FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A" Grade by NAAC (3rd Cycle)
74th Rank in India Ranking 2020 (NIRF) by MHRD
Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT : MATHEMATICS

NAME OF THE PROGRAMME : M.Sc. MATHEMATICS

PROGRAMME CODE : PSMA

ACADEMIC YEAR : 2022 - 2023

Minutes of the Board of Studies
Department of Mathematics
To be implemented from 2022-2023 onwards.

Venue : B5
Convened on : 16.3.2022 Convened at : 2pm.

Members Present : (Names with Initial and Designation)

1.	Dr. Pandia Raja Principal Thyagaraja College, Madurai - 625009 Mail ID : pandiaraja.d@gmail.com Mobile No : 7708091177	University Nominee
2.	Dr. M. Navaneethakrishnan Associate Professor & Head Department of Mathematics Kamaraj College, Thoothukudi - 628003 Mail ID : navaneetha n65@yahoo.co.in Mobile No : 9443871893	Subject Expert.
3.	Dr. D. Muthuramakrishnan, Dean of Science. Head of the Department, Department of Mathematics National College. Trichy - 620001 Mail ID : dmuthuramakrishnan@gmail.com	Subject Expert.

4.	MS. S. Sindhuja Senior Statistical officer National Statistical office (FOD) Ministry of Statistics and Programme implementation B Wing 2nd Floor Shastri Bhavan, Haddows Road Nungambakkam, Chennai - 600006	Industrialist.
5.	Dr. K.P.V. Preethi Assistant Professor Department of Mathematics Saiva Bhanu Kshatriya College Aruppukottai - 626101 Mail ID: vpreethi90@yahoo.com Mobile No: 9655234040	Alumna.
6.	Dr. A. PAULIN MARY	Head of the Department
7.	Mrs. A. Sheela Roselin. Dr. Sr. M. Fatima Mary Dr. C. Prasanna Devi Dr. E. Helena Mrs. Nigila Raghavan Mrs. M. Teresa Nirmala Dr. V. Vanitha Dr. M.V. Selvi Meenakshi Mrs. R. Tenovi Rosary Deepa	

Mrs. B. Velkamary Jackquiline
Mrs. J. Annal Mercy.

Minutes of the Board of Studies.
1. Presentation of the Action Taken Report.

Action Taken Report for 2021-2022 - UG

S.No.	Common Suggestions offered in the Previous Board	Action Taken for the Academic year 2021-2022.
1.	The Board recommended to Shift Computer programming with C and object oriented Programming with C^{++} from V and VI Semesters to I and II Semesters respectively as Allied papers.	Computer programming with C and object oriented programming with C^{++} are Shifted to I and II Semesters as Allied Papers.
2.	The Board passed the Syllabus for new Self-learning interdisciplinary Course, "Mathematics and Economics for Competitive Examinations" (21UGLM2SL) for advanced learners of I UG.	The Syllabi passed by the Board for new Self-Learning Interdisciplinary Course, "Mathematics and Economics for Competitive Examinations" (21UGLM2SL) for advanced learners of I UG was Implemented

Action Taken Report for 2021-2022 - PG.

S.No.	Common Suggestions offered in the Previous Board	Action Taken for the Academic year 2021-2022
1.	The Board recommended to remove "Crisp Sets and Fuzzy Sets - Unit I, Classical logic an over View, Fuzzy logic & Necessity measures in Unit IV of 19PG3ME1 - Fuzzy Sets and its Applications.	Removed Classical Logic an over View, Fuzzy logic in Unit I: Crisp Sets and Fuzzy Sets & Neccessity measure, in Unit IV, Fuzzy Measures of 19PG3ME1- Fuzzy Sets and its Applications and the code no is changed to 21PG3ME
2.	The Board passed the Syllabi for new Self-Learning Course, "Verbal and Numerical Aptitude for National Examination", (21PGLM2SL) for advanced learners of I PG.	The Syllabi passed by the Board for new Self-learning Interdisciplinary Course, "Verbal and Numerical Aptitude for National Examination (21PGLM2SL) for advanced learners of I PG was Implemented.

Change of Course Title : Nil

S.NO	Old Course Code	New Course Code	Old course Title	New Course Title	Need for Change

New Courses Introduced - UG.

S.No.	Course Code	Course Title	Relevance To Global	Scope for Emp	Need for Introduction
1.	21UGLM2SL	Mathematics and Economics for Competitive Examinations	✓	✓	Enable the Students to appear for Competitive Exams

New Courses Introduced - PG.

S.No	Course Code	Course Title	Relevance To National level	Scope for Emp.	Need for Introduction
1.	21PGLM2SL	Verbal and Numerical Aptitude for National Examinations	✓	✓	Enable the Students to appear for National Examinations

Revised Courses.

S.No	Course Code	Course Title	No & Title of Units Revised with the Content Specified	% Of Revision	Need For Revision
1.	21PG3MEI	Fuzzy Sets and its applications	Unit I: Crisp Sets and		

		Fuzzy sets: Classical Logic: an overview, Fuzzy Logic Unit IV Fuzzy Measurers: Neccessity Measures.	10% removed	Based on the feed back from the Students. Syllabus is too heavy for 4 hrs.

2. Updations of open Educational Resources in the list of references of each Course - UG.

S.No	Course code	Course Title	Details of Updation
1.	19M3CC5/19M3CC5	Modern Algebra	1. https://www.khanacademy.org 2. https://www.britanica.com/
2.	19M4CC5/19M4CC7	Sequences and series	1. https://www.cuemath.com/ 2. https://www.ncert.nic.in/
3.	19M6ME3	Object Oriented Programming with C++.	1. https://www.cplusplus.com/ 2. https://www.cppreference.com/
4.	19M3ACC1	Allied Mathematics - I	1. https://mathworld.wolfram.com 2. www.britannica.com

Updation of open Educational Resources in the list of reference of Course - PG.

S.No.	Course code	Course Title	Details of Updation.
1.	19PG3M10	Optimization Techniques	http://books.google.com/books/about Mathematical Optimization Techniques./
2.	19PG4ME3	Formal Languages	1. http://cse.iitkgp.ac.in/Course theory 2. https://people.cs.uchicago.edu/

3. Revision of Courses - UG.

S.No	Course Code	Course Title	No & Title of Units Revised with the Revised Content.	Y. of Revision	Need for Revision
1.	19M2CC3/ 19C2CC3	Differential Equations	Unit I, Differential Equations of First order; variable Separable Method	21 Included	It is the basic for the other Content of the Unit
2.	21M2AC P2	Allied Mathematics-II	Unit I, Diff. Equations of First order	21 included	Basic of the Unit.

		Variable Separable method			
3.	21M3AcC1	Allied Mathematics - I	Unit III, Differential equations of the first order, variable Separable method.	5% included	Basic for the other Content of the Unit
4.	22M6CC14	Dynamics	Unit IV; Simple Harmonic Motion is removed and "Moment of Inertia" is included. Units are rearranged according to the chapters given in the text book	20% changed	Students learn "Simple Harmonic Motion" in XI Std Physics.

Revisions of Courses - PG.

S.No	Course Code	Course Title	No of Units With the Content	% Of Revision	Need for Revision
1.	19PG1M4	Classical Mechanics	Unit V Bertrand's Theorem	2% Removed	Too heavy for the Students.
2.	19PG2M7	Differential Equations	Unit II - Linear Equations	2% Included	It is needed to

			with variable Coefficients Section 9 of Chapter - 3.		prove other theorems
3.	19PM1M2	Real Analysis	Unit I: Remove appendix.	2% Removed.	Too heavy for the Students
4.	22PM2M6	Advanced Real Analysis	Unit V - Functions of Several variables removed and other four Units are converted into V units.	20% Removed.	Board felt the Syllabus is too heavy.
5.	22PM3M9	Measure and Integration	Unit V - Measure and Integration in a Product Space is removed and the first Unit is divided into two Units	20% Removed.	Board felt the Syllabus is heavy.
6.	19PM3M12	Topology	Unit V - Countability and Separation axioms - Tychonoff's Theorem.	2% Introduced	It is an important Concept in Topology

4. New Courses Introduced - UG

S.NO.	Course Code	Course Title	Relevance to Global	Scope for Skill Dev.	Need for Introduction
1.	22M4SB2/ 22G4SB2	Trigonometry	✓	✓	To enhance Conceptual understanding and problem solving ability
2.	22UGMA4 SL	Financial Mathe-matics	National Level	Emp. S.D ✓ ✓	To enhance employabi-lity Skills

New Courses Introduced - PG. - Nil.

5. Introduction of Purely Skill - Embedded certificate / Diploma / Advanced Diploma value added Course other than the value added Course that is already being offered.

The Certificate Course 'Speed Arithmetic' is changed Also 'Computational Mathematics' is changed.

S.No	Course Code	Course Title		Skills Sharpened	Course Out Come
1.	22UGVACM1	Quantitative and Qualitative Methods for Competitive Examinations.	NEW	Analytical Reasoning Skills	1. Develop General Mental Ability 2. Apply Analytical Reasoning 3. Understand Pattern, and Problem Solving techniques to apply for Competitive exams.
2	22UGVACG1	Concrete Mathematics	NEW	Analytical Reasoning Skills	

6. Rubrics for Internship / Project

S.No.	C_1 20mks	C_2 20mks	CIA Total 40mks	External 60mks.
1.	Followup after 15 days	Viva Voce after Completion	40	60.

For the 2020-2023 Batch, the V and VI Semester Elective papers are interchanged as.

19M5ME1/- Computer Programming with C
19G5ME1

19M5MEP1/19G5MEP1 - C Practical

19M5ME2/- Object oriented Programming
19G5ME2 with C++

19M5MEP2/- C++ Practical
19G5MEP2

19M6ME3/- Fuzzy Mathematics
19G6ME3

19M6ME4 - Theory of Numbers.

