:** Introduction – Gomory's all - I.P.P. method – Construction of Gomory's constraints – Fractional cut method-all integer – Fractional cut method-mixed integer – Branch and bound method.
UNIT – II	**Dynamic Programming:** Introduction – The recursive equation approach – Characteristics of dynamic programming – Dynamic programming algorithm – Solutions of discrete D.P.P. – Some applications – Solution of L.P.P. by dynamic programming.
UNIT – III	**Inventory Control:** Introduction – The inventory decisions – Cost associated with inventories – Factors affecting inventory control – Economic order quantity – Deterministic inventory problems with no shortages – Deterministic inventory problems with shortages – EOQ problems with price breaks – Probabilistic inventory problems.
UNIT – IV	**Queueing Theory:** Introduction – Queueing system – Elements of a queueing system – Operating characteristics of queueing system – Probability distributions in queueing systems – Classification of queueing models – Definition of transient and steady states – Poisson queueing systems.
UNIT – V	**Classical Optimization Theory:** Unconstrained problems – Constrained problems – **Nonlinear Programming Algorithms:** Unconstrained nonlinear algorithms – constrained algorithms (Omit: Linear combinations method and SUMT algorithm).

TEXT BOOK:

1. Hamdy A. Taha, Operations Research, (10th edition) Prentice–Hall of India private Limited, New Delhi,1997.
2. Kanti Swarup, P.K. Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, Educational Publishers, New Delhi, 1977.

Unit	Chapters	Sections
1	7[2]	7.1 to 7.6
2	13[2]	13.1 to 13.7
3	19[2]	19.1 to 19.8 & 19.12
4	20[2]	20.1 to 20.8
5	20,21[1]	20.1,20.2 & 21.1,21.2.1 to 21.2.3

REFERENCE BOOKS:

1. Panneerselvam.R, Operations Research, 2nd Edition, PHI Learning Private Limited, Delhi, 2015
2. Hiller.F.S & Lieberman.J Introduction to Operation Research ,7th Edition, Tata–MC Graw Hill Publishing Company, New Delhi, 2001.
3. Prem Kumar Gupta. Er, Hira. D.S. Operations Research,7th Edition, S.Chand & Company Pvt.Ltd.2014.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Solve Integer Programming by Gomory's cutting plane method

CO 2 Examine the technologies of Dynamic Programming and solves the shortest route problem.

CO 3 Solve a Linear programming problem using the dynamic programming approach.

CO 4 Analyze and solve multivariable optimization with equality constraints

CO 5 Formulate the general Non Linear Programming Problem and able to solve by Wolfe's modified simplex method.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**3**	**3**	
CO 2	**3**	**3**	**2**	**2**	
CO 3	**3**	**3**	**2**	**2**	
CO 4	**3**	**3**		**2**	
CO 5	**3**	**3**	**2**	**2**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER : Dr. P.ARUNASWATHI VYJAYANTHI

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM3E3B**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – III SEMESTER - ELECTIVE COURSE – III

(For the candidates admitted from the year 2021-2022 onwards)

PROBABILITY AND STOCHASTIC PROCESSES

COURSE OBJECTIVES:

This course will enable the students to

Expose the students to the basics of probability theory and random processes essential for their subsequent study of analog and digital communication.

UNIT – I	The probability set function – Conditional probability and Independence – Random variable of discrete type and continuous type – Transformations – Expectation of random variable – Some special expectations – Important inequalities.
UNIT – II	Distribution of two random variables – Transformations: Bivariate Random variables - Conditional distribution and expectation – Correlation coefficient – Independent random variables - Expectation of functions – Convergence in probability – Convergence in Distribution – Central Limit Theorem.
UNIT – III	Stochastic processes – An Introduction – Specification of Stochastic processes – Markov Chains: Definitions and Examples – Higher Transition probabilities – Generalization of Independent Bernoulli Trails: Sequence of Chain –Dependent Trails.
UNIT – IV	Markov Chains: Classification of States and Chains – Determination of Higher Transition probabilities – Stability of a Markov Chains-Markov Chain with Denumerable number of states - Reducible Chains - Markov Chain with Continuous state space.
UNIT – V	Markov processes with Discrete state space : Poisson process – Poisson process and related distributions – Generalization of Poisson process –Birth and Death process-Markov processes with Discrete state space (Continuous time Markov Chains).

