# 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 : 2021 - 2022**

## VISION OF THE DEPARTMENT

To empower students both as individuals and as citizens in the society through Mathematics with sound knowledge and investigate new methodologies for future applications.

## MISSION OF THE DEPARTMENT

- To achieve high standards of excellence in generating and propagating knowledge in Mathematics
- To lay a solid foundation for the concept of numeracy and scientific thinking
- To give the students, opportunities for developing, manipulative skills that will enable them function effectively in the society within the limits of their capacity
- To contribute to the development of students as Mathematical thinkers and to continue to grow in their chosen professions
- To enable the students to become lifelong learners and to function as productive citizens

## PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

| | |
|---|---|
| **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 their strengths and improving on 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 entrepreneursand 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 discipline 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)

The learners will be able to

| | |
|---|---|
| **PO 1** | Apply acquired scientific knowledge to solve major and complex issues in the society/industry. |
| **PO 2** | Attain research skills to solve complex cultural, societal and environmental issues. |
| **PO 3** | Employ latest and updated tools and technologies to solve complex issues. |
| **PO 4** | Demonstrate Professional Ethics that foster Community, Nation and Environment Building Initiatives. |

## PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion 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 Mathematical ideas based on them. |
| **PSO 5** | Provide advanced knowledge on topics in Pure Mathematics, empowering the students to pursue higher studies. |

**FATIMA COLLEGE (AUTONOMOUS), MADURAI-18**

**DEPARTMENT OF MATHEMATICS**

***For those who joined in June 2019 onwards***

**MAJOR CORE – 70 CREDITS**

**PROGRAMME CODE : PSMA**

| S. No | SEM. | COURSE CODE | COURSE TITLE | HRS | CREDITS | CIA Mks | ESE Mks | TOT. MKs |
|---|---|---|---|---|---|---|---|---|
| 1. | I | 19PG1M1 | Algebra | 6 | 4 | 40 | 60 | 100 |
| 2. | | 19PG1M2 | Real Analysis | 6 | 4 | 40 | 60 | 100 |
| 3. | | 19PG1M3 | Number Theory | 6 | 4 | 40 | 60 | 100 |
| 4. | | 19PG1M4 | Classical Mechanics | 6 | 4 | 40 | 60 | 100 |
| 5. | II | 19PG2M5 | Advanced Algebra | 6 | 4 | 40 | 60 | 100 |
| 6. | | 19PG2M6 | Advanced Real Analysis | 6 | 4 | 40 | 60 | 100 |
| 7. | | 19PG2M7 | Differential Equations | 6 | 4 | 40 | 60 | 100 |
| 8. | | 19PG2M8 | Graph Theory | 6 | 4 | 40 | 60 | 100 |
| 9. | III | 19PG3M9 | Measure and Integration | 6 | 4 | 40 | 60 | 100 |
| 10. | | 19PG3M10 | Optimization Techniques | 6 | 4 | 40 | 60 | 100 |
| 11. | | 19PG3M11 | Combinatorics | 6 | 4 | 40 | 60 | 100 |
| 12. | | 19PG3M12 | Topology | 6 | 6 | 40 | 60 | 100 |
| 13. | IV | 19PG4M13 | Complex Analysis | 6 | 5 | 40 | 60 | 100 |
| 14. | | 19PG4M14 | Statistics | 6 | 5 | 40 | 60 | 100 |
| 15. | | 19PG4M15 | Methods of Applied Mathematics | 6 | 5 | 40 | 60 | 100 |
| 16. | | 19PG4M16 | Functional Analysis | 6 | 5 | 40 | 60 | 100 |

**MAJOR ELECTIVE / EXTRA DEPARTMENTAL COURSE / INTERNSHIP/ PROJECT -20 CREDITS**

| S. No | SEM. | COURSECODE | COURSE TITLE | HRS | CREDITS | CIA Mks | ESE Mks | TOT. Mks |
|---|---|---|---|---|---|---|---|---|
| 1. | I | 19M1EDC | Optimization Methods | 3 | 3 | 40 | 60 | 100 |
| 2. | II | 19M2EDC | Optimization Methods | 3 | 3 | 40 | 60 | 100 |
| 3. | III | 21PG3ME1/ 19PG3ME2 | Fuzzy sets and Applications / Numerical Analysis | 4 | 4 | 40 | 60 | 100 |
| 4. | | 19PG3SIL1 | Summer Internship | - | 3 | 40 | 60 | 100 |
| 5. | IV | 19PG4ME3/ 19PG4ME4 | Formal Languages/ Algebraic Graph Theory | 4 | 4 | 40 | 60 | 100 |
| 6. | | 19PG4L17 | Project | - | 3 | 40 | 60 | 100 |
| | | | **TOTAL** | **14** | **20** | | | |

**OFF-CLASS PROGRAMMES**

**ADD-ON COURSES**

| COURSE CODE | COURSES | HRS. | CREDITS | SEMESTER IN WHICH THE COURSE IS OFFERED | CIA MKS | ESE MKS | TOTAL MARKS |
|---|---|---|---|---|---|---|---|
| 19PADSS | **SOFT SKILLS** | 40 | 3 | I | 40 | 60 | 100 |
| 19PADCA | **COMPUTER APPLICATIONS** LATEX | 40 | 4 | II | 40 | 60 | 100 |
| 19PADCV | **COMPREHENSIVE VIVA** (Question bank to be prepared for all the courses by the respective course teachers) | - | 2 | IV | - | - | 100 |
| 19PADRC | **READING CULTURE** | 10 | 1 | I-IV | - | - | - |
| | **TOTAL** | | **10** | | | | |

**EXTRA CREDIT COURSES**

| COURSE CODE | COURSES | HRS. | CREDITS | SEMESTER IN WHICH THE COURSE IS OFFERED | CIA MKS | ESE MKS | TOTAL MARKS |
|---|---|---|---|---|---|---|---|
| 19PGSLM1 | **PROBLEMS IN ADVANCED MATHEMATICS FOR II PG)** | - | 2 | IV | 40 | 60 | 100 |
| 21PGSLLM1 | **Verbal and Numerical Aptitude for National Examinations (For I PG)** | - | 2 | II | 40 | 60 | 100 |
| | **MOOC COURSES / International Certified online Courses**(Department Specific Courses/any other courses) * Students can opt other than the listed course from UGC-SWAYAM /UGC /CEC | - | Minimum 2 Credits | I – IV | - | - | |

- **Summer Internship:**
  - Duration-1 month (2nd Week of May to 2nd week of June-before college reopens)
- **Project:**
  - Off class
  - Evaluation components-Report writing + Viva Voce (Internal marks-40) + External marks 60
- **EDC:**
  - Syllabus should be offered for two different batches of students from other than the parent department in Sem-I & Sem-II

# I M.Sc. Mathematics

## SEMESTER –I

***For those who joined in 2019 onwards***

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PG1M1 | Algebra | Core | 6 | 4 |

**COURSE DESCRIPTION**

This course is designed to emphasis the study of Algebra.