For 2021-2024 Batch the following are the 2nd and 3rd year papers.

19M3CC5/19G3CC5 - Modern Algebra,
19M3CC6/19G3CC6 - Advanced Statistics
19M4CC7/19G4CC7 - Sequences & Series
19M4CC8/19G4CC8 - Linear Algebra
19M5CC9/19M5CC9 - Real Analysis
19M5CC10/19G5CC10 - Statics
19M5CC11/19G5CC11 - Linear Programming

19M5CC12/19G5CC12 – Graph Theory
19M6CC13/19G6CC13 – Complex Analysis
22M6CC14/22G6CC14 – Dynamics
19M6CC15/19G6CC15 – Operations Research
19M3SB1/19G3SB1 – Applications of Calculus and Differential Equations.
22M4SB2/22G4SB2 – Trigonometry

Name	Signature
1. Dr. A. Paulin Mary	
2. Dr D. Pandia Raja	Absent
3. Dr. M. Navaneetha Krishnan	
4. Dr. D. Muthuramakrishnan	
5. Dr. K. P. V. Preethi	
6. Ms. S. Sindhuja	Absent
7. Dr N. Malathi	16/03/22
8. Mrs. A. Sheela Roselin	
9. Dr. Sr. M. Fatima Mary	
10. Dr. C. Prasanna Devi	
11. Dr. E. Helena	

12. Mrs. Nigila Ragavan

13. Mrs. M. Teresa Nirmala

14. Dr. V. Vanitha

15. Mrs. R. Jenovi Rosary Deepa.

16. Mrs. B. Vetha Mary Jackelin

17. Mrs. J. Annal Mercy

18.

18. Dr. K. Amutha

19 Dr. M. Rasi

20. Dr. M. V. Sethu Meenakshi

16/3/22

COLLEGE PROFILE

Fatima College (Autonomous), Mary Land, Madurai, is a Post Graduate and Research Institution for Women affiliated to Madurai Kamaraj University. It is a Catholic Minority institution established and run by St. Joseph's Society of Madurai (of the Congregation of the Sisters of St. Joseph of Lyons, France). This institution came into existence through the tireless efforts of the missionary sisters of St. Joseph of Lyons and the zeal and heroic sacrifice of Rev. Sr. Rose Benedicta, the Foundress of the College.

The College was started in St. Joseph's Campus Madurai as a Second Grade College with 63 students in 1953. It was upgraded into a Post Graduate College in 1964; Autonomous in 1990 and a Research Institute in 2004. The College now offers 21 Undergraduate Programmes, 13 Postgraduate Programmes, 2 Professional Programme, 5 M.Phil. Programmes and 6 Departments have become Research Centres. It has strength of 4134 Students, 206 Teaching Staff and 100 Non-Teaching Staff.

The comprehensive assessment by NAAC in 1999 placed Fatima College in Five Star Status of merit. The college strives to sustain excellence, quality and relevance while equipping the students to meet the demands of higher education in India. In 2004 UGC conferred on Fatima College the status of College with Potential for Excellence. In 2006 and 2013 NAAC Re-Accredited the College with 'A' Grade. The College was ranked 94th in the All India NIRF Ranking in 2019 by MHRD.

VISION

WOMEN'S EMPOWERMENT THROUGH EDUCATION

The vision of the college is to empower women by developing human capabilities through quality education based on Christian values, making them responsible citizens who can work for the advancement of the society and promote communal harmony in the multi-religious and multi-cultural reality of India eventually evolving into women of communion.

MISSION

- To enhance quality of life through the development of individuals.
- To enable women to become contributors in the economic, social and political development of India.
- To equip the students with 21st century skill-sets with a focus on problem-solving abilities
- To motivate them to work for social justice
- To give preference to the rural economically backward and first-generation learners
- To enable students to be employed in the technology oriented competitive market

VISION OF THE DEPARTMENT

To enhance quality of life through Mathematical skills and its applications

MISSION OF THE DEPARTMENT

To empower the students to contribute to the world of Mathematics by their inventions

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

A graduate of M.Sc. Mathematics programme after five years will be

PEO 1	Our graduates will be academic, digital and information literates, creative, inquisitive, innovative and committed researchers who would be desirous for the "more" in all aspects
PEO 2	They will be efficient individual and team performers who would deliver excellent professional service exhibiting progress, flexibility, transparency, accountability and in taking up initiatives in their professional work
PEO 3	The graduates will be effective managers of all sorts of real – life and professional circumstances, making ethical decisions, pursuing excellence within the time framework and demonstrating apt leadership skills
PEO 4	They will engage locally and globally evincing social and environmental stewardship demonstrating civic responsibilities and employing right skills at the right moment.

GRADUATE ATTRIBUTES (GA)

Fatima College empowers her women graduates holistically. A Fatimite achieves all-round empowerment by acquiring Social, Professional and Ethical competencies. A graduate would sustain and nurture the following attributes:

I. SOCIAL COMPETENCE	
GA 1	Deep disciplinary expertise with a wide range of academic and digital literacy
GA 2	Hone creativity, passion for innovation and aspire excellence
GA 3	Enthusiasm towards emancipation and empowerment of humanity
GA 4	Potentials of being independent
GA 5	Intellectual competence and inquisitiveness with problem solving abilities befitting the field of research
GA 6	Effectiveness in different forms of communications to be employed in personal and professional environments through varied platforms
GA 7	Communicative competence with civic, professional and cyber dignity and decorum
GA 8	Integrity respecting the diversity and pluralism in societies, cultures and religions
GA 9	All – inclusive skill sets to interpret, analyse and solve social and environmental issues in diverse environments
GA 10	Self awareness that would enable them to recognise their uniqueness through continuous self-assessment

	in order to face and make changes building on their strengths and improving their weaknesses
GA 11	Finesse to co-operate exhibiting team-spirit while working in groups to achieve goals
GA 12	Dexterity in self-management to control their selves in attaining the kind of life that they dream for
GA 13	Resilience to rise up instantly from their intimidating setbacks
GA 14	Virtuosity to use their personal and intellectual autonomy in being life-long learners
GA 15	Digital learning and research attributes
GA 16	Cyber security competence reflecting compassion, care and concern towards the marginalised
GA 17	Rectitude to use digital technology reflecting civic and social responsibilities in local, national and global scenario
II. **PROFESSIONAL COMPETENCE**	
GA 18	Optimism, flexibility and diligence that would make them professionally competent
GA 19	Prowess to be successful entrepreuners and become employees of trans-national societies
GA 20	Excellence in Local and Global Job Markets
GA 21	Effectiveness in Time Management
GA 22	Efficiency in taking up Initiatives
GA 23	Eagerness to deliver excellent service
GA 24	Managerial Skills to Identify, Commend and tap Potentials
III. **ETHICAL COMPETENCE**	

GA 25	Integrity and be disciplined in bringing stability leading a systematic life promoting good human behaviour to build better society
GA 26	Honesty in words and deeds
GA 27	Transparency revealing one's own character as well as self-esteem to lead a genuine and authentic life
GA 28	Social and Environmental Stewardship
GA 29	Readiness to make ethical decisions consistently from the galore of conflicting choices paying heed to their conscience
GA 30	Right life skills at the right moment

PROGRAMME OUTCOMES (PO)

On completion (after years) of M. Sc Programme, the graduates would be able to

PO 1	**Acquire advanced research skills by utilising their Mathematical knowledge**
PO 2	**Develop analytical ability and carry out complex activities with an application approach**
PO 3	**Access the effective computability using Mathematical models**

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion (after two years) of M.Sc. Mathematics programme, the graduates would be able to

PSO 1	Develop proficiency in the analysis of complex mathematical problems and the use of Mathematical or other appropriate techniques to solve them.
PSO 2	Provide a systematic understanding of core mathematical concepts, principles and theories along with their applications.
PSO 3	Demonstrate the ability to conduct Research independently and pursue higher studies towards the Ph. D degree in Mathematics and computing.
PSO 4	Understand the fundamental axioms in Mathematics and develop Mathematical ideas based on them.
PSO 5	Provide advanced knowledge on topics in Pure Mathematics, empowering the students to pursue higher studies.

2% removed

I M.Sc. Mathematics

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG1M4	CLASSICAL MECHANICS	PG Core	6	4

COURSE DESCRIPTION

This course provides a sound knowledge of the concepts and principles in mechanics.

COURSE OBJECTIVES

The aim of the course is to help the students to understand mechanics of a particle, Lagrange's equations, Hamilton's principles, Two body problem and Kepler's problem and apply it for solving problems.

UNITS

UNIT –I MECHANICS OF A PARTICLE (15 HRS.)

Mechanics of a particle, Mechanics of a system of particles, Constraints, D'Alambert's principle.

UNIT –II LAGRANGE'S EQUATIONS (15HRS.)

Lagrange's equations, velocity – dependent potentials and the dissipation function, simple application of the Lagrangian formulation

UNIT –III HAMILTON'S PRINCIPLE (20 HRS.)

Hamilton's principle, some techniques of the calculus of variations, Derivation of Lagrange's equation from Hamilton's principle

UNIT –IV: LAGRANGE'S EQUATIONS FOR NON-HOLONOMIC SYSTEMS AND SYMMETRIC PROPERTIES (20HRS.)

Extension of Hamilton's principle to non-holonomic systems, **Advantages of a variational principle formulation (self study)**, conservation theorems and symmetry properties.

UNIT –V CLASSIFICATION OF ORBITS (20 HRS.)