TEXT BOOK:

1. Robert V. Hogg, Allen Craig and Joseph W. Mckean., **"Introduction to Mathematical Statistics"** – 6th edition, Peer son Prentice Hall Publications.
2. J. Medhi **"Stochastic Processes" –** 3rd edition, New Age International Publishers

Unit	Chapters	Sections
1	1	1.3 to 1.10
2	2, 4	2.1 to 2.5, 4.1 to 4.4
3	1, 2	1.5, 2.1 to 2.3
4	2	2.4 , 2.5,2.6,2.8,2.9,2.11
5	3	3.1 to 3.5

REFERENCE BOOKS:

1. PaulG.Hoel, **"Introduction to Mathematical Statistics"**, John Wiley and sons Inc.
2. S.C.Gupta and V.K.Kapoor., **"Fundamentals of Mathematical statistics"**, S.Chand Company.
3. Samuel Karlin, Howard M.Taylor, **"A first course in Stochastic processes"**, 2ndEdition, Academic Press, 1975.
4. Narayan Bhat, **"Elements of Applied Stochastic Process"**, 2nd edition, John Wiley,1984.
5. S. K. Srinivasan and K. Mehata, **"Stochastic Processes"**, Tata McGraw Hill,1976.
6. N. U. Prabhu, **"Stochastic Processes"**. Macmillan,1965.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.

CO 2 Characterize probability models and function of random variables based on single & multiples random variables

CO 3 Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits

CO 4 Understand the concept of random processes and determine covariance and spectral density of stationary random processes

CO 5 Demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**		**3**	**3**
CO 2	**3**	**3**		**2**	**2**
CO 3	**3**	**3**	**2**	**3**	**2**
CO 4	**3**	**3**		**3**	**2**
CO 5	**3**	**3**	**2**	**2**	**1**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: Dr. P.ARUNA SWATHI VYJAYANTHI

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM3E4A**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – III SEMESTER - ELECTIVE COURSE – IV

(For the candidates admitted from the year 2021-2022 onwards)

TYPE SETTING IN LATEX

COURSE OBJECTIVES:

To develop article writing with the help of $LaTeX$.

UNIT – I	**Introduction**: What Is $LaTeX$? – Why $LaTeX$ Over Other Word Processors? – How to Prepare a $LaTeX$ Input File? – How to Compile a $LaTeX$ Input File? – $LaTeX$ Syntax – Keyboard Characters in $LaTeX$. **Fonts Selection:** Text-Mode Fonts – Math-Mode Fonts – Emphasized Fonts – Colored Fonts.
UNIT – II	**Formatting Texts I:** Sectional Units – Labeling and Referring Numbered Items – Texts Alignment – Quoted Texts –New Lines and Paragraphs – Creating and Filling Blank Space – Producing Dashes Within Texts – Preventing Line Break – Adjusting Blank Space After a Period Mark – Hyphenating a Word. **Formatting Texts II:** Increasing Depth of Sectional Units – Changing Titles and Counters of Sectional Units – Multiple Columns–Mini Pages – Foot Notes – Marginal Notes.
UNIT – III	**Page Layout and Style:** Page Layout – Page Style – Running Header and Footer – Page Breaking and Adjustment – Page Numbering. **Listing and Tabbing Texts:** Listing Texts – Tabbing Texts Through the tabbing Environment.
UNIT – IV	**Table Preparation I:** Table Through the tabular Environment – Table Through the tabularx Environment – Vertical Positioning of Tables – Sideways(Rotated) Texts in Tables – Adjusting Column Width in Tables – Additional Provisions for Customizing Columns of Tables – Merging Rows and Columns of Tables – Table Wrapped by Texts – Table with Colored Back ground. **Figure Insertion:** Commands and Environment for Inserting Figures – Inserting a Simple Figure – Side-by-Side Figures – Sub-numbering a Group of Figures – Figure Wrapped by Texts – Rotated Figure – Mathematical Notations in Figures – Figuresin Tables – Figures in Multi-column Documents – Changing Printing Format of Figures – Figures at the End of a Document – Editing LATEX Input File Involving Many Figures.
UNIT – V	**Equation Writing I:** Basic Mathematical Notations and Delimiters – Mathematical Operators – Mathematical Expressions in Text-Mode – Simple Equations – Array of Equations – Left Aligning an Equation – Sub-numbering a Set of Equations. **User-Defined Macros**: Defining New Commands – Defining New Environments – Redefining Existing Environments.