**COURSE OBJECTIVES**

To enable the students learn Counting principle, Sylow's theorem, Euclidean rings and Solvable groups.

**UNITS**

**UNIT –I COUNTING PRINCIPLE (20 HRS.)**

Group Theory: A Counting Principle, **Homomorphisms, Cayley's theorem (self study),** Another Counting Principle.

**UNIT –II SYLOW'S THEOREM (20 HRS.)**

Sylow's theorem, Direct Products, Finite Abelian Groups.

**UNIT –III EUCLIDEAN RINGS (20 HRS.)**

The field of Quotients of an Integral Domain, **Euclidean Rings, A Particular Euclidean Ring (self study)**.

**UNIT –IV POLYNOMIAL RINGS (15 HRS.)**

Polynomial Rings, Polynomials over the Rational Field, Polynomial Rings over Commutative Rings

**UNIT –V SOLVABLE GROUPS (15 HRS.)**

Solvable groups and Jordan Holder theorem**.**

**TEXT BOOKS:**

**1.** Herstein I. N., *Topics in algebra*, John Wiley & Sons, Second Edition, 2002.

**2.** Surjeet Singh and Qazi Zameeruddin, *Modern algebra*, Vikas Publishing House Pvt.

**TEXT BOOK I**

**UNIT I** Chapter 2 : 2.5, 2.7, 2.9, 2.11

**UNIT II** Chapter 2 : 2.12, 2.13, 2.14

**UNIT III** Chapter 3 : 3.6, 3.7, 3.8

**UNIT IV** Chapter 3 : 3.9, 3.10, 3.11

**TEXT BOOK II**

**UNIT V** Chapter 5

**REFERENCES:**

1. Micheal Artin, *Algebra,* Prentice Hall of India, 1991.

2. David M.Fraleigh, *A first course in Modern Algebra* Seventh Edition, Addison Wesley Publishing House, 2006.

3. Serge Lang, *Algebra*, Addison Wesley Publishing House, 1990.

4. Fraleigh J. B., *A first course in Abstract algebra,* , Pearson Education Ltd, 2005.

**COURSE CONTENTS & LECTURE SCHEDULE:**

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **COUNTING PRINCIPLE** | | | |
| 1.1 | Group Theory | 5 | Chalk & Talk | Black Board |
| 1.2 | A Counting Principle | 4 | Chalk & Talk | Black Board |
| 1.3 | Homomorphisms | 2 | Discussion, Seminar | Black Board |
| 1.4 | Cayley's theorem | 3 | Discussion, Seminar | Black Board |
| 1.5 | Another Counting Principle | 6 | Chalk & Talk | Black Board |
| **UNIT -2** | **SYLOW'S THEOREM** | | | |
| 2.1 | Sylow's theorem | 7 | Chalk & Talk | Black Board |
| 2.2 | Direct Products | 7 | Chalk & Talk | Black Board |
| 2.3 | Finite Abelian Groups | 6 | Chalk & Talk | Black Board |
| **UNIT -3** | **EUCLIDEAN RINGS** | | | |
| 3.1 | The field of Quotients of an Integral Domain | 7 | Chalk & Talk | Black Board |
| 3.2 | Euclidean Rings | **7** | Discussion , Seminar | Black Board |
| 3.3 | A Particular Euclidean Ring | **6** | Discussion , Seminar | Black Board |
| **UNIT -4** | **POLYNOMIAL RINGS** | | | |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 4.1 | Polynomial Rings | 5 | Discussion | Black Board |
| 4.2 | Polynomials over the Rational Field | 5 | Discussion | Black Board |
| 4.3 | Polynomial Rings over Commutative Rings | 5 | Discussion | Black Board |
| **UNIT -5 SOLVABLE GROUPS** | | | | |
| 5.1 | Solvable groups | 8 | Discussion | Black Board |
| 5.2 | Jordan Holder theorem | 7 | Discussion | Black Board |

# INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1 10 Mks. | T2 10 Mks. | Seminar 5 Mks. | Assignment 5 Mks | OBT/PPT 5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 | Recall various properties of algebraic structures and explain counting principle. | K2 ,K3 | PSO1 |
| CO 2 | Describe Sylow's theorems and solve problems | K2, K3 | PSO3 |
| CO 3 | Distinguish Integral Domain and Euclidean Rings | K4 | PSO5 |
| CO 4 | Classify Rings | K2, K5 | PSO2 |
| CO 5 | Describe basic concepts of Solvable groups | K2 | PSO4 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 3 |
| CO4 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 |

## Mapping of COs with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

1. **Mrs. Nigila Ragavan**
2. **Dr. Mrs. V. Vanitha**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 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
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 |
| | | | | |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -5 DIFFERENTIATION** | | | | |
| 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 |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | Seminar | Assignment | OBT/ PPT | | | | |
| | 10 Mks. | 10 Mks. | 5 Mks. | 5 Mks | 5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| C1 | - | Test (CIA 1) | 1 | - | 10 Mks |
| C2 | - | Test (CIA 2) | 1 | - | 10 Mks |
| C3 | - | Assignment | 2 * | - | 5 Mks |
| C4 | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| C5 | - | Seminar | 1 | - | 5 Mks |
| C6 | - | Attendance | | - | 5 Mks |

***The best out of two will be taken into account***

## 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 | K2 | PSO1& PSO2 |
| CO 2 | Explain concepts of metric, compact and connected sets | K2 & K3 | PSO3 |
| CO 3 | Recall Sequence and series in Real line | K2 | PSO4 |

| | | | |
|---|---|---|---|
| **CO 4** | Differentiate Continuous functions and Uniformly continuous functions | K4 | PSO5 |
| **CO 5** | Describe Derivatives of functions | K2 & K4 | PSO3 |

## Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 3 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 2 |
| CO4 | 2 | 2 | 2 | 2 | 3 |
| CO5 | 2 | 2 | 3 | 2 | 2 |

## Mapping of C0s with POs

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

**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**

**(A.Paulin Mary)**

**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 | 19PG1M3 | Number Theory | Core | 6 | 4 |

**COURSE DESCRIPTION**

This course discovers interesting and unexpected relationships between different sorts of numbers and to prove that these relationships are true.