Two body central force problem – reduction to the equivalent one-body problem – the equations of motions and first integrals – the equivalent one - dimensional problem and classification of orbits – the Virial theorem – **the differential equation for the orbit and integrable power law potentials – The Kepler problem; Inverse square law of force - The motion in time in the Kepler's problem-The Laplace –Runge-Lenz vector(self study**)

TEXT BOOK:

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

UNIT I : Chapter: 1(1.1-1.4)
UNIT II : Chapter: 1(1.4-1.6)
UNIT III : Chapter: 2(2.1-2.3)
UNIT IV : Chapter: 2(2.4-2.6)
UNIT V : Chapter: 3(3.1 - 3.5,3.7-3.9)

REFERENCES:

1. Rutherford,*Classical Mechanics,* Oliver and Boyd Ltd, 1964

2. RanaN.C. and JoagR.S., *Classical Mechanics,* TMH Publishers

3. https://www.springer.com/gp/book/9783030385842

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**MECHANICS OF A PARTICLE**			
1.1	Mechanics of a particle	4	Chalk & Talk	Black Board
1.2	Mechanics of a system of particles	4	Chalk & Talk	Black Board
1.3	Constraints	4	Chalk & Talk	Black Board
1.4	D'Alambert's principle	3	Chalk & Talk	Black Board
UNIT -2	**LAGRANGE'S EQUATIONS**			
2.1	Lagrange's equations	4	Chalk & Talk	Black Board
2.2	Velocity – dependent potentials and the dissipation function	5	Chalk & Talk	Black Board
2.3	Simple application of the Lagrangian formulation	6	Discussion	Black Board
UNIT -3	**HAMILTON'S PRINCIPLE**			
3.1	Hamilton's principle	6	Chalk & Talk	Black Board
3.2	Some techniques of the calculus of the variations	8	Chalk & Talk	Black Board
3.3	Derivation of Lagrange's equation from Hamilton's principle	6	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -4 LAGRANGE'S EQUATIONS FOR NON-HOLONOMIC SYSTEMS AND SYMMETRIC PROPERTIES				
4.1	Extension of Hamilton's principle to non-holonomic systems	5	Chalk & Talk	Black Board
4.2	Advantages of a variational principle formulation	6	Discussion	Black Board
4.3	conservation theorems and symmetric properties	9	Discussion	Black Board
UNIT -5 CLASSIFICATION OF ORBITS				
5.1	Two body problem, reduction to the equivalent one body problem	2	Discussion	Black Board
5.2	The equations of motions and first integrals	3	Discussion	Black Board
5.3	The equivalent one dimensional problem and classification of orbits- The Virial theorem	4	Discussion	Black Board
5.4	The differential equation for the orbit and integrable power law potential	3	Discussion	PPT
5.5	The Kepler problem; Inverse square law of force.	5	Discussion	PPT
5.6	The motion in time in the Kepler's problem-The Laplace – Runge-Lenz vector	4	Discussion	PPT

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Describe the behaviour of a particle, the system of particles and D'Alambert's principle.	K2	PSO2
CO 2	Solve problems using Lagrangian formulation	K2& K3	PSO1
CO 3	Explain Hamilton's principle in Physical reality	K2,K3 & K4	PSO3
CO 4	Construct Lagrange's equation for non - holonomic system	K2, K3 & K4	PSO4
CO 5	Apply the laws of forces in central orbit to solve Kepler's problem	K2, K4&K5	PSO5

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**3**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**3**

CO4	2	2	2	3	2
CO5	2	3	2	2	2

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	3
CO3	3	3	2	2
CO4	2	3	2	3
CO5	2	3	2	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Mrs. A. Paulin Mary

Forwarded By

HOD'S Signature

& Name

I M.Sc. Mathematics

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG1M4	CLASSICAL MECHANICS	PG Core	6	4

COURSE DESCRIPTION

This course provides a sound knowledge of the concepts and principles in mechanics.

COURSE OBJECTIVES

The aim of the course is to help the students to understand mechanics of a particle, Lagrange's equations, Hamilton's principles, Two body problem and Kepler's problem and apply it for solving problems.

UNITS

UNIT –I MECHANICS OF A PARTICLE (15 HRS.)

Mechanics of a particle, Mechanics of a system of particles, Constraints, D'Alambert's principle.

UNIT –II LAGRANGE'S EQUATIONS (15HRS.)

Lagrange's equations, velocity – dependent potentials and the dissipation function, simple application of the Lagrangian formulation

UNIT –III HAMILTON'S PRINCIPLE (20 HRS.)

Hamilton's principle, some techniques of the calculus of variations, Derivation of Lagrange's equation from Hamilton's principle

UNIT –IV: LAGRANGE'S EQUATIONS FOR NON-HOLONOMIC SYSTEMS AND SYMMETRIC PROPERTIES (20HRS.)

Extension of Hamilton's principle to non-holonomic systems, **Advantages of a variational principle formulation (self study)**, conservation theorems and symmetry properties.

UNIT –V CLASSIFICATION OF ORBITS (20 HRS.)

Two body central force problem – reduction to the equivalent one-body problem – the equations of motions and first integrals – the equivalent one - dimensional problem and classification of orbits – the Virial theorem – **the differential equation for the orbit and integrable power law potentials – The Kepler problem; Inverse square law of force - The motion in time in the Kepler's problem-The Laplace –Runge-Lenz vector(self study**)

TEXT BOOK:

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

UNIT I : Chapter: 1(1.1-1.4)
UNIT II : Chapter: 1(1.4-1.6)
UNIT III : Chapter: 2(2.1-2.3)
UNIT IV : Chapter: 2(2.4-2.6)
UNIT V : Chapter: 3(3.1- 3.5,3.7- 3.9)

REFERENCES:

1. Rutherford,*Classical Mechanics,* Oliver and Boyd Ltd, 1964

2. RanaN.C. and JoagR.S., *Classical Mechanics,* TMH Publishers

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**MECHANICS OF A PARTICLE**			
1.1	Mechanics of a particle	4	Chalk & Talk	Black Board
1.2	Mechanics of a system of particles	4	Chalk & Talk	Black Board
1.3	Constraints	4	Chalk & Talk	Black Board
1.4	D'Alambert's principle	3	Chalk & Talk	Black Board
UNIT -2	**LAGRANGE'S EQUATIONS**			
2.1	Lagrange's equations	4	Chalk & Talk	Black Board
2.2	Velocity – dependent potentials and the dissipation function	5	Chalk & Talk	Black Board
2.3	Simple application of the Lagrangian formulation	6	Discussion	Black Board
UNIT -3	**HAMILTON'S PRINCIPLE**			
3.1	Hamilton's principle	6	Chalk & Talk	Black Board
3.2	Some techniques of the calculus of the variations	8	Chalk & Talk	Black Board
3.3	Derivation of Lagrange's equation from Hamilton's principle	6	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -4 LAGRANGE'S EQUATIONS FOR NON-HOLONOMIC SYSTEMS AND SYMMETRIC PROPERTIES				
4.1	Extension of Hamilton's principle to non-holonomic systems	5	Chalk & Talk	Black Board
4.2	Advantages of a variational principle formulation	6	Discussion	Black Board
4.3	conservation theorems and symmetric properties	9	Discussion	Black Board
UNIT -5 CLASSIFICATION OF ORBITS				
5.1	Two body problem, reduction to the equivalent one body problem	2	Discussion	Black Board
5.2	The equations of motions and first integrals	3	Discussion	Black Board
5.3	The equivalent one dimensional problem and classification of orbits- The Virial theorem	4	Discussion	Black Board
5.4	The differential equation for the orbit and integrable power law potential	3	Discussion	PPT
5.5	The Kepler problem; Inverse square law of force.	5	Discussion	PPT
5.6	The motion in time in the Kepler's problem-The Laplace – Runge-Lenz vector	4	Discussion	PPT

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 – Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non – Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Describe the behaviour of a particle, the system of particles and D'Alambert's principle.	K2	PSO2
CO 2	Solve problems using Lagrangian formulation	K2& K3	PSO1
CO 3	Explain Hamilton's principle in Physical reality	K2,K3 & K4	PSO3
CO 4	Construct Lagrange's equation for non - holonomic system	K2, K3 & K4	PSO4
CO 5	Apply the laws of forces in central orbit to solve Kepler's problem	K2, K4&K5	PSO5

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	2	2
CO2	2	2	3	2	2
CO3	2	2	2	2	3
CO4	2	2	2	3	2
CO5	2	3	2	2	2

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	3
CO3	3	3	2	2
CO4	2	3	2	3
CO5	2	3	2	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Dr. A. Paulin Mary

Forwarded By

(Dr. A. Paulin Mary)

HOD'S Signature & Name

2% included

I M.Sc. Mathematics

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG2M7	DIFFERENTIAL EQUATIONS	PG Core	6	4

COURSE DESCRIPTION

This course will provide the knowledge for solving of ordinary and partial differential equations in physical and other phenomena.

COURSE OBJECTIVES

To give an in-depth knowledge for solving differential equations which are frequently used in Physics, Chemistry, Biology, Economics and Mechanics.

UNITS

UNIT –I: LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS (20 HRS)

Introduction-The second order homogeneous equation-Initial value problems for second order equations - Linear dependence and independence-A formula for the Wronskian - the non-homogeneous equation of order two-the homogeneous equation of order n- Initial value problems for n-th order equations-the non homogeneous equation of order n.

UNIT –II LINEAR EQUATIONS WITH VARIABLE COEFFICIENT (20 HRS)

Initial value problems for the homogeneous equations – solutions of the homogeneous equations – The Wronskian and linear independence – reduction of the order of a homogeneous equation - the non-homogeneous equation- homogeneous equation with analytic coefficients – the Legendre equation.

UNIT –III: LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS

(15 HRS)

The Euler equation – second order equations with regular singular points – an example – The Bessel Equation – The Bessel Equations (Continued).

UNIT –IV PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

(20 HRS)

Linear equations of the first order – integral surfaces passing through a given curve – Compatible systems of first order equations - **Charpit's method** – **solutions satisfying given conditions – Jacobi's method.**

UNIT –V PARTIAL DIFFERENTIAL EQUATIONS OF THE SECOND ORDER

(15 HRS)

The origin of second order equations – linear partial equations with constant coefficients (self study) – equations with variable coefficients – separation of variables.