TEXT BOOK:

Dilip Datta, $LaTeX$ in 24 Hours – A Practical Guide for Scientific Writing, Springer International Publishing AG, 2017.

Unit	Chapters	Page Numbers
1	1, 2	1 to 14
2	3, 4	15 to 36
3	5, 6	37 to 58
4	7,9	59 to 70, 81 to 90
5	11, 13	101 to 112, 125 to 136

REFERENCE BOOKS:

1. George Grätzer, More Math Into $LaTeX$, Fifth Edition, Springer International Publishing AG, 2016.
2. Stefan Kottwitz, LaTeX Cookbook, Packt Publishing, BIRMINGHAM, 2015.
3. George Gr¨atzer, Practical $LaTeX$, Springer International Publishing, Switzerland, 2014.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Install and use MikTeX

CO 2 Know the procedure for typesetting documents in $L^{A}T_{E}X$.

CO 3 Understand the working rules of document preparation.

CO 4 Produce the $L^{A}T_{E}X$ documents.

CO 5 Define and use new commands within LaTeX.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	
Skill oriented	✓	Enterpreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**3**	**2**	
CO 2	**3**	**3**	**3**		
CO 3	**3**	**3**	**3**		
CO 4	**3**	**3**	**3**		
CO 5	**3**	**3**	**3**	**2**	**1**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	Section	Nature of the question	Maximum Marks	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: K. KALPANA

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3	COURSE CODE: P21MM3E4B
GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005 **M.Sc. MATHEMATICS – III SEMESTER - ELECTIVE COURSE – IV** (For the candidates admitted from the year 2021-2022 onwards) **PROGRAMMING IN C++**	
COURSE OBJECTIVE: To develop programming skills in C++ and its object oriented concepts.	
UNIT – I	**Beginning with C++:**Applications of C++ – A simple C++ Program – More C++ statements – An example with class – Structure of C++ Program–Creating the Source File– Compiling and Linking. **Tokens, Expressions and Control Structures:** Introduction– Tokens – Keywords.
UNIT – II	**Functions in C++**: Introduction – The Main Function – Function Prototyping – Call by Reference – Return by Reference – Inline Functions – Default Arguments – *const* Arguments – Function Overloading – Friend and Virtual Functions. **Classes and Objects:** Introduction–C Structures Revisited – Specifying a Class – Defining Membership Functions – A C++ Program with Class – Making an Outside Function Inline – Nesting of Member Functions – Private Member Functions – Arrays within a Class.
UNIT – III	**Classes and Objects:** Memory Allocation for Objects – Static Data Member – Static Member Functions – Arrays of Objects – Objects as Function Arguments – Friendly Functions – Returning Objects – const Member Functions – Pointers to Members – Local Classes. **Constructors and Destructors:** Introduction – Constructors – Parameterized Constructors – Multiple constructors in a class – Constructors with Default Arguments.
UNIT – IV	**Constructors and Destructors:** Dynamic Initialization of Objects – Copy Constructor – Dynamic Constructors – Constructing Two-Dimensional Arrays – const Objects – Destructors. **Operator Overloading and Types Conversions**: Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators Using Friends – Manipulation of Strings Using Operators– Rules For Overloading Operators – Type Conversions.