**COURSE OBJECTIVES**

To help the students to learn the concepts of Divisibility, Congruences, Quadratic Reciprocity, some functions and Diophantine equations in Number Theory.

**UNITS**

**UNIT –I DIVISIBILITY (15 HRS.)**

Introduction, Divisibility, **Primes (Self Study).**

**UNIT –II CONGRUENCES (20 HRS.)**

Congruences, Solutions of Congruences, Congruences of Degree 1, the Function φ (n), Congruences of Higher Degree, Prime Power Moduli, Prime Modulus, Power Residues.

**UNIT –III QUADRATIC RECIPROCITY (15 HRS.)**

Quadratic Residues, Quadratic Reciprocity, **The Jacobi Symbol (Self study).**

**UNIT –IV SOME FUNCTIONS OF NUMBER THEORY (20 HRS.)**

Greatest Integer Function, Arithmetic Functions , the Moebius Inversion Formula, Recurrence Functions.

**UNIT –V SOME DIOPHANTINE EQUATIONS (20 HRS.)**

Diophantine Equations, The Equation ax + by = c, Positive Solutions, Other Linear Equations, **The Equation $x^2 + y^2 = z^2$ (Self study)** , **The Equation $x^4 + y^4 = z^2$ (Self study)** , Sums of Four and Five Squares, Sum of Fourth Powers, Sum of Two Squares.

**TEXT BOOK:**

1. Ivan Nivan and Herbert S. Zuckerman, *An Introduction to the Theory of Numbers,* Third Edition, Wiley Eastern Ltd, 1976.

**REFERENCES**

1. T. M. Apostle, *Introduction to Analytic number theory*, Narosa Publishing House, 1998.
2. D.M.Burton, *Elementary Number Theory*, McGraw Hill Book Company, 7th Edition , 2006.

**Unit 1 : Chapter 1** : 1.1 – 1.3

**Unit 2 : Chapter 2 :** 2.1 – 2.7 , 2.9

**Unit 3 : Chapter 1** : 3.1 – 3.3

**Unit 4 : Chapter 1** : 4.1 – 4.3 , 4.5

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1 DIVISIBILITY** | | | | |
| 1.1 | Introduction | 5 | Chalk & Talk | Black Board |
| 1.2 | Divisibility | 5 | Chalk & Talk | Black Board |
| 1.3 | Primes | 5 | Discussion, Seminar | Black Board |
| **UNIT -2 CONGRUENCES** | | | | |
| 2.1 | Congruences | 3 | Chalk & Talk | Black Board |
| 2.2 | Solutions of Congruences | 3 | Chalk & Talk | Black Board |
| 2.3 | Congruences of Degree 1 | 3 | Chalk & Talk | Black Board |
| 2.4 | the Function φ (n) | 3 | Chalk & Talk | Black Board |
| 2.5 | Congruences of Higher Degree | 2 | Chalk & Talk | Black Board |
| 2.6 | Prime Power Moduli | 3 | Chalk & Talk | Black Board |
| 2.7 | Prime Modulus | 2 | Chalk & Talk | Black Board |
| 2.8 | Power Residues | 1 | Chalk & Talk | Black Board |
| **UNIT -3 QUADRATIC RECIPROCITY** | | | | |
| 3.1 | Quadratic Residues | 5 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 3.2 | Quadratic Reciprocity | 5 | Chalk & Talk | Black Board |
| 3.3 | The Jacobi Symbol | 6 | Discussion, Seminar | Black Board |
| **UNIT -4 SOME FUNCTIONS OF NUMBER THEORY** | | | | |
| 4.1 | Greatest Integer Function | 5 | Discussion | Black Board |
| 4.2 | Arithmetic Functions | 5 | Discussion | Black Board |
| 4.3 | the Moebius Inversion Formula | 5 | Discussion | Black Board |
| 4.4 | Recurrence Functions | 5 | Discussion | Black Board |
| **UNIT -5 SOME DIOPHANTINE EQUATIONS** | | | | |
| 5.1 | Diophantine Equations | 2 | Discussion | Black Board |
| 5.2 | The Equation $ax + by = c$ | 2 | Discussion | Black Board |
| 5.3 | Positive Solutions | 2 | Discussion | Black Board |
| 5.4 | Other Linear Equations | 2 | Discussion | Black Board |
| 5.5 | The Equation $x^2 + y^2 = z^2$ | 3 | Discussion , Seminar | Black Board |
| 5.6 | The Equation $x^4 + y^4 = z^2$ | 4 | Discussion , Seminar | Black Board |
| 5.7 | Sums of Four and Five Squares | 2 | Discussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 5.8 | Sum of Fourth Powers, Sum of Two Squares | 2 | Discussion | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | Seminar | Assignment | OBT/PPT | | | | |
| | 10 Mks. | 10 Mks. | 5 Mks. | 5 Mks | 5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

| CIA | |
|---|---|
| **Scholastic** | **35** |
| **Non Scholastic** | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **CIA** | **ESE** | **Total** |
| **10** | **10** | **5** | **5** | **5** | **5** | **40** | **60** | **100** |

- **PG CIA Components**

| | | | **Nos** | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 and interpret the concepts of divisibility | K2 | PSO1 |
| **CO 2** | Explain properties of congruences | K2 | PSO3 |
| **CO 3** | Apply the Law of Quadratic Reciprocity | K3 | PSO5 |
| **CO 4** | Classify functions of number theory | K4 | PSO4 |
| **CO 5** | Solve Linear Diophantine equation | K3,K5 | PSO2 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **2** | **2** | **2** |
| **CO2** | **2** | **2** | **3** | **2** | **2** |
| **CO3** | **2** | **2** | **2** | **2** | **3** |
| **CO4** | **2** | **3** | **2** | **2** | **2** |
| **CO5** | **2** | **2** | **2** | **3** | **2** |

## Mapping of COs with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

1. **Mrs. Nigila Ragavan**
2. **Dr. Mrs. V. Vanitha**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 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 |

# INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | 35 |
| Non Scholastic | 5 |
| | 40 |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 2 | 2 |
| CO4 | 2 | 3 | 2 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 3 |

## Mapping of COs with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**1.Mrs. A. Paulin Mary**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19PG2M5 | ADVANCED ALGEBRA | Core | 6 | 4 |

**COURSE DESCRIPTION**

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

**COURSE OBJECTIVES**

To study the Dual spaces, Matrices, Linear Transformations and Galois Theory.