TEXT BOOKS:

1. Earl. A. Coddington, *An Introduction to Ordinary Differential Equations,* Prentice Hall of India – 1987

Unit I **:** Chapter 2: 2.1- 2.8, 2.10

Unit II **:** Chapter 3**:** 3.1 - 3.8

Unit III **:** Chapter 4 **:** 4.1 - 4.3, 4.7 - 4.8

2. Ian Sneddon -*Elements of Partial differential equations,* McGraw-Hill International Editions, 1986

Unit IV **:** Chapters 2 : 2.4 - 2.5, 2.9 - 2.13

Unit V **:** Chapters 3**:** 3.1, 3.4, 3.5, 3.9

REFERENCES:

1. S. G. Deo, & V. Raghvendra Rao- *Ordinary Differential Equations and stability Theory* - Prentice Hall Second Edition - 1988
2. John. F, Narosa - *Partial Differential Equations* - 3rd Edition – 1979
3. D. Somasundaram, Narosa - *Ordinary Differential Equations* - Narosa Publishing House - Fifth Reprint -2011.
4. http://tutorial.math.lamar.edu/classes/DE/DE.aspx

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS**			
1.1	Introduction-The second order homogeneous equation	3	Chalk & Talk	Black Board
1.2	Initial value problems for second order equations	3	Chalk & Talk	Black Board
1.3	Linear dependence and independence	3	Chalk & Talk	Black Board
1.4	A formula for the Wronskian	3	Chalk & Talk	Black Board
1.5	The non-homogeneous equation of order two, the homogeneous equation of order n	4	Chalk & Talk	Black Board
1.6	Initial value problems for n-th order equations-the non homogeneous equation of order n.	4	Chalk & Talk	Black Board
UNIT -2	**LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS**			
2.1	Initial value problems for the homogeneous equations	3	Chalk & Talk	Black Board
2.2	Solutions of the homogeneous equations	3	Chalk & Talk	Black Board
2.3	The Wronskian and linear independence	3	Chalk & Talk	Black Board
2.4	Reduction of the order of the homogeneous equation	3	Chalk & Talk	Black Board
2.5	The non-homogeneous equation- homogeneous	4	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	equation with analytic coefficients			
2.6	The Legendre equation	4	Chalk & Talk	Black Board
UNIT -3	**LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS**			
3.1	The Euler equation	4	Chalk & Talk	Black Board
3.2	second order equations with regular singular points – an example	4	Chalk & Talk	Black Board
3.3	Bessel Equation	4	Chalk & Talk	Black Board
3.4	The Bessel Equations (Continued).	3	Chalk & Talk	Black Board
UNIT -4	**PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER**			
4.1	Linear equations of the first order	2	Chalk & Talk	Black Board
4.2	Integral surfaces passing through a given curve	4	Chalk & Talk	Black Board
4.3	Compatible systems of first order equations	4	Chalk & Talk	Black Board
4.4	Charpit's method	3	Discussion	Black Board
4.5	Solutions satisfying given conditions	4	Discussion	Black Board
4.6	Jacobi's method	3	Discussion	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -5	**PARTIAL DIFFERENTIAL EQUATIONS OF THE SECOND ORDER**			
5.1	The origin of second order equations	4	Discussion	PPT
5.2	Linear partial equations with constant coefficients	4	Discussion	PPT
5.3	Equations with variable coefficients	4	Discussion	Black Board
5.4	Separation of variables	3	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2	M1+M2	Mid-Sem.Test	Once in a Sem.				
	5	5+5=10	15	5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	**5**		**5**	**12.5 %**
K3	5	3	4	-	**12**		**12**	**30 %**
K4	-	5	4	-	**9**		**9**	**22.5%**
K5	-	-	4	5	**9**		**9**	**22.5 %**
Non-Scho.						**5**	**5**	**12.5 %**
Total	**5**	**10**	**15**	**5**	**35**	**5**	**40 mks.**	**100 %**

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 – Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Define Linear differential equations with constant coefficients and prove different theorems and solve problems.	K2&K3	PSO2
CO 2	Solving problems of the n^{th} order in differential equations with variable coefficients	K2& K3	PSO1
CO 3	Identify Regular singular points and derive Bessel's Equation.	K2 & K3	PSO4
CO 4	Explain the methods of solving problems in partial differential equations of first order.	K2, K3&K4	PSO5
CO 5	Form Partial differential equations of the second order and solve problems in partial differential equations of second order.	K2,K3, K4&K5	PSO3

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**3**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**3**
CO4	**2**	**2**	**2**	**3**	**2**

CO5	**2**	**3**	**2**	**2**	**2**

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**2**	**3**	**2**	**2**
CO2	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**3**
CO5	**2**	**3**	**2**	**3**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Mrs. A. Paulin Mary

Forwarded By

HOD'S Signature

& Name

I M.Sc. Mathematics

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG2M7	DIFFERENTIAL EQUATIONS	PG Core	6	4

COURSE DESCRIPTION

This course will provide the knowledge for solving of ordinary and partial differential equations in physical and other phenomena.

COURSE OBJECTIVES

To give an in-depth knowledge for solving differential equations which are frequently used in Physics, Chemistry, Biology, Economics and Mechanics.

UNITS

UNIT –I: LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS (20 HRS)

Introduction-The second order homogeneous equation-Initial value problems for second order equations - Linear dependence and independence- A formula for the Wronskian - the non-homogeneous equation of order two- the homogeneous equation of order n- Initial value problems for n-th order equations-the non homogeneous equation of order n.

UNIT –II LINEAR EQUATIONS WITH VARIABLE COEFFICIENT (20 HRS)

Initial value problems for the homogeneous equations – solutions of the homogeneous equations – The Wronskian and linear independence – reduction of the order of a homogeneous equation - the non-homogeneous equation- homogeneous equation with analytic coefficients – the Legendre equation- Justification of the power series method

UNIT –III: LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS

(15 HRS)

The Euler equation – second order equations with regular singular points – an example – The Bessel Equation – The Bessel Equations (Continued).

UNIT –IV PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

(20 HRS)

Linear equations of the first order – integral surfaces passing through a given curve – Compatible systems of first order equations - **Charpit's method** – **solutions satisfying given conditions – Jacobi's method.**

UNIT –V PARTIAL DIFFERENTIAL EQUATIONS OF THE SECOND ORDER

(15 HRS)

The origin of second order equations – linear partial equations with constant coefficients (self study) – equations with variable coefficients – separation of variables.

TEXT BOOKS:

1. Earl. A. Coddington, *An Introduction to Ordinary Differential Equations,* Prentice Hall of India – 1987

Unit I **:** Chapter 2: 2.1- 2.8, 2.10

Unit II **:** Chapter 3**:** 3.1 - 3.9

Unit III **:** Chapter 4 **:** 4.1 - 4.3, 4.7 - 4.8

2. Ian Sneddon -*Elements of Partial differential equations,* McGraw-Hill International Editions, 1986

Unit IV **:** Chapters 2: 2.4 - 2.5, 2.9 - 2.13

Unit V **:** Chapters 3**:** 3.1, 3.4, 3.5, 3.9

REFERENCES:

1. S. G. Deo, & V. Raghvendra Rao- *Ordinary Differential Equations and stability Theory* - Prentice Hall Second Edition - 1988
2. John. F, Narosa - *Partial Differential Equations* - 3rd Edition – 1979
3. D. Somasundaram, Narosa - *Ordinary Differential Equations* - Narosa Publishing House - Fifth Reprint -2011.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS**			
1.1	Introduction-The second order homogeneous equation	3	Chalk & Talk	Black Board
1.2	Initial value problems for second order equations	3	Chalk & Talk	Black Board
1.3	Linear dependence and independence	3	Chalk & Talk	Black Board
1.4	A formula for the Wronskian	3	Chalk & Talk	Black Board
1.5	The non-homogeneous equation of order two, the homogeneous equation of order n	4	Chalk & Talk	Black Board
1.6	Initial value problems for n-th order equations-the non homogeneous equation of order n.	4	Chalk & Talk	Black Board
UNIT -2	**LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS**			
2.1	Initial value problems for the homogeneous equations	3	Chalk & Talk	Black Board
2.2	Solutions of the homogeneous equations	3	Chalk & Talk	Black Board
2.3	The Wronskian and linear independence	3	Chalk & Talk	Black Board
2.4	Reduction of the order of the homogeneous equation	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.5	The non-homogeneous equation- homogeneous equation with analytic coefficients	4	Chalk & Talk	Black Board
2.6	The Legendre equation, Justification of the power series Method.	4	Chalk & Talk	Black Board
UNIT -3	**LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS**			
3.1	The Euler equation	4	Chalk & Talk	Black Board
3.2	second order equations with regular singular points – an example	4	Chalk & Talk	Black Board
3.3	Bessel Equation	4	Chalk & Talk	Black Board
3.4	The Bessel Equations (Continued).	3	Chalk & Talk	Black Board
UNIT -4	**PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER**			
4.1	Linear equations of the first order	2	Chalk & Talk	Black Board
4.2	Integral surfaces passing through a given curve	4	Chalk & Talk	Black Board
4.3	Compatible systems of first order equations	4	Chalk & Talk	Black Board
4.4	Charpit's method	3	Discussion	Black Board
4.5	Solutions satisfying given conditions	4	Discussion	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.6	Jacobi's method	3	Discussion	Black Board
UNIT -5	**PARTIAL DIFFERENTIAL EQUATIONS OF THE SECOND ORDER**			
5.1	The origin of second order equations	4	Discussion	PPT
5.2	Linear partial equations with constant coefficients	4	Discussion	PPT
5.3	Equations with variable coefficients	4	Discussion	Black Board
5.4	Separation of variables	3	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2	M1+M2	Mid-Sem.Test	Once in a Sem.				
	5	5+5=10	15	5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 – Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Define Linear differential equations with constant coefficients and prove different theorems and solve problems.	K2&K3	PSO2
CO 2	Solving problems of the n^{th} order in differential equations with variable coefficients	K2& K3	PSO1
CO 3	Identify Regular singular points and derive Bessel's Equation.	K2 & K3	PSO4
CO 4	Explain the methods of solving problems in partial differential equations of first order.	K2, K3&K4	PSO5
CO 5	Form Partial differential equations of the second order and solve problems in partial differential equations of second order.	K2,K3, K4&K5	PSO3

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**3**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**3**

CO4	**2**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**	**2**

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**2**	**3**	**2**	**2**
CO2	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**3**
CO5	**2**	**3**	**2**	**3**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr.Mrs. A. Paulin Mary

Forwarded By

(Dr.A. Paulin Mary)

HOD'S Signature& Name

2% removed

I M.Sc. Mathematics

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATE GORY	HRS/WE EK	CREDITS
PSMA	19PG1M2	Real Analysis	PG Core	6	4

COURSE DESCRIPTION

This course provides a comprehensive idea about the principles of Real Analysis.