UNIT – V	**Inheritance: Extending Classes**: Introduction – Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes: Nesting of Classes. **Pointers, Virtual Functions and Polymorphism:** Introduction – Pointers – Pointers to Objects – this Pointer – Pointers to Derived Classes – Virtual Functions – Pure Virtual Functions.

TEXT BOOK:

E. Balagurusamy, Object Oriented Programming with C++, 4th Edition, The McGraw–Hill Company Ltd, New Delhi, 2008.

Unit	Chapters	Sections
1	2, 3	2.2 to 2.8, 3.1to 3.3
2	4, 5	4.1 to 4.10, 5.1 to 5.9
3	5, 6	5.10 to 5.19, 6.1 to 6.5
4	6, 7	6.6 to 6.11, 7.1 to 7.8
5	8, 9	8.1 to 8.12, 9.1 to 9.7

REFERENCE BOOKS:

1. V. Ravichandran, Programming with C++, Second Edition Tata McGraw – Hill, New Delhi,2006.
2. H. Schildt, The complete Reference of C++, Tata–McGraw–Hill publishing Company Ltd. New Delhi,2003.
3. S.B. Lipman and J.Lafer, C++ Primer, Addition Wesley, Mass., 1998.
4. Ashok N.Kamthane, Object Oriented Programming with ANSI and TURBO C++, Pearson Education(P) Ltd,2003.
5. Bjarme Stroustrup, The C++ Programming Language, AT & T Labs, Murray Hills, NewJersey,1998.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Demonstrate Object oriented features and C++ concepts.

CO 2 Discuss the file operators in C++ programming

CO 3 Explain structures and Arrays within structures

CO 4 Create C++ Program using pointers.

CO 5 Learn the syntax and semantics of the **C++** programming language.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	
Skill oriented	✓	Entrepreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**3**	**3**	**1**
CO 2	**3**	**3**	**3**	**3**	**1**
CO 3	**3**	**3**	**3**	**3**	
CO 4	**3**	**3**	**3**	**3**	
CO 5	**3**	**3**	**3**	**2**	**1**

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture (Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
Total				75

COURSE DESIGNER: K.KALPANA

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM4C12**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – IV SEMESTER - CORE COURSE – XII

(For the candidates admitted from the year 2021-2022 onwards)

FUNCTIONAL ANALYSIS

COURSE OBJECTIVES:

1. To introduce Banach spaces and Hilbert spaces.
2. To study fundamental theorems of functional analysis that includes Hahn Banach theorem, Open mapping theorem and Uniform boundedness principle and introduce operator theory and Banach algebras leading to the spectral theory of operators.

UNIT – I	**Banach Spaces:** The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem.
UNIT – II	**Banach Spaces:** The natural embedding of N in N** – The open mapping theorem – The conjugate of an operator.
UNIT – III	**Hilbert Spaces:** The definition and some simple properties – Orthogonal complements – Orthonormal sets – The conjugate space H*.
UNIT – IV	**Hilbert Spaces:** The adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections.
UNIT – V	**General Preliminaries on Banach Algebras:** The Definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum– The formula for the spectral radius – The radial and semi-simplicity.

TEXT BOOK:

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

Unit	Chapters	Sections
1	9	46 to 48
2	9	49 to 51
3	10	52 to 55
4	10	56 to 59
5	12	302 to 317

REFERENCE BOOKS:

1. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & sons, 1978.
2. G. Bachman and Lawrence Narici, Functional Analysis, Dover Publications, 2000.
3. H. C. Goffman and G. Fedrick, First course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
4. A. E. Taylor and D. C. Lay, Introduction to Functional Analysis, second edition, John Wiley & Sons, 1980.
5. B. Bollabas, Linear Analysis - An introductory course, Cambridge University Press (Indian edition), 1999.
6. B. V. Limaye, Functional Analysis, Revised Third Edition, New Age International, 2017.
7. M. Thamban Nair, Functional Analysis - A First Course, Prentice Hall of India, 2010.
8. S. Ponnusamy, Foundations of Functional Analysis, Narosa Publishing House, 2002.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME:

At the end of the course, students will be able

CO 1 Identify Banach spaces and analyse their properties with other types of spaces.