**UNITS**

**UNIT –I DUAL SPACES (15 HRS.)**

Dual spaces, the algebra of linear transformations, Characteristic roots.

**UNIT –II MATRICES & TRANSFORMATIONS (20 HRS.)**

**Matrices (Self-study)** , Canonical forms: triangular form, Nilpotent transformations.

**UNIT –III TYPES OF LINEAR TRANSFORMATIONS (15 HRS.)**

Hermitian, Unitary and Normal transformations, **Real quadratic forms. (Self-study).**

**UNIT –IV ROOTS IN EXTENSION FIELDS (20 HRS.)**

Extension Fields, Roots of polynomials, **More about roots (Self-study).**

**UNIT –V GALOIS THEORY (15 HRS.)**

The elements of Galois Theory, Solvability by radicals, **Finite fields (Self-study)**

**TEXT BOOK:**

1. I. N. Herstein -*Topics in algebra,* 2nd Edition, John Wiley and Sons, 2002.

**UNIT I :** Chapter 4 (Section 4.3) , Chapter 6 ( Section 6.1, 6.2 )

**UNIT II :** Chapter 6 ( Section 6.3, 6.4, 6.5 )

**UNIT III :** Chapter 6 ( Section 6.10 , 6.11 )

**UNIT IV :** Chapter 5 ( Section 5.1 , 5.3, 5.5 )

**UNIT V :** Chapter 5 ( Section 5.6) , Section 5.7 (Lemma 5.7.3, Theorms 5.7.2 & 5.7.3)

Chapter 7 (Section 7.1)

**REFERENCES:**

1. Micheal Artin - *Algebra*, Prentice Hall of India, 2002.

2. Surjeet Singh and Quazi Zameeruddin - *Modern Algebra*, 7th Edition, Vikas Publishing House Pvt Ltd., 1990.

3. K. Hoffman and R. Kunze - *Linear Algebra*, Prentice Hall, 1972.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT - 1** | **DUAL SPACES** | | | |
| 1.1 | Dual spaces | 5 | Chalk & Talk | Green Board |
| 1.2 | the algebra of linear transformations | 5 | Chalk & Talk | Green Board |
| 1.3 | Characteristic roots | 5 | Chalk & Talk | Green Board |
| **UNIT - 2** | **MATRICES & TRANSFORMATIONS** | | | |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 2.1 | Matrices | **4** | Discussion , Seminar | Green Board |
| 2.2 | Canonical forms : Triangular form | 8 | Chalk & Talk | Green Board |
| 2.3 | Nilpotent Trransformations | 8 | Chalk & Talk | Green Board |
| | **UNIT - 3 TYPES OF LINEAR TRANSFORMATIONS** | | | |
| 3.1 | Hermitian, Unitary and Normal Transformations | 12 | Chalk & Talk | Green Board |
| 3.2 | Real Quadratic forms | **3** | Discussion , Seminar | Green Board |
| | **UNIT - 4 ROOTS IN EXTENSION FIELDS** | | | |
| 4.1 | Extension Fields | 8 | Chalk & Talk | Green Board |
| 4.2 | Roots of polynomials | 7 | Chalk & Talk | Green Board |
| 4.3 | More about roots | **5** | Discussion , Seminar | Green Board |
| | **UNIT - 5 GALOIS THEORY** | | | |
| 5.1 | The elements of Galois Theory | 6 | Chalk & Talk | Green Board |
| 5.2 | Solvability by radicals | 8 | Chalk & Talk | Green Board |
| 5.3 | Finite Fields | **6** | Discussion , Seminar | Green Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| C1 | - | Test (CIA 1) | 1 | - | 10 Mks |
| C2 | - | Test (CIA 2) | 1 | - | 10 Mks |
| C3 | - | Assignment | 2 * | - | 5 Mks |
| C4 | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| C5 | - | Seminar | 1 | - | 5 Mks |
| C6 | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## COURSE OUTCOMES

| NO. | COURSE OUTCOMES | KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY) | PSOs ADDRESSED |
|---|---|---|---|
| CO 1 | Appraise characteristic roots of linear transformations | K5 | PSO1& PSO2 |
| CO 2 | Explain Matrices and Nilpotent transformation | K2, K4 | PSO3 |
| CO 3 | Classify transformations | K4 | PSO5 |
| CO 4 | Describe various concepts of fields | K2, K4 | PSO4 |
| CO 5 | Analyse Galois theory | K4 | PSO3 |

**Mapping COs Consistency with PSOs**

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| 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 | 2 | 3 | 2 | 2 |

## Mapping of C0s with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**1.Mrs NIGILA RAGAVAN**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19PG2M6 | ADVANCED REAL ANALYSIS | 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.

**UNITS**

**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 [15 HRS.]**

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 |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 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** | | | |
| 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 |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 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 |
| 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 |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 3 | 2 | 3 |

## Mapping of C0s with POs

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

**(A.Paulin Mary)**

**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 | 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 |

| 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 | 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 |
| **UNIT -5** | **PARTIAL DIFFERENTIAL EQUATIONS OF THE SECOND ORDER** | | | |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 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 |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| **K2** | **4** | **4** | **-** | **-** | **-** | **8** | - | **8** | 20 % |
| **K3** | **2** | **2** | **-** | **5** | **-** | **9** | - | **9** | 22.5 % |
| **K4** | **2** | **2** | **-** | **-** | **5** | **9** | - | **9** | 22.5 % |
| **K5** | **2** | **2** | **5** | **-** | **-** | **9** | - | **9** | 22.5 % |
| **Non Scholastic** | **-** | **-** | **-** | **-** | - | | **5** | **5** | 12.5 % |
| **Total** | **10** | **10** | **5** | **5** | **5** | **35** | **5** | **40** | **100 %** |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | **Nos** | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | **2** | **3** | **2** | **2** | **2** |
| **CO2** | **3** | **2** | **2** | **2** | **2** |
| **CO3** | **2** | **2** | **2** | **3** | **2** |
| **CO4** | **2** | **2** | **2** | **2** | **3** |
| **CO5** | **2** | **2** | **3** | **2** | **2** |

**Mapping of COs with POs**

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**1. Mrs. A. Paulin Mary**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19PG2M8 | GRAPH THEORY | Core | 6 | 4 |

**COURSE DESCRIPTION**

This course enables the students to study some advanced concepts in Graph Theory.