COURSE OBJECTIVES

To enable the students learn real number system, metric spaces, limits, continuity and differentiation.

UNITS

UNIT –I THE REAL AND COMPLEX NUMBER SYSTEMS (15 HRS.)

Introduction – Ordered Sets – Fields – The Real Field – The Extended Real Number System – The Complex Field – Euclidean Spaces.

UNIT –II BASIC TOPOLOGY (15 HRS.)

Finite, Countable and Uncountable Sets – Metric Spaces (self study) – Compact Sets – Perfect Sets – Connected Sets.

UNIT –III NUMERICAL SEQUENCES AND SERIES (20 HRS.)

Convergent sequences – Subsequences – Cauchy's sequences – Upper and lower limits (self study) – Some special sequences – Series : Series of Non negative terms – The number e – The Root and Ratio Tests – Power series – Summation by Parts – Absolute Convergence – Addition and Multiplication of series – Rearrangements.

UNIT –IV CONTINUITY (20 HRS.)

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

UNIT –V DIFFERENTIATION (20 HRS.)

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

TEXT BOOK:

1.Walter Rudin - *Principles of Mathematical Analysis* - McGraw-Hill - Third Edition - 1976.

UNIT I : Chapter: 1
UNIT II : Chapter: 2
UNIT III : Chapter: 3
UNIT IV : Chapter: 4
UNIT V : Chapter: 5

REFERENCES:

1. Richard R. Goldberg - *Methods of Real Analysis* - Oxford & IBH Publishing Company - 1970
1. Apostol - *Mathematical Analysis* - Narosa Publishing House - Twentieth Reprint - 2002.
2. D. Somasundaram and Choudhary - *A first Course in Mathematical Analysis* - Narosa corrected Edition - 1999.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**THE REAL AND COMPLEX NUMBER SYSTEMS**			
1.1	Ordered Sets	4	Chalk & Talk	Black Board
1.2	Fields	3	Chalk & Talk	Black Board
1.3	The Real Field	4	Chalk & Talk	Black Board
1.4	The Extended Real Number System	3	Chalk & Talk	Black Board
1.5	The Complex Field	3	Chalk & Talk	Black Board
1.6	Euclidean Spaces	3	Chalk & Talk	Black Board
UNIT -2	**BASIC TOPOLOGY**			
2.1	Finite	4	Chalk & Talk	Green Board Charts
2.2	Countable and Uncountable Sets	3	Chalk & Talk	Green Board
2.3	Metric Spaces	3	Chalk & Talk	Black Board
2.4	Compact Sets	3	Chalk & Talk	Black Board
2.5	Perfect Sets	3	Chalk & Talk	Black Board
2.6	Connected Sets	4	Chalk & Talk	Black Board
UNIT -3	**NUMERICAL SEQUENCES AND SERIES**			

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.1	Convergent sequences, Subsequences	3	Chalk & Talk	Black Board
3.2	Cauchy's sequences	3	Chalk & Talk	Black Board
3.3	Upper and lower limits - Some special sequences	2	Chalk & Talk	Black Board
3.4	Series : Series of Non negative terms – The number e	4	Chalk & Talk	Black Board
3.5	The Root and Ratio Tests	3	Chalk & Talk	Black Board
3.6	Power series – Summation by Parts	3	Chalk & Talk	Black Board
3.7	Absolute Convergence, Addition and Multiplication of series – Rearrangements	2	Chalk & Talk	Black Board
UNIT -4 CONTINUITY				
4.1	Limit of Functions	4	Discussion	Black Board
4.2	Continuous Functions – Continuity and Compactness	4	Discussion	Black Board
4.3	Continuity and Connectedness	4	Discussion	Black Board
4.4	Discontinuities – Monotonic functions	4	Discussion	Black Board
4.5	Infinite Limits and Limits at Infinity	4	Discussion	Black Board
UNIT -5 DIFFERENTIATION				
5.1	The Derivative of a Real Function	4	Discussion	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.2	Mean Value Theorems	3	Discussion	Black Board
5.3	The Continuity of Derivatives	3	Discussion	Black Board
5.4	L'Hospital's Rule – Derivatives of Higher Order	3	Discussion	Black Board
5.5	Taylor's Theorem	4	Discussion	Black Board
5.6	Differentiation of Vector-valued Functions	3	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 – Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Describe analysis concepts in Real and Complex Number systems	K1	PSO1& PSO2
CO 2	Explain concepts of metric, compact and connected sets	K2 & K3	PSO3
CO 3	Recall Sequence and series in Real line	K1 & K2	PSO4
CO 4	Differentiate Continuous functions and Uniformly continuous functions	K1 & K4	PSO5
CO 5	Describe Derivatives of functions	K2 & K4	PSO3

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	2	2
CO2	2	2	3	2	2
CO3	2	2	2	2	3
CO4	2	2	2	3	2

CO5	**2**	**3**	**2**	**2**	**2**

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**2**	**3**	**2**	**2**
CO2	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**3**
CO5	**2**	**3**	**2**	**3**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Mrs. A. Sheela Roselin**
2. **Dr. Mrs. C. Prasanna Devi**

Forwarded By

HOD'S Signature

& Name

I M.Sc. Mathematics

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG1M2	Real Analysis	PG Core	6	4

COURSE DESCRIPTION

This course provides a comprehensive idea about the principles of Real Analysis.

COURSE OBJECTIVES

To enable the students learn real number system, metric spaces, limits, continuity and differentiation.

UNITS

UNIT –I THE REAL AND COMPLEX NUMBER SYSTEMS (15 HRS.)

Introduction – Ordered Sets – Fields – The Real Field – The Extended Real Number System–The Complex Field – Euclidean Spaces (excluding appendix)

UNIT –II BASIC TOPOLOGY (15 HRS.)

Finite, Countable and Uncountable Sets – Metric Spaces (self study) – Compact Sets – Perfect Sets – Connected Sets.

UNIT –III NUMERICAL SEQUENCES AND SERIES (20 HRS.)

Convergent sequences – Subsequences – Cauchy's sequences – Upper and lower limits (self study) – Some special sequences – Series : Series of Non negative terms – The number e – The Root and Ratio Tests – Power series – Summation by Parts – Absolute Convergence – Addition and Multiplication of series – Rearrangements.

UNIT –IV CONTINUITY (20 HRS.)

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

UNIT –V DIFFERENTIATION (20 HRS.)

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

TEXT BOOK:

Walter Rudin - *Principles of Mathematical Analysis* - McGraw-Hill - Third Edition - 1976.

UNIT I : Chapter: 1
UNIT II : Chapter: 2
UNIT III : Chapter: 3
UNIT IV : Chapter: 4
UNIT V : Chapter: 5

REFERENCES:

1.Richard R. Goldberg - *Methods of Real Analysis* - Oxford & IBH Publishing Company - 1970
2.Apostol - *Mathematical Analysis* - Narosa Publishing House - Twentieth Reprint - 2002.
3.D. Somasundaram and Choudhary - *A first Course in Mathematical Analysis* - Narosa corrected Edition - 1999.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**THE REAL AND COMPLEX NUMBER SYSTEMS**			
1.1	Ordered Sets	4	Chalk & Talk	Black Board
1.2	Fields	3	Chalk & Talk	Black Board
1.3	The Real Field	4	Chalk & Talk	Black Board
1.4	The Extended Real Number System	3	Chalk & Talk	Black Board
1.5	The Complex Field	3	Chalk & Talk	Black Board
1.6	Euclidean Spaces	3	Chalk & Talk	Black Board
UNIT -2	**BASIC TOPOLOGY**			
2.1	Finite	4	Chalk & Talk	Green Board Charts
2.2	Countable and Uncountable Sets	3	Chalk & Talk	Green Board
2.3	Metric Spaces	3	Chalk & Talk	Black Board
2.4	Compact Sets	3	Chalk & Talk	Black Board
2.5	Perfect Sets	3	Chalk & Talk	Black Board
2.6	Connected Sets	4	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -3 NUMERICAL SEQUENCES AND SERIES				
3.1	Convergent sequences, Subsequences	3	Chalk & Talk	Black Board
3.2	Cauchy's sequences	3	Chalk & Talk	Black Board
3.3	Upper and lower limits - Some special sequences	2	Chalk & Talk	Black Board
3.4	Series : Series of Non negative terms – The number e	4	Chalk & Talk	Black Board
3.5	The Root and Ratio Tests	3	Chalk & Talk	Black Board
3.6	Power series – Summation by Parts	3	Chalk & Talk	Black Board
3.7	Absolute Convergence, Addition and Multiplication of series – Rearrangements	2	Chalk & Talk	Black Board
UNIT -4 CONTINUITY				
4.1	Limit of Functions	4	Discussion	Black Board
4.2	Continuous Functions – Continuity and Compactness	4	Discussion	Black Board
4.3	Continuity and Connectedness	4	Discussion	Black Board
4.4	Discontinuities – Monotonic functions	4	Discussion	Black Board
4.5	Infinite Limits and Limits at Infinity	4	Discussion	Black Board
UNIT -5 DIFFERENTIATION				