CO 2 Examine and identify properties of complex Banach spaces- Hilbert spaces.

CO 3 Apply the analytical techniques and theoretical knowledge in Hilbert Spaces. Find out and determine orthonormal sets.

CO 4 Explain various properties of Hilbert spaces.

CO 5 Attain knowledge and experience of working with many pure mathematical problems.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**		**2**	
CO 2	**3**	**3**		**2**	
CO 3	**3**	**3**		**3**	
CO 4	**3**	**3**		**2**	
CO 5	**3**	**3**		**3**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1. Lecture(Chalk and Talk-OHP-LCD)
2. Quiz Seminar
3. Pear Learning
4. Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
Total				75

COURSE DESIGNER : Dr. A. VADIVEL

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM4C13**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR - 639005

M.Sc. MATHEMATICS – IV SEMESTER - CORE COURSE – XIII

(For the candidates admitted from the year 2021-2022 onwards)

DIFFERENTIAL GEOMETRY

COURSE OBJECTIVES:

This course gives students basic knowledge of classical differential geometry of curves and surfaces such as the catenary, the tractrix, the cycloid and the surfaces of constant Gaussian curvature and minimal surfaces.

UNIT – I	**The Theory of Space Curves:** Introductory remarks about space curves – Definitions – Arc length – Tangent, normal and binormal – Curvature and torsion of a cure given as the intersection of two surfaces –Contact between curves and surfaces – Tangent surface, involutes and evolutes – Intrinsic equations, fundamental existence theorem for space curves– Helices.
UNIT – II	**The Metric: Local Intrinsic Properties of a Surface:** Definition of a surface – Curves on a surface – Surfaces of revolution – Helicoids – Metric – Direction coefficients – Families of curves – Isometric correspondence – Intrinsic properties.
UNIT – III	**The Metric: Local Intrinsic Properties of a Surface:** Geodesics – Canonical geodesic equations – Normal property of geodesics - Existence theorems – Geodesic parallels – Geodesics curvature – Gauss- Bonnet Theorem –Gaussian curvature–Surfaces of constant curvature.
UNIT – IV	**The second fundamental form: Local Non-intrinsic Properties of a Surface:** The second fundamental form – Principal curvatures – Lines of curvature – Developables – Developables associated with space curves – Developables associated with curves on surfaces–Minimal surfaces– Ruled surfaces.
UNIT – V	**Differential Geometry of Surfaces in the Large:** Compact surfaces whose points are umblics – Hilbert's lemma – Compact surface of constant Gaussian or mean curvature – Complete surfaces – Characterization of complete surfaces–Hilbert's Theorem–Conjugate points on geodesics.

TEXT BOOK:

T.J. Willmore, "An Introduction to Differential Geometry", Oxford University press, New Delhi, 1959.

Unit	Chapters	Sections
1	1	1 to 9
2	2	1 to 9
3	2	10 to 18
4	3	1 to 8
5	4	2 to 8

REFERENCE BOOK:

1. D.T. Struik, "Lectures on Classical Differential Geometry",Addition –Wesley, Mass, 1950.
2. S. Kobayashi and K.Nomizu, "Foundations of Differential Geometry", Interscience Publishers,1963.
3. W.Klingenberg, "A Course in Differential Geometry", Graduate Texts in Mathematics, Springer – Verlag 1979.
4. C.E.Weatherburn, "Differential Geometry of Three Dimensions", University Press, Cambridge,1930.

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

COURSE OUTCOME: At the end of the course, students will be able

CO 1 Compute the curvature and torsion of space curves. coefficients and their derivatives.

CO 2 Understand the fundamental theorem for plane curves. involutes and evolutes of space curves with the help of examples

CO 3 Find the osculating surface and osculating curve at any point of a given curve.

CO 4 Determine the first and the second fundamental forms of surface.