**COURSE OBJECTIVES**

To study the concepts of Connectivity, Digraphs, Matchings, Planarity and Domination in Graphs.

**UNITS**

**UNIT –I : CONNECTIVITY (15 HRS)**

Cut vertices, Blocks, Connectivity, Menger's theorem.

**UNIT –II TRAVERSABILITY (20 HRS)**

Eulerian graphs, Hamiltonian graphs, **Hamiltonian walks and numbers (self study).**

**UNIT –III DIGRAPHS, MATCHINGS AND FACTORIZATION (20 HRS)**

Strong digraphs, Tournaments, Matchings, Factorization.

**UNIT –IV PLANARITY AND COLORING (20 HRS)**

Planar graphs, Four color problem, Vertex coloring, **edge coloring (self study)**.

**UNIT –V DISTANCE AND DOMINATION (15 HRS)**

The center of a graph, **distant vertices (self study)**, the domination number of a graph.

**TEXT BOOK:**

1.Gary Chartrand and Ping Zhang ,*Introduction to graph theory*, Tata McGraw Hill Publishing Company Ltd, Edition 2006.

**UNIT I:** Chapters 5: Sections 5.1 - 5.4,
**UNIT II:** Chapter 6: Sections 6.1 - 6.3
**UNIT III:** Chapter 7: Sections 7.1, 7.2,
Chapter 8: Sections 8.1, 8.2
**UNIT IV:** Chapter 9: Section 9.1
Chapter 10: Sections 10.1 - 10.3
**UNIT V:** Chapter 12: Sections 12.1, 12.2
Chapter13: Section 13.1

**REFERENCES**

1.Harary ,*Graph Theory*, Narosa Publishing company, 2001
2.Douglas West, *Introduction to graph Theory,* Pearson Prentice Hall, 2nd Edition, 2006.
3.Bondy J. A and Murty V. S. R, *Graph Theory with applications* Macmillan Press Ltd, 1976.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **CONNECTIVITY** | | | |
| 1.1 | Cut vertices | 4 | Chalk & Talk | Black Board |
| 1.2 | Blocks, | 4 | Chalk & Talk | Black Board |
| 1.3 | Connectivity | 4 | Chalk & Talk | Black Board |
| 1.4 | Menger's theorem | 3 | Chalk & Talk | Black Board |
| **UNIT -2** | **TRAVERSABILITY** | | | |
| 2.1 | Eulerian graphs | 7 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 2.2 | Hamiltonian graphs | 6 | Chalk & Talk | Black Board |
| 2.3 | Hamiltonian walks and numbers | 7 | Chalk & Talk, Discussion | Black Board |
| **UNIT -3 DIGRAPHS, MATCHINGS AND FACTORIZATION** | | | | |
| 3.1 | Strong digraphs | 5 | Chalk & Talk | Black Board |
| 3.2 | Tournaments | 5 | Chalk & Talk | Black Board |
| 3.3 | Matchings | 5 | Chalk & Talk | Black Board |
| 3.4 | Factorization | 5 | Chalk & Talk | Black Board |
| **UNIT 4 PLANARITY AND COLORING** | | | | |
| 4.1 | Planar graphs | 5 | Discussion | Black Board |
| 4.2 | Four color problem | 5 | Discussion | Black Board |
| 4.3 | Vertex coloring | 4 | Discussion | Black Board |
| 4.4 | edge coloring | 6 | Discussion | Black Board |
| **UNIT 5 DISTANCE AND DOMINATION** | | | | |
| 5.1 | The center of a graph | 5 | Discussion | Black Board |
| 5.2 | distant vertices | 5 | Discussion | Black Board |
| 5.3 | the domination number of a graph | 5 | Discussion | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | 35 |
| Non Scholastic | 5 |
| | 40 |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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** | Build the knowledge of Connectivity in graphs | K3 | PSO1& PSO2 |
| **CO 2** | Identify Eulerian and Hamiltonian graphs | K2 & K4 | PSO2 & PSO4 |
| **CO 3** | Explain Digraphs, Matchings and Factorization in graphs | K3 | PSO4 & PSO5 |
| **CO 4** | Describe Planarity and Coloring in graphs | K2 & K3 | PSO3 & PSO4 |
| **CO 5** | Define and Explain Domination in graph | K2 & K4 | PSO3 & PSO5 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 3 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 3 | 2 | 3 |

## Mapping of COs with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

1. **Mrs. A. Sheela Roselin**
2. **Dr. Sr. M. Fatima Mary**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19M1EDC/19M2EDC | Optimization Methods | EDC | 3 | 3 |

**COURSE DESCRIPTIONS**

This course helps the students to convert real life problems into mathematical models and solve them using various techniques.

**COURSE OBJECTIVES**

To enable the students to learn Transportation, Assignment Problems, Sequencing Problem and Game Theory.

**UNITS**

**UNIT –I TRANSPORTATION PROBLEM (9 HRS)**

Transportation Problem: Mathematical formulation - Existence of feasible solution - Feasible solution by (i) North – West corner rule (ii) Matrix – Minima method (iii) Vogel's approximation method.

**UNIT –II MODIFIED DISTRIBUTION METHOD (9HRS)**

Optimal solution to a T.P by modified distribution method – **Degeneracy in T.P – Unbalanced T.P .(Self Study)**

**UNIT –III ASSIGNMENT PROBLEM (9HRS)**

Introduction – Mathematical formulation of the problem – The assignment method – **Special cases in assignment problems.(Self study)**

**UNIT –IV SEQUENCING PROBLEM (9 HRS)**

Introduction – problem of sequencing – Basic terms used in sequencing – Processing n jobs through two machines – Processing n jobs through k machines – Processing 2 jobs through k machines.

**UNIT –V GAME THEORY**

Introduction – Two person zero sum games – Some basic terms - The maximin-minimax principle – Games without saddle points – mixed strategies – Graphical solution of 2 x n and m x 2 games – Dominance property .