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.1	The Derivative of a Real Function	4	Discussion	Black Board
5.2	Mean Value Theorems	3	Discussion	Black Board
5.3	The Continuity of Derivatives	3	Discussion	Black Board
5.4	L'Hospital's Rule – Derivatives of Higher Order	3	Discussion	Black Board
5.5	Taylor's Theorem	4	Discussion	Black Board
5.6	Differentiation of Vector-valued Functions	3	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 – Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Describe analysis concepts in Real and Complex Number systems	K1	PSO1& PSO2
CO 2	Explain concepts of metric, compact and connected sets	K2 & K3	PSO3
CO 3	Recall Sequence and series in Real line	K1 & K2	PSO4
CO 4	Differentiate Continuous functions and Uniformly continuous functions	K1 & K4	PSO5
CO 5	Describe Derivatives of functions	K2 & K4	PSO3

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	2	2
CO2	2	2	3	2	2
CO3	2	2	2	2	3
CO4	2	2	2	3	2
CO5	2	3	2	2	2

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2

CO2	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**3**
CO5	**2**	**3**	**2**	**3**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Mrs. A. Sheela Roselin

2.Dr. Mrs. C. Prasanna Devi

Forwarded By

(Dr. A. Paulin Mary)

HOD'S Signature & Name

20% removed

I M.Sc. Mathematics

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG2M6	ADVANCED REAL ANALYSIS	PG Core	6	4

COURSE DESCRIPTION

This course enables the students to study some advanced concepts in Real Analysis.

COURSE OBJECTIVES

To study the Riemann integral, sequences and series of functions and special functions.

UNIT –I THE RIEMANN - STIELTJES INTEGRAL [20 HRS.]

Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector-valued Functions – Rectifiable Curves.

UNIT –II SEQUENCES AND SERIES OF FUNCTIONS [20HRS.]

Discussion of Main problem – Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equicontinuous Families of Functions – The Stone-Weierstrass Theorem.

UNIT –III SOME SPECIAL FUNCTIONS [20 HRS.]

Power Series – The Exponential and Logarithmic Functions – **The Trigonometric Functions (self study)** – The Algebraic Completeness of the Complex Field – **Fourier Series – The Gamma Function (self study)**.

UNIT –IV FUNCTIONS OF SEVERAL VARIABLES [15 HRS.]

Linear Transformations – Differentiation – The Contraction Principle – The Inverse Function Theorem

UNIT –V FUNCTIONS OF SEVERAL VARIABLES [15HRS.]

The Implicit Function Theorem – The Rank Theorem – Determinants – Derivative of Higher Order – Differentiation of Integrals.

TEXT BOOK:

1.Walter Rudin, *Principles of Mathematical Analysis*, McGraw-Hill, Third edition, 1976.

UNIT I : Chapters: 6
UNIT II : Chapters: 7
UNIT III : Chapter: 8
UNIT IV : Chapter: 9 : pages 204 - 222
UNIT V : Chapter: 9 : pages 223 - 238

REFERENCES:

1. Richard R. Goldberg, *Methods of Real Analysis,* Oxford & IBH Publishing Company,1970
2. Apostol, *Mathematical Analysis* - Narosa Publishing House, Twentieth Reprint, 2002.
3. D. Somasundaram and Choudhary, *A first Course in Mathematical Analysi,* Narosa corrected Edition, 1999.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**THE RIEMANN - STIELTJES INTEGRAL**			
1.1	Definition and Existence of the Integral	4	Chalk & Talk	Black Board
1.2	Properties of the Integral	5	Chalk & Talk	Black Board
1.3	Integration and Differentiation	4	Lecture	Black Board
1.4	Integration of Vector-valued Functions	5	Lecture	Black Board
1.5	Rectifiable Curves	2	Lecture	Black Board
UNIT - 2	**SEQUENCES AND SERIES OF FUNCTIONS**			
2.1	Discussion of Main problem, Uniform Convergence	4	Lecture	Black Board
2.2	Uniform Convergence and Continuity	3	Chalk & Talk	Black Board
2.3	Uniform Convergence and Integration	2	Chalk & Talk	Black Board
2.4	Uniform Convergence and Differentiation	6	Chalk & Talk	Black Board
2.5	Equicontinuous Families of Functions	3	Chalk & Talk	Black Board
2.6	The Stone-Weierstrass Theorem	2	Chalk & Talk	Black Board
UNIT -3	**SOME SPECIAL FUNCTIONS**			

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.1	Power Series	5	Chalk & Talk, Discussion	Black Board
3.2	The Exponential and Logarithmic Functions	3	Chalk & Talk, Discussion	Black Board
3.3	The Trigonometric Functions	3	Chalk & Talk, Discussion	Black Board
3.4	The Algebraic Completeness of the Complex Field	2	Chalk & Talk	Black Board
3.5	Fourier Series	3	Chalk & Talk, Discussion	Black Board
3.6	The Gamma Function	4	Chalk & Talk, Discussion	Black Board
UNIT - 4 FUNCTIONS OF SEVERAL VARIABLES				
4.1	Linear Transformations	4	Discussion	Black Board
4.2	Differentiation	6	Discussion	Black Board
4.3	The Contraction Principle	5	Discussion	Black Board
4.4	The Inverse Function Theorem	5	Discussion	Black Board
UNIT - 5 FUNCTIONS OF SEVERAL VARIABLES				
5.1	The Implicit Function Theorem	4	Discussion	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.2	The Rank Theorem	3	Discussion	Black Board
5.3	Determinants	5	Discussion	Black Board
5.4	Derivative of Higher Order	4	Discussion	Black Board
5.5	Differentiation of Integrals	4	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify Riemann Integral and Riemann - Stieltjes Integral	K5	PSO1& PSO2
CO 2	Explain Uniform convergence of functions	K2	PSO1& PSO4
CO 3	Define Power Series and Fourier Series	K3	PSO1& PSO4

CO 4	Describe Linear Transformations	K2 & K3	PSO3 & PSO5
CO 5	Explain Implicit function theorem and Rank theorem	K2 & K4	PSO 3 & PSO5

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	2	2
CO2	2	2	3	2	2
CO3	2	2	2	2	3
CO4	2	2	2	3	2
CO5	2	3	2	2	2

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	3
CO3	3	3	2	2
CO4	2	3	2	3
CO5	2	3	2	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr. Mrs. C. Prasanna Devi

2. Mrs. A. Sheela Roselin

Forwarded By

HOD'S Signature

& Name

I M.Sc. Mathematics

SEMESTER –II

For those who joined in 2022 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	22PG2M6	ADVANCED REAL ANALYSIS	PG Core	6	4

COURSE DESCRIPTION

This course enables the students to study some advanced concepts in Real Analysis.

COURSE OBJECTIVES

To study the Riemann integral, sequences and series of functions and special functions.

UNIT –I THE RIEMANN - STIELTJES INTEGRAL [20 HRS.]

Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector-valued Functions – Rectifiable Curves.

UNIT –II SEQUENCES AND SERIES OF FUNCTIONS [20HRS.]

Discussion of Main problem – Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equicontinuous Families of Functions – The Stone-Weierstrass Theorem.

UNIT –III SOME SPECIAL FUNCTIONS [20 HRS.]

Power Series – The Exponential and Logarithmic Functions – The Trigonometric Functions.

UNIT –IV SOME SPECIAL FUNCTIONS [15 HRS.]

The Algebraic Completeness of the Complex Field – Fourier Series – The Gamma Function.

UNIT –V FUNCTIONS OF SEVERAL VARIABLES [20 HRS.]

Linear Transformations – Differentiation – The Contraction Principle – The Inverse Function Theorem.

TEXT BOOK:

1.Walter Rudin, *Principles of Mathematical Analysis*, McGraw-Hill, Third edition, 1976.

UNIT I : Chapter : 6
UNIT II : Chapter : 7
UNIT III : Chapter : 8- pages 172 - 184
UNIT IV : Chapter : 8- pages 184 - 195
UNIT V : Chapter : 9- pages 204-223

REFERENCES:

1. Richard R. Goldberg, *Methods of Real Analysis,* Oxford & IBH Publishing Company,1970
2. Apostol, *Mathematical Analysis* - Narosa Publishing House, Twentieth Reprint, 2002.
3. D. Somasundaram and Choudhary, *A first Course in Mathematical Analysi,* Narosa corrected Edition, 1999.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**THE RIEMANN - STIELTJES INTEGRAL**			
1.1	Definition and Existence of the Integral	4	Chalk & Talk	Black Board
1.2	Properties of the Integral	5	Chalk & Talk	Black Board
1.3	Integration and Differentiation	4	Lecture	Black Board
1.4	Integration of Vector-valued Functions	5	Lecture	Black Board
1.5	Rectifiable Curves	2	Lecture	Black Board
UNIT - 2	**SEQUENCES AND SERIES OF FUNCTIONS**			
2.1	Discussion of Main problem, Uniform Convergence	4	Lecture	Black Board
2.2	Uniform Convergence and Continuity	3	Chalk & Talk	Black Board
2.3	Uniform Convergence and Integration	2	Chalk & Talk	Black Board
2.4	Uniform Convergence and Differentiation	6	Chalk & Talk	Black Board
2.5	Equicontinuous Families of Functions	3	Chalk & Talk	Black Board
2.6	The Stone-Weierstrass Theorem	2	Chalk & Talk	Black Board
UNIT -3	**SOME SPECIAL FUNCTIONS**			

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.1	Power Series	5	Chalk & Talk, Discussion	Black Board
3.2	The Exponential and Logarithmic Functions	3	Chalk & Talk, Discussion	Black Board
3.3	The Trigonometric Functions	3	Chalk & Talk, Discussion	Black Board
UNIT -4 SOME SPECIAL FUNCTIONS				
4.1	The Algebraic Completeness of the Complex Field	2	Chalk & Talk	Black Board
4.2	Fourier Series	3	Chalk & Talk, Discussion	Black Board
4.3	The Gamma Function	4	Chalk & Talk, Discussion	Black Board
UNIT - 5 FUNCTIONS OF SEVERAL VARIABLES				
5.1	Linear Transformations	4	Discussion	Black Board
5.2	Differentiation	6	Discussion	Black Board
5.3	The Contraction Principle	5	Discussion	Black Board
5.4	The Inverse Function Theorem	5	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

All the course outcomes are to be assessed in the various CIA components.

- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 – Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non – Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify Riemann Integral and Riemann - Stieltjes Integral	K5	PSO1& PSO2
CO 2	Explain Uniform convergence of functions	K2	PSO1& PSO4
CO 3	Define Power Series and Logarithmic Functions	K3	PSO1& PSO4
CO 4	Define Fourier Series and Gamma Function	K2 & K3	PSO3 & PSO5
CO 5	Describe Linear Transformations and Explain Inverse function theorem	K2 & K4	PSO 3 & PSO5

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**3**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**3**

CO4	**2**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**	**2**

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**2**	**3**	**2**	**2**
CO2	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**3**
CO5	**2**	**3**	**2**	**3**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr. Mrs. C. Prasanna Devi

2. Mrs. A. Sheela Roselin

Forwarded By

(Dr. A. Paulin Mary)

HOD'S Signature& Name

20% removed

II M.Sc. Mathematics

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3M9	MEASURE AND INTEGRATION	PG Core	6	4

COURSE DESCRIPTION

This course presents the fundamental concepts and techniques of measure theory. It includes measures, measurable sets, functions, integrals as measures, modes of convergence and product measure.

COURSE OBJECTIVES

To provide the students a comprehensive idea about the measures on the real line, Integration of Functions of a real variable, Abstract Measure Spaces, Signed Measures, Measure and Integration in a Product space.

UNITS

UNIT –I MEASURE ON THE REAL LINE (20 HRS.)

Lebesgue outer Measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue Measurability.

UNIT –II INTEGRATION OF FUNCTIONS OF A REAL VARIABLE (20 HRS.)

Integration of non-negative functions, the general integral, integration of series, Riemann and Lebesgue integrals.

UNIT –III ABSTRACT MEASURE SPACES (20 HRS.)

Measures and outer Measures, Extension of a Measure, Uniqueness of extension, Completion of a Measure, Measure spaces and Integration with respect to a Measure.

UNIT –IV SIGNED MEASURES (15HRS.)

Signed Measures and Hahn Decomposition, The Jorden Decomposition and **the Radon – Nikodym Theorem (self study)**.

UNIT –V MEASURE AND INTEGRATION IN A PRODUCT SPACE (15HRS.)

Measurability in a Product space, **The Product Measure and Fubini's theorem (self study).**

TEXT BOOK:

1) G.de Barra, *Measure Theory and Integration*, New age International (p) Ltd. Publishers,

2008.

REFERENCES

1. Royden H.L, *Real Analysis,* Prentice Hall of India Pvt. Ltd, 2004

2. Paul R. Halmos, *Measure Theory*, Narosa Publishing House, 2000.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**MEASURE ON THE REAL LINE**			
1.1	Lebesgue outer Measure	4	Chalk & Talk	Black Board
1.2	Measurable sets	5	Chalk & Talk	Black Board
1.3	Regularity	5	Chalk & Talk	Black Board
1.4	Measurable functions	3	Chalk & Talk	Black Board
1.5	Borel and Lebesgue Measurability	3	Chalk & Talk	Black Board
UNIT -2	**INTEGRATION OF FUNCTIONS OF A REAL VARIABLE**			
2.1	Integration of non-negative functions	5	Chalk & Talk	Black Board
2.2	the general integral	5	Chalk & Talk	Black Board
2.3	integration of series	5	Chalk & Talk	Black Board
2.4	Riemann and Lebesgue integrals	5	Chalk & Talk	Black Board
UNIT -3	**ABSTRACT MEASURE SPACES**			
3.1	Measures and outer Measures	4	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.2	Extension of a Measure	4	Chalk & Talk	Black Board
3.3	Uniqueness of extension	4	Chalk & Talk	Black Board
3.4	Completion of a Measure	3	Chalk & Talk	Black Board
3.5	Measure spaces and Integration with respect to a Measure	5	Chalk & Talk	Black Board
UNIT -4	**SIGNED MEASURES**			
4.1	Signed Measures and Hahn Decomposition and The Jorden Decomposition and the Jorden Decomposition	6	Discussion	Black Board
4.2	The Radon – Nikodym Theorem	9	Discussion	Black Board
UNIT -5	**MEASURE AND INTEGRATION IN A PRODUCT SPACE**			
5.1	Measurability in a Product space	6	Discussion	Black Board
5.2	The Product Measure and Fubini's theorem	9	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2	M1+M2	Mid-Sem.Test	Once in a Sem.				

	5	5+5=10	15	5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 – Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain Lebesgue measurable sets and measurability	K2	PSO1& PSO2
CO 2	Classify Riemann and Lebesgue Integrals	K5	PSO2 & PSO4
CO 3	Describe Abstract measure spaces	K3 & K4	PSO1
CO 4	Define Signed Measures and distinguish Hahn Decomposition and Jorden Decomposition	K2 & K3	PSO5
CO 5	Explain the concept of measurability in product space	K2 & K4	PSO3 & PSO5

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**3**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**3**
CO4	**2**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**	**2**

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	3
CO3	3	3	2	2
CO4	2	3	2	3
CO5	2	3	2	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr. Mrs. C. Prasanna Devi

2. Mrs. Nigila Ragavan

Forwarded By

HOD'S Signature

& Name

II M.Sc. Mathematics

SEMESTER –III

For those who joined in 2022 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	22PG3M9	MEASURE AND INTEGRATION	PG Core	6	4

COURSE DESCRIPTION

This course presents the fundamental concepts and techniques of measure theory. It includes measures, measurable sets, functions, integrals as measures, modes of convergence and product measure.

COURSE OBJECTIVES

To provide the students a comprehensive idea about the measures on the real line, Integration of Functions of a real variable, Abstract Measure Spaces, Signed Measure.

UNITS

UNIT –I MEASURE ON THE REAL LINE (20 HRS.)

Lebesgue outer Measure, Measurable sets, Regularity.

UNIT –II MEASURE ON THE REAL LINE (20 HRS.)

Measurable functions, Borel and Lebesgue Measurability.

UNIT –III INTEGRATION OF FUNCTIONS OF A REAL VARIABLE (20 HRS.)

Integration of non-negative functions, the general integral, integration of series, Riemann and Lebesgue integrals.

UNIT –IV ABSTRACT MEASURE SPACES (20 HRS.)

Measures and outer Measures, Extension of a Measure, Uniqueness of extension, Completion of a Measure, Measure spaces and Integration with respect to a Measure.

UNIT –V SIGNED MEASURES (15HRS.)

Signed Measures and Hahn Decomposition, The Jorden Decomposition and the Radon – Nikodym Theorem.

TEXT BOOK:

1) G.de Barra, *Measure Theory and Integration*, New age International (p) Ltd. Publishers, 2008.

REFERENCES

1. Royden H.L, *Real Analysis,* Prentice Hall of India Pvt. Ltd, 2004

2. Paul R. Halmos, *Measure Theory*, Narosa Publishing House, 2000.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**MEASURE ON THE REAL LINE**			
1.1	Lebesgue outer Measure	4	Chalk & Talk	Black Board
1.2	Measurable sets	5	Chalk & Talk	Black Board
1.3	Regularity	5	Chalk & Talk	Black Board
UNIT -2	**MEASURE ON THE REAL LINE**			
2.1	Measurable functions	3	Chalk & Talk	Black Board
2.2	Borel and Lebesgue Measurability	3	Chalk & Talk	Black Board
UNIT -3	**INTEGRATION OF FUNCTIONS OF A REAL VARIABLE**			
3.1	Integration of non-negative functions	5	Chalk & Talk	Black Board
3.2	the general integral	5	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.3	integration of series	5	Chalk & Talk	Black Board
3.4	Riemann and Lebesgue integrals	5	Chalk & Talk	Black Board
UNIT -4	**ABSTRACT MEASURE SPACES**			
4.1	Measures and outer Measures	4	Chalk & Talk	Black Board
4.2	Extension of a Measure	4	Chalk & Talk	Black Board
4.3	Uniqueness of extension	4	Chalk & Talk	Black Board
4.4	Completion of a Measure	3	Chalk & Talk	Black Board
4.5	Measure spaces and Integration with respect to a Measure	5	Chalk & Talk	Black Board
UNIT -5	**SIGNED MEASURES**			
5.1	Signed Measures and Hahn Decomposition and The Jorden Decomposition	6	Discussion	Black Board
5.2	The Radon – Nikodym Theorem	9	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2	**M1+M2**	**Mid-Sem.Test**	**Once in a Sem.**				

	5	5+5=10	15	5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	**5**		**5**	**12.5 %**
K3	5	3	4	-	**12**		**12**	**30 %**
K4	-	5	4	-	**9**		**9**	**22.5%**
K5	-	-	4	5	**9**		**9**	**22.5 %**
Non-Scho.						**5**	**5**	**12.5 %**
Total	**5**	**10**	**15**	**5**	**35**	**5**	**40 mks.**	**100 %**

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 - Evaluate*

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC				**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain Lebesgue measurable sets and measurability	K2	PSO1& PSO2
CO 2	Explain measurable functions	K5	PSO2 & PSO4
CO 3	Classify Riemann and Lebesgue Integrals	K5	PSO2 & PSO4
CO 4	Describe Abstract measure spaces	K3 & K4	PSO1
CO 5	Define Signed Measures and distinguish Hahn Decomposition and Jorden Decomposition	K2 & K3	PSO5

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**3**	**2**	**2**

CO3	2	2	2	2	3
CO4	2	2	2	3	2
CO5	2	3	2	2	2

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	3
CO3	3	3	2	2
CO4	2	3	2	3
CO5	2	3	2	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr. Mrs. C. Prasanna Devi**
2. **Mrs. Nigila Ragavan**

Forwarded By

(Dr.A. Paulin Mary)

HOD'S Signature& Name

2% added

II M.Sc. Mathematics

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3M12	TOPOLOGY	PG Core	6	6

COURSE DESCRIPTION

This course introduces the fundamental notions of topology which provides foundation for many other branches of mathematics.