CO 5 Explain the Gaussian curvature, the mean curvature, the curvature lines, the asymptotic lines, the geodesics of a surface.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**2**	**2**	
CO 2	**3**	**3**	**2**	**2**	
CO 3	**3**	**3**	**2**	**2**	
CO 4	**3**	**3**	**2**	**2**	
CO 5	**3**	**3**		**2**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)
2.Quiz Seminar
3.Pear Learning
4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
			Total	75

COURSE DESIGNER: A. PRIYA

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM4C14**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005
M.Sc. MATHEMATICS – IV SEMESTER - CORE COURSE – XIV

(For the candidates admitted from the year 2021-2022 onwards)

GRAPH THEORY

COURSE OBJECTIVE:

To have knowledge about graphs and its structure, understand Trees and Connectivity, identify Euler tours, Hamilton Cycles and Matchings and study about Colourings and its characterization.

UNIT – I	**Graphs and Subgraphs:** Graphs and simple graphs – Graph isomorphism – The incidence and adjacency matrices – Sub graphs – Vertex degrees – Paths and connection – Cycles – Applications: The shortest path problem.
UNIT – II	**Trees:** Trees – Cut edges and bonds – Cut vertices -Cayley's formula. **Connectivity**: Connectivity – Blocks.
UNIT – III	**Euler Tours and Hamilton Cycles:** Euler Tours – Hamilton Cycles – The Chinese postman problem – The travelling salesman problem.
UNIT – IV	**Matchings:** Matchings – Matchings and coverings in bipartite graphs – Perfect matchings – **Edge Colourings:** Edge chromatic number, Vizing's theorem.
UNIT – V	**Independent Sets and Cliques:** Independent sets – Ramsey's theorem. **Vertex Colourings:** Chromatic number, Brook's Theorem.

TEXT BOOK:

J.A. Bondy and U.S.R. Murty, Graph theory with applications, The Macmillan Press Ltd., 1976.

Unit	Chapters	Sections
1	1	1.1 to 1.8
2	2, 3	2.1 to 2.4, 3.1, 3.2
3	4	4.1 to 4.4
4	5, 6	5.1 to 5.3, 6.1,6.2
5	7, 8	7.1, 7.2, 8.1, 8.2

REFERENCE BOOKS:

1. Doughlas B. West, Introduction to Graph Theory –Second edition, PHI learning pvt. Ltd,2011.
2. A.Gibbons, Algorithmic Graph Theory, Cambridge University Press, Cambridge,1989.
3. S.A.Choudum, A First Course in Graph Theory, MacMillan India Ltd.1987.
4. Richard J. Trudeau, Introduction to Graph Theory (Dover Books on Mathematics) Paperback – 9 Feb 1994.
5. Gary Chartrand, Ping Zhang, A First Course in Graph Theory, courier Corporation,2012.

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COURSE OUTCOME: At the end of the course, students will be able

CO 1 Analyze various types of graphs and identify bipartite graphs.

CO 2 Examine and identify properties of trees. Find out and determine vertex and edge connectivity of all simple graphs.

CO 3 Apply the analytical techniques and theoretical knowledge in solving many real-life problems. To prove theorems related to Hamiltonian, Eulerian graphs and matching.

CO 4 Solve and analyze the colouring problem and apply them in the Time tabling problem and the Storage Problem.

CO 5 Apply Euler's formula and Four Colour Conjecture in various problems and in many practical situations.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**3**	**2**	
CO 2	**3**	**3**	**3**	**2**	
CO 3	**3**	**3**		**2**	
CO 4	**3**	**3**	**2**	**2**	
CO 5	**3**	**3**	**2**	**2**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)
2.Quiz Seminar
3.Pear Learning
4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
Total				75

COURSE DESIGNER: A. PRIYA

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM4E5A**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – IV SEMESTER - ELECTIVE COURSE – V

(For the candidates admitted from the year 2021-2022 onwards)

FLUID DYNAMICS

COURSE OBJECTIVES:

This course will enable the students to

Understand the basic techniques and results of the Fluid dynamics, familiarize with the properties of fluids and the applications of fluid mechanics, understand the concept of fluid measurement, types of flows and dimensional analysis, formulate important results and theorems, use the theory, methods and techniques of fluid dynamics to solve problems.