**REFERENCES:**

1.Kanti Swarup, P.K.Gupta, Man Mohan - Operations Research, 2006 – Sultan Chand & Sons, New Delhi.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT –I TRANSPORTATION PROBLEM** | | | | |
| 1.1 | Transportation Problem: Mathematical formulation - Existence of feasible solution | 1 | Chalk & Talk | Black Board |
| 1.2 | Feasible solution by North – West corner rule | 2 | Chalk & Talk | Black Board |
| 1.3 | Feasible solution by Matrix – Minima method | 2 | Chalk & Talk | Black Board |
| 1.4 | Feasible solution by Vogel's approximation method. | 2 | Chalk & Talk | Black Board |
| **UNIT –II MODIFIED DISTRIBUTION METHOD** | | | | |
| 2.1 | Optimal solution to a T.P by modified distribution method | 4 | Chalk & Talk | Black Board |
| 2.2 | Degeneracy in T.P – Unbalanced T.P. | 5 | Discussion | Black Board |
| **UNIT –III ASSIGNMENT PROBLEM** | | | | |
| 3.1 | Introduction – Mathematical formulation of the problem | 1 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 3.2 | The assignment method | 4 | Chalk & Talk | Black Board |
| 3.3 | Special cases in assignment problems. | 4 | Discussion | Black Board |
| **UNIT –IV SEQUENCING PROBLEM** | | | | |
| 4.1 | Introduction – problem of sequencing – Basic terms used in sequencing | 1 | Chalk & Talk | Black Board |
| 4.2 | Processing n jobs through two machines | 2 | Chalk & Talk | Black Board |
| 4.3 | Processing n jobs through k machines | 2 | Chalk & Talk | Black Board |
| 4.4 | Processing 2 jobs through k machines. | 2 | Chalk & Talk | Black Board |
| **UNIT –V GAME THEORY** | | | | |
| 5.1 | Introduction – Two person zero sum games – Some basic terms | 2 | Chalk & Talk | Black Board |
| 5.2 | The maximin-minimax principle – Games without saddle points | 3 | Chalk & Talk | Black Board |
| 5.3 | Mixed strategies – Graphical solution of 2 x n and m x 2 games – Dominance property . | 4 | Chalk & Talk | Black Board |

# INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | Seminar | Assignment | OBT/PPT | | | | |
| | 10 Mks. | 10 Mks. | 5 Mks. | 5 Mks | 5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

**CIA**

| | |
|---|---|
| **Scholastic** | **35** |
| **Non Scholastic** | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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** | Distinguish Transportation problem and Assignment problem. | K2 | PSO1& PSO2 |
| **CO 2** | Classify the methods of finding IBFS to a transportation problem. | K2, K3, | PSO3 |
| **CO 3** | Explain assignment problem and solve. | K2 & K4 | PSO5 |
| **CO 4** | Solve Sequencing problem. | K2, K3 & K4 | PSO2 |
| **CO 5** | Define two person zero sum game, saddle point and solve problems | K3 & K5 | PSO4 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **2** | **2** | **2** |
| **CO2** | **2** | **2** | **3** | **2** | **2** |
| **CO3** | **2** | **2** | **2** | **2** | **3** |
| **CO4** | **2** | **3** | **2** | **2** | **2** |
| **CO5** | **2** | **2** | **2** | **3** | **2** |

## Mapping of COs with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

1. **Dr.Sr.M.Fatima Mary**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19PG3M9 | MEASURE AND INTEGRATION | 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 |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 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 |
| 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 |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 |
| CO4 | 2 | 2 | 2 | 2 | 3 |
| CO5 | 2 | 2 | 3 | 2 | 3 |

## Mapping of C0s with POs

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

**Note**: □ Strongly Correlated – **3** □ Moderately Correlated – **2** Weakly Correlated -**1**

**COURSE DESIGNER:**

**1. Dr. Mrs. C. Prasanna Devi**

**2. Mrs. Nigila Ragavan**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19PG3M10 | OPTIMIZATION TECHNIQUES | Core | 6 | 4 |

**COURSE DESCRIPTION**

This course makes the better decisions in complex scenarios by the application of a set of advanced analytical methods.

**COURSE OBJECTIVES**

To enable the students to become aware of and appreciate the potential of the theory of optimization and to introduce various decision making tools and techniques based on optimization.

**UNITS**

**UNIT –I REVISED SIMPLEX METHOD (15 HRS.)**

Introduction, Standard forms for Revised Simplex Method, Computational Procedure for Standard Form I, Comparison of Simplex Method and Revised Simplex Method.

**UNIT –II INTEGER LINEAR PROGRAMMING (20 HRS.)**

Introduction, Types of Integer Linear Programming Problems, Enumeration and Cutting Plane Solution Concept, Gomory's All Integer Cutting Plane Method , **Gomory's mixed Integer Cutting Plane method(Self Study)** , Branch and Bound Method

**UNIT –III DYNAMIC PROGRAMMING (15 HRS.)**

Introduction, Dynamic Programming Terminology, Developing Optimal Decision Policy, Dynamic Programming Under Certainty, **Dynamic Programming Approach for Solving Linear Programming Problem(Self Study).**

**UNIT –IV DETERMINISTIC INVENTORY CONTROL MODEL (20 HRS.)**

Introduction, The Meaning of Inventory Control, Functional Role of Inventory, Reasons of Carrying Inventory, Factors Involved in Inventory Problem Analysis, Inventory Model building, Inventory Control Models without Shortage, **Inventory Control Models with Shortages (Self Study)**

**UNIT –V QUEUING THEORY (20 HRS.)**

Introduction, The structure of Queuing system, Performance Measures of a Queuing system, Probability Distributions in Queuing systems, Classification of Queuing Models, **Single server Queuing Models, Multi server Queuing Models, Finite calling population Queuing Models (Self Study)**

**TEXT BOOK:**

1.J.K. Sharma, *Operations Research Theory and Applications,*Second Edition, Macmillan (India) New Delhi 2005

**REFERENCES:**

1.J. Lieberman, F.S. Hiller, *Introduction to Operations Research,* 7th Edition, Tata- McGraw Hill Company, New Delhi, 2001.

2.Kanti Swarup, Manmohan, P.K. Gupta,*Operations Research*, , Sultan & Chand Publications, 2003.

3.Hamdy A. Taha, *Operations Research, ,* (Edition 7), Prentice - Hall of India Private Limited, New Delhi, 1997.