COURSE OBJECTIVES

To enable the students to learn open sets, closed sets, continuous functions, compactness, connectedness and separation axioms in Topological spaces.

UNITS

UNIT –I TOPOLOGICAL SPACES (20 HRS.)

Topological Spaces, Basis for a topology, the order topology, the product topology on $X \times Y$, **the subspace topology**, **Closed sets and limit points (self study)**.

UNIT –II CONTINUOUS FUNCTIONS (15 HRS.)

Continuous functions, The Product topology, The Metric topology.

UNIT –III CONNECTED SPACES (15HRS.)

Connected Spaces, connected subspaces of the real line, Components and Local connectedness

UNIT –IV COMPACT SPACES (20 HRS.)

Compact Spaces, Compact subspaces of the real line (self study), limit point compactness.

UNIT –V COUNTABILITY AND SEPARATION AXIOMS (20 HRS.)

The Countability axioms, The Separation axioms, Normal spaces, Urysohn lemma - Urysohn Metrization theorem.

TEXT BOOK:

1) James. R Munkres, *Topology*, Prentice Hall of India Private Ltd, New Delhi, Second Edition, 2012

REFERENCES:

1. George F.Simmons, *Introduction to Topology and Modern Analysis*, McGraw-Hill Book Co., INC, 1963

2. S. T. Hu, *Elements of General Topology*, London :Holden day, 1964.

3. K. D. Joshi, Introduction to General *Topology*, Wiley Eastern, 1983.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**TOPOLOGICAL SPACES**			
1.1	Topological Spaces	3	Chalk & Talk	Black Board
1.2	Basis for a topology	4	Chalk & Talk	Black Board
1.3	the order topology	3	Chalk & Talk	Black Board
1.4	the product topology on X × Y	2	Chalk & Talk	Black Board
1.5	the subspace topology	3	Chalk & Talk	Black Board
1.6	Closed sets and limit points	5	Chalk & Talk, Discussion	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -2	**CONTINUOUS FUNCTIONS**			
2.1	Continuous functions	5	Chalk & Talk	Black Board
2.2	The Product topology	5	Chalk & Talk	Black Board
2.3	The Metric topology	5	Chalk & Talk	Black Board
UNIT -3	**CONNECTED SPACES**			
3.1	Connected Spaces	6	Chalk & Talk	Black Board
3.2	connected subspaces of the real line	7	Chalk & Talk	Black Board
3.3	Components and Local connectedness	7	Chalk & Talk	Black Board
UNIT 4	**COMPACT SPACES**			
4.1	Compact Spaces	5	Discussion	Black Board
4.2	Compact subspaces of the real line	5	Discussion	Black Board
4.3	limit point compactness	5	Discussion	Black Board
UNIT 5	**COUNTABILITY AND SEPARATION AXIOMS**			
5.1	The Countability axioms	5	Discussion	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.2	The Separation axioms	5	Discussion	Black Board
5.3	Normal spaces	5	Discussion	Black Board
5.4	Urysohn lemma	5	Discussion	Black Board
5.5	Urysohn Metrization theorem	5	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2	M1+M2	Mid-Sem.Test	Once in a Sem.				
	5	5+5=10	15	5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.						5	5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Classify various Topologies in Topological spaces	K5	PSO1& PSO2
CO 2	Explain connectedness and Components in Topological spaces	K2	PSO3 & PSO4
CO 3	Describe compactness in Topological spaces	K2 & K3	PSO4 & PSO5
CO 4	Identify Seperation axioms	K2 & K3	PSO3
CO 5	Explain Urysohn Metrization theorem	K2 & K4	PSO4

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	2	2
CO2	2	2	3	2	2
CO3	2	2	2	2	3
CO4	2	2	2	3	2
CO5	2	3	2	2	2

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	3
CO3	3	3	2	2
CO4	2	3	2	3
CO5	2	3	2	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr. Mrs. C. Prasanna Devi

2. Mrs. Nigila Ragavan

Forwarded By

HOD'S Signature& Name

II M.Sc. Mathematics

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSMA	19PG3M12	TOPOLOGY	PG Core	6	6

COURSE DESCRIPTION

This course introduces the fundamental notions of topology which provides foundation for many other branches of mathematics.

COURSE OBJECTIVES

To enable the students to learn open sets, closed sets, continuous functions, compactness, connectedness and separation axioms in Topological spaces.

UNITS

UNIT –I TOPOLOGICAL SPACES (20 HRS.)

Topological Spaces, Basis for a topology, the order topology, the product topology on $X \times Y$, **the subspace topology**, **Closed sets and limit points (self study)**.

UNIT –II CONTINUOUS FUNCTIONS (15 HRS.)

Continuous functions, The Product topology, The Metric topology.

UNIT –III CONNECTED SPACES (15HRS.)

Connected Spaces, connected subspaces of the real line, Components and Local connectedness

UNIT –IV COMPACT SPACES (20 HRS.)

Compact Spaces, Compact subspaces of the real line (self study), limit point compactness.

UNIT –V COUNTABILITY AND SEPARATION AXIOMS (20 HRS.)

The Countability axioms, The Separation axioms, Normal spaces, Urysohn lemma - Urysohn Metrization theorem-The Tychonoff's theorem.

TEXT BOOK:

1) James. R Munkres, *Topology*, Prentice Hall of India Private Ltd, New Delhi, Second Edition, 2012

REFERENCES:

1. George F.Simmons, *Introduction to Topology and Modern Analysis*, McGraw-Hill Book Co., INC, 1963

2. S. T. Hu, *Elements of General Topology*, London :Holden day, 1964.

3. K. D. Joshi, Introduction to General *Topology*, Wiley Eastern, 1983.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**TOPOLOGICAL SPACES**			
1.1	Topological Spaces	3	Chalk & Talk	Black Board
1.2	Basis for a topology	4	Chalk & Talk	Black Board
1.3	the order topology	3	Chalk & Talk	Black Board
1.4	the product topology on X × Y	2	Chalk & Talk	Black Board
1.5	the subspace topology	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.6	Closed sets and limit points	5	Chalk & Talk, Discussion	Black Board
UNIT -2	**CONTINUOUS FUNCTIONS**			
2.1	Continuous functions	5	Chalk & Talk	Black Board
2.2	The Product topology	5	Chalk & Talk	Black Board
2.3	The Metric topology	5	Chalk & Talk	Black Board
UNIT -3	**CONNECTED SPACES**			
3.1	Connected Spaces	6	Chalk & Talk	Black Board
3.2	connected subspaces of the real line	7	Chalk & Talk	Black Board
3.3	Components and Local connectedness	7	Chalk & Talk	Black Board
UNIT 4	**COMPACT SPACES**			
4.1	Compact Spaces	5	Discussion	Black Board
4.2	Compact subspaces of the real line	5	Discussion	Black Board
4.3	limit point compactness	5	Discussion	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT 5 AXIOMS	**COUNTABILITY AND SEPARATION**			
5.1	The Countability axioms	5	Discussion	Black Board
5.2	The Separation axioms	5	Discussion	Black Board
5.3	Normal spaces	5	Discussion	Black Board
5.4	Urysohn lemma	5	Discussion	Black Board
5.5	Urysohn Metrization theorem	3	Discussion	Black Board
5.6	The Tychonoff's theorem.	2	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2	M1+M2	Mid-Sem.Test	Once in a Sem.				
	5	5+5=10	15	5	35	5	40	
K1	-	-	-	-	-		-	-
K2	-	2	3	-	**5**		**5**	**12.5 %**
K3	5	3	4	-	**12**		**12**	**30 %**
K4	-	5	4	-	**9**		**9**	**22.5%**
K5	-	-	4	5	**9**		**9**	**22.5 %**
Non-Scho.						**5**	**5**	**12.5 %**

Total	**5**	**10**	**15**	**5**	**35**	**5**	**40 mks.**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-*Understand,* ***K3-****Apply,* ***K4-****Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Better of Two Weekly Tests

C2 – Total of Two Monthly Tests

C3 - Mid Sem Test

C4 – Once in a semester (Seminar / Assignment/Project)

C5 – Non - Scholastic

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Classify various Topologies in Topological spaces	K5	PSO1& PSO2
CO 2	Explain connectedness and Components in Topological spaces	K2	PSO3 & PSO4
CO 3	Describe compactness in Topological spaces	K2 & K3	PSO4 & PSO5
CO 4	Identify Seperation axioms	K2 & K3	PSO3
CO 5	Explain Urysohn Metrization theorem	K2 & K4	PSO4

Mapping COs Consistency with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**3**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**3**
CO4	**2**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**	**2**

Mapping COs Consistency with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	3
CO3	3	3	2	2
CO4	2	3	2	3
CO5	2	3	2	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr. Mrs. C. Prasanna Devi

2. Mrs. Nigila Ragavan

Forwarded By

(Dr. A. Paulin Mary)

HOD'S Signature

& Name