UNIT – I	**Kinematics of Fluids in Motion:** Real fluids and ideal fluids – Velocity of a fluid at a point – stream lines and path lines; steady and unsteady flows – The velocity potential – The vorticity vector – Local and particle rates of change – The equation of continuity – Worked examples.
UNIT – II	**Equations of Motion of a Fluid:** Pressure at a point in a fluid at rest – Pressure at a point in a moving fluids – Conditions at a boundary of two inviscid immiscible fluids – Euler's equations of motion – Discussion of the case of steady motion under conservative body forces.
UNIT – III	**Some Three-Dimensional Flows:** Introduction – Sources, sinks and doublets – Images in a rigid infinite plane – Axi-symmetric flows; Stoke's stream function. **Some Two-dimensional Flows:** Meaning of two-dimensional flow – Use of cylindrical polar coordinates – The stream function.
UNIT – IV	**Viscous Flow:** Stress components in a real fluid – Relations between Cartesian components of stress – Translation motion of fluid element – The rate of strain quadric and principle stresses –Some further properties of the rate of strain quadric.
UNIT – V	**Viscous Flow:** Stress analysis in fluid motion – Relations between stress and rate of strain – The coefficient of viscosity and laminar flow – The Navier-Stoke's equations of motion of a viscous fluid.

TEXT BOOK:

F. Chorlton, Fluid Dynamics, CBS publications, New Delhi, 1985.

Unit	Chapters	Sections
1	2	2.1 to 2.8
2	3	3.1 to 3.4, 3.7
3	4, 5	4.1 to 4.3, 4.5, 5.1 to 5.3
4	8	8.1 to 8.5
5	8	8.6 to 8.9

REFERENCE BOOK:

1. G.K.Batchaclor, An introduction to fluid mechanics, foundation books.
2. S.W.Yuan, Foundation of fluid mechanics, Prentice Hall of India Pvt.Ltd
3. R.K.Rathy, An introduction to fluid dynamics, IBH publishing company.

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COURSE OUTCOME: At the end of the course, students will be able

CO 1 Identify and obtain the values of fluid properties and relationship between them.

CO 2 Understand the principles of continuity, momentum, and energy as applied to fluid motions.

CO 3 Recognize these principles written in form of mathematical equations.

CO 4 Apply dimensional analysis to predict physical parameters that influence the flow in fluid dynamics.

CO 5 Know the relation between Cartesian components of stress.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**		**2**	
CO 2	**3**	**3**		**3**	
CO 3	**3**	**3**	**2**	**2**	**2**
CO 4	**3**	**3**	**3**	**3**	
CO 5	**3**	**3**		**2**	

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems-At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation –One question from every Unit	3(Out of 5)x10	30
Total				75

COURSE DESIGNER: S. MURUGAMBIGAI – Dr. S. BALASUBRAMANIAN

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 3 **COURSE CODE: P21MM4E5B**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – IV SEMESTER - ELECTIVE COURSE – V

(For the candidates admitted from the year 2021-2022 onwards)

MEASURE THEORY AND INTEGRATION

COURSE OBJECTIVE:

To Study financial mathematics through various models and various aspects of financial mathematics.

UNIT – I	**Measure on Real line:** Lebesgue outer measure – Measurable sets – Regularity –Measurable function – Boral and Lebesgue measurability.
UNIT – II	**Integration of Non-negative functions:** The general integral – Integration of series –Riemann and Lebesgue integrals.
UNIT – III	**Abstract measure spaces:** Measures and outer measures – Completion of Measures– Measure spaces – Integration with respect to measure.
UNIT – IV	**Convergence in measure:** Almost uniform convergence – Signed measure and the Hahn decomposition – The Jordan decomposition – Radon-Nikodym Theorem.
UNIT – V	**The Classical Banach spaces:** LP spaces – Minkowski and Holder's inequality –Completeness – Approximation in LP spaces.