**COURSE CONTENTS & LECTURE SCHEDULE:**

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **REVISED SIMPLEX METHOD** | | | |
| 1.1 | Introduction | 2 | Lecture | Black Board |
| 1.2 | Standard forms for Revised Simplex Method | 5 | Chalk & Talk | Black Board |
| 1.3 | Computational Procedure for Standard Form I | 5 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 1.4 | Comparison of Simplex Method and Revised Simplex Method | 3 | Chalk & Talk | Black Board |
| **UNIT -2** | **INTEGER LINEAR PROGRAMMING** | | | |
| 2.1 | Introduction | 1 | Lecture | Black Board |
| 2.2 | Types of Integer Linear Programming Problems | 1 | Chalk & Talk | Black Board |
| 2.3 | Enumeration and Cutting Plane Solution Concept | 3 | Chalk & Talk | Black Board |
| 2.4 | Gomory's All Integer Cutting Plane Method | 6 | Chalk & Talk | Black Board |
| 2.5 | Gomory's mixed Integer Cutting Plane method | 4 | Discussion | Black Board |
| 2.6 | Branch and Bound Method | 5 | Chalk & Talk | Black Board |
| **UNIT -3 DYNAMIC PROGRAMMING** | | | | |
| 3.1 | Introduction | 1 | Lecture | Black Board |
| 3.2 | Dynamic Programming Terminology | 2 | Chalk & Talk | Black Board |
| 3.3 | Developing Optimal Decision Policy | 5 | Chalk & Talk | Black Board |
| 3.4 | Dynamic Programming Under Certainty | 5 | Chalk & Talk | Black Board |
| 3.5 | Dynamic Programming Approach for Solving Linear Programming Problem. | 2 | Discussion | Black Board |
| **UNIT- 4 DETERMINISTIC INVENTORY CONTROL MODELS** | | | | |
| 4.1 | Introduction | 1 | Discussion | LCD |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 4.2 | The Meaning of Inventory Control | 1 | Discussion | LCD |
| 4.3 | Functional Role of Inventory | 3 | Discussion | Black Board |
| 4.4 | Reasons of Carrying Inventory | 3 | Discussion | Black Board |
| 4.5 | Factors Involved in Inventory Problem Analysis | 3 | Discussion | Black Board |
| 4.6 | Inventory Model building | 3 | Discussion | Black Board |
| 4.7 | Inventory Control Models without Shortage | 3 | Discussion | Black Board |
| 4.8 | Inventory Control Models with Shortages | 3 | Discussion | Google Slides |
| **UNIT- 5 QUEUING THEORY** | | | | |
| 5.1 | Introduction | 1 | Discussion | LCD |
| 5.2 | The structure of Queuing system | 1 | Discussion | Black Board |
| 5.3 | Performance Measures of a Queuing system | 3 | Discussion | Black Board |
| 5.4 | Probability Distributions in Queuing systems | 3 | Discussion | Black Board |
| 5.5 | Classification of Queuing Models | 3 | Discussion | Black Board |
| 5.6 | Single server Queuing Models | 3 | Discussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 5.7 | Multi server Queuing Models | 3 | Discussion | Black Board |
| 5.8 | Finite calling population Queuing Models | 3 | Discussion | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | 35 |
| Non Scholastic | 5 |
| | 40 |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 revised simplex method and solve problems | K2 | PSO1& PSO2 |
| **CO 2** | Classify integer programming problem and explain cutting plane and branch and bound methods | K2, K3, | PSO3 |
| **CO 3** | Recognize dynamic programming problem and formulate recurrence relation | K2 & K4 | PSO5 |
| **CO 4** | Distinguish inventory control models | K2, K3, K4 | PSO3 |
| **CO 5** | Identify Queuing models | K2 & K4 | PSO4 |

## Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 |

## Mapping of C0s with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

**1.Dr. V. Vanitha**

**2.Dr. Sr. M. Fatima Mary**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19PG3M11 | COMBINATORICS | Core | 6 | 4 |

**COURSE DESCRIPTION**

Combinatorics may be defined as the study of discrete structures and how these structures can be combined subject to various constraints. It can be described as the art of counting.

**COURSE OBJECTIVES**

To introduce topics and techniques of discrete and combinatorial methods. Topics that will be studied includes generating functions, recurrence relations, the principle of inclusion and exclusion, Polya's theory of counting and methods to solve different equations.

**UNITS**

**UNIT –I PERMUTATIONS AND COMBINATIONS (15 HRS.)**

Introduction, rules of sum and product, Permutations and Combinations, Distributions of distinct objects, distributions of non distinct objects.

**UNIT –II GENERATING FUNCTIONS (20 HRS.)**

Generating functions for combinations, enumerators for permutations, Distributions of distinct objects into non distinct cells, partitions of integers.

**UNIT –III RECURRENCE RELATIONS (20 HRS.)**

Linear Recurrence relations with constant coefficients, Solution by the technique of generating functions, **A Special class of nonlinear difference equations,Recurrence relation with two indices (Self study).**

**UNIT –IV THE PRINCIPLE OF INCLUSION AND EXCLUSION (15HRS.)**

The principle of Inclusion and Exclusion, **the general formula, Derangements (Self Study),** Permutations with restrictions on relative positions.

**UNIT –V POLYA'S THEORY OF COUNTING (20 HRS.)**

Equivalence classes under a permutation group, Equivalence classes of functions, Weights and inventories of functions, Polya's fundamental theorem.

**TEXT BOOK:**

1.Liu C. L., *Introduction to Combinatorial Mathematics*, McGraw Hill, 1968.

**UNIT I :** Chapter1:Sections 1.1 -1.6,
**UNIT II :**Chapter 2: Sections 2.1 - 2.7,
**UNIT III :** Chapter 3: Sections 3.1 - 3.5,
**UNIT IV :** Chapter 4: Sections 4.1 - 4.5,
**UNIT V :** Chapter 5: Sections 5.3 - 5.6.