TEXT BOOKS:

1. G. de. Barra. **"Measure theory and integration"**, New Age International(P) Ltd.
2. H. L. Royden, **"Real Analysis"**, 3rd Edition, PHI Ltd.

Unit	Chapters	Sections
1	2[1]	2.1 to 2.5
2	3[1]	3.1 to 3.4
3	5[1]	5.1, 5.4 to 5.6
4	7, 8[1]	7.1,7.2 & 8.1 to 8.3
5	6[2]	6.1 to 6.4

REFERENCE BOOKS:

1. **"Measure and Integration"** 2nd Edition by M. E. Munroe, Addison – Wesley PublishingCompany – 1971.
2. **"Lebesgue Measure and Integration"**, P. K . Jain , V. P. Gupta , New Age International(P) Ltd,New Delhi - 1986 (Reprint - 2000)
3. Measure and Integral: **"An Introduction to Real Analysis"**, Richard L.Wheeden and AntoniZygmund, Marcel Dekker Inc. 1977.
4. **"An Introduction to Measure and Integration"** , Inder K. Rana, Narosa Publishing House,New Delhi – 1997.

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COURSE OUTCOME: At the end of the course, students will be able

CO 1 Learn the basic concepts of measure and integration.

CO 2 Comprehend the differences between different types of convergences.

CO 3 Understand the concepts of Classical Banach Spaces

CO 4 Learn completeness and approximation in L_p-spaces.

CO 5 An overview of the central results of the theory of Lebesgue integration.

Nature of Course			
Knowledge and Skill	✓	Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	✓

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**3**	**3**	**2**	**2**	
CO 2	**3**	**3**	**1**	**3**	**2**
CO 3	**3**	**3**	**2**	**2**	
CO 4	**3**	**3**			
CO 5	**3**	**3**			

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1

PEDEGOGY:

1.Lecture(Chalk and Talk-OHP-LCD)

2.Quiz Seminar

3.Pear Learning

4.Assignments

Template – End Semester Examination

Knowledge level	**Section**	**Nature of the question**	**Maximum Marks**	
K_3	A	Understanding Description/Problems – Two questions from every Unit	10x2	20
K_4,K_5	B	Analysis, Evaluation, Description/Problems- At least one question from every Unit	5(Either or type)x5	25
K_4, K_5	C	Application/Analysis/Synthesis/ Evaluation – One question from every Unit	3(Out of 5)x10	30
Total				75

COURSE DESIGNER: S. MURUGAMBIGAI – Dr. S. BALASUBRAMANIAN

CHARIMAN - BOS **CONTROLLER OF EXAMINATIONS**

CREDIT: 5 **COURSE CODE: P21MM4PW**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-639005

M.Sc. MATHEMATICS – IV SEMESTER – PROJECT WORK

(For the candidates admitted from the year 2021-2022 onwards)

PROJECT WORK

COURSE OBJECTIVES:

Develop critical understanding on issues and investigations in Mathematics curriculum, pedagogy and assessment, differentiate between significant research trends in Mathematics Education, understand ethical issues in Mathematics Education research.

SL.	Area of Work	Maximum Marks
I.	PROJECT WORK	
(i)	Plan of the Project	20
(ii)	Execution of the plan / Collection of data / Organization of materials/ Fabrication Experimental study / Hypothesis, Testing etc., and Presentation of there port.	45
(iii)	Individual Initiative	15
II.	VIVA VOCE EXAMINATION	**20**
	Total (I+II)	**100**

COURSE OUTCOME: At the end of the course, students will be able to

CO 1 Describe several areas of mathematics.

CO 2 Solve problems using mathematics in unfamiliar settings, and explain why Mathematical thinking is valuable in daily life.

CO 3 Acquire knowledge for future research work.

CO 4 Get innovative ideas for social benefit.

CO 5 At the end of the final semester, students are given exposure to present their project report using latex, a mathematical document preparation system.

MAPPING

COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**			
CO 2	**3**	**3**			
CO 3	**3**	**3**			
CO 4	**3**	**3**			
CO 5	**3**	**3**	**3**		

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