**REFERENCES:**

1. Alan Tucker , *Applied Combinatorics*, John Wiley and Sons (Asia) 2004
2. Herbert John Ryser, *Combinatorial Mathematics,* The Mathematical Association of America, 1963
3. I. A. Cohen, *Combinatorics,*
4. V.Krishnamurthy, *Combinatorics: Theory and Applications*, East-West Press, 2000.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **PERMUTATIONS AND COMBINATIONS** | | | |
| 1.1 | Introduction | 3 | Chalk & Talk | Black Board |
| 1.2 | rules of sum and product | 3 | Chalk & Talk | Black Board |
| 1.3 | Permutations and Combinations | 3 | Chalk & Talk | Black Board |
| 1.4 | Distributions of distinct objects | 3 | Chalk & Talk | Black Board |
| 1.5 | Distributions of non distinct objects | 3 | Chalk & Talk | Black Board |
| **UNIT -2** | **GENERATING FUNCTIONS** | | | |
| 2.1 | Generating functions for combinations | 5 | Chalk & Talk | Black Board |
| 2.2 | Enumerators for permutations | 5 | Chalk & Talk | Black Board |
| 2.3 | Distributions of distinct objects into non distinct cells | 5 | Chalk & Talk | Black Board |
| 2.4 | partitions of integers | 5 | Chalk & Talk | Black Board |
| **UNIT -3** | **RECURRENCE RELATIONS** | | | |
| 3.1 | Linear Recurrence relations with constant coefficients | 5 | Chalk & Talk | Black Board |
| 3.2 | Solution by the technique of generating functions | 5 | Chalk & Talk | Black Board |
| 3.3 | A Special class of nonlinear difference equations | 5 | Chalk & Talk, Discussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 3.4 | Recurrence relation with two indices | 5 | Chalk & Talk, Discussion | Black Board |
| **UNIT -4** | **THE PRINCIPLE OF INCLUSION AND EXCLUSION** | | | |
| 4.1 | The principle of Inclusion and Exclusion | 4 | Chalk & Talk | Black Board |
| 4.2 | The general formula | 4 | Chalk & Talk, Discussion | Black Board |
| 4.3 | Derangements | 4 | Chalk & Talk, Discussion | Black Board |
| 4.4 | Permutations with restrictions on relative positions | 3 | Discussion | Black Board |
| **UNIT -5** | **POLYA'S THEORY OF COUNTING** | | | |
| 5.1 | Equivalence classes under a permutation group | 5 | Discussion | Black Board |
| 5.2 | Equivalence classes of functions | 5 | Discussion | Black Board |
| 5.3 | Weights and inventories of functions | 5 | Discussion | Black Board |
| 5.4 | Polya's fundamental theorem | 5 | Discussion | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 the rules of sum and product of permutations and combinations. | K2 | PSO1& PSO2 |
| **CO 2** | Describe distributions of distinct objects into non-distinct cells and partitions of integers. | K3&K5 | PSO4 |
| **CO 3** | Identify solutions by the technique of generating functions and recurrence relations with two indices | K2& K3 | PSO2 |
| **CO 4** | Solve problems on principle of inclusion and exclusion | K2 &K3 | PSO3 |
| **CO 5** | Apply Polya's theory using configuration. | K3& K4 | PSO5 |

## Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 2 | 3 | 2 |
| CO3 | 2 | 3 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 3 |

## Mapping of COs with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

1. **Mrs. M. Teresa Nirmala**
2. **Dr. V. Vanitha**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 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 $X \cdot Y$, **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 |
| **UNIT -2** | **CONTINUOUS FUNCTIONS** | | | |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 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 |
| 5.2 | The Separation axioms | 5 | Discussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 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 |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1 10 Mks. | T2 10 Mks. | Seminar 5 Mks. | Assignment 5 Mks | OBT/PPT 5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| **K2** | **4** | **4** | **-** | **-** | **-** | **8** | - | **8** | 20 % |
| **K3** | **2** | **2** | **-** | **5** | **-** | **9** | - | **9** | 22.5 % |
| **K4** | **2** | **2** | **-** | **-** | **5** | **9** | - | **9** | 22.5 % |
| **K5** | **2** | **2** | **5** | **-** | **-** | **9** | - | **9** | 22.5 % |
| **Non Scholastic** | **-** | **-** | **-** | **-** | - | | **5** | **5** | 12.5 % |
| **Total** | **10** | **10** | **5** | **5** | **5** | **35** | **5** | **40** | **100 %** |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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** | 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 | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 3 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 2 | 2 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 |

## Mapping of COs with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**1. Dr. Mrs. C. Prasanna Devi**

**2. Mrs. Nigila Ragavan**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

# II M.Sc. Mathematics

## SEMESTER –III

## *For those who joined in 2021 onwards*

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 21PG3ME1 | FUZZY SETS AND APPLICATIONS | Core | 4 | 4 |

**COURSE DESCRIPTION**

This course is focused on the fundamental theory of fuzzy sets, fuzzy logic which can be applied in data mining and decision making in various fields.

**COURSE OBJECTIVES**

To enable the students to understand the basic concepts of Crisp sets, Fuzzy sets, operations on fuzzy set, Fuzzy relations and applications of Fuzzy sets.

**UNITS**

**UNIT –I CRISP SETS AND FUZZY SETS (12 HRS.)**

Crisp sets : An over view, the notion of Fuzzy sets, Basic concepts of Fuzzy sets.

**UNIT –II OPERATIONS ON FUZZY SETS (12 HRS.)**

General discussion, Fuzzy Complements, Fuzzy Union, Fuzzy Intersection, Combinations of operations.

**UNIT –III FUZZY RELATIONS (12 HRS.)**

Crisp and Fuzzy Relations, Binary Relations on a single set, **Equivalence and similarity Relations (self study)**..

**UNIT –IV FUZZY MEASURES (12 HRS.)**

General Discussion, Belief and Plausibility Measures, Probability Measures.

**UNIT –V APPLICATIONS (12 HRS.)**

General Discussion, natural, Life and Social Sciences, **Engineering**, **Medicine and Management and Decision making (self study)**.

**TEXT BOOK:**

1.George J. Klir And Tina A. Folger, *Fuzzy Sets*, Uncertainty and Information-Prentice Hall of India Private Limited, New Delhi – 1, 2009.

**REFERENCES:**

1. George J. Llir and Boyuan, *Fuzzy Sets and Fuzzy logic, Theory and applications*- Prentice Hall of India, 2002.

2. Zimmermann, *Fuzzy Set Theory and its applications*, Affiliated East West Press Pvt , Ltd, Second Edition 1996.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **CRISP SETS AND FUZZY SETS** | | | |
| 1.1 | Crisp sets : An over view | 3 | Chalk & Talk | Black Board |
| 1.2 | the notion of Fuzzy sets | 3 | Chalk & Talk | Black Board |
| 1.3 | Basic concepts of Fuzzy sets | 2 | Chalk & Talk | Black Board |
| 1.4 | Classical Logic: an over view | 2 | Chalk & Talk | Black Board |
| 1.5 | Fuzzy logic. | 2 | Chalk & Talk | Black Board |
| **UNIT -2** | **OPERATIONS ON FUZZY SETS** | | | |
| 2.1 | General discussion | 3 | Chalk & Talk | Black Board |
| 2.2 | Fuzzy Complements | 3 | Chalk & Talk | Black Board |
| 2.3 | Fuzzy Union, Fuzzy Intersection | 3 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 2.4 | Combinations of operations | 3 | Chalk & Talk | Black Board |
| **UNIT -3 FUZZY RELATIONS** | | | | |
| 3.1 | Crisp and Fuzzy Relations | 4 | Chalk & Talk | Black Board |
| 3.2 | Binary Relations on a single set | 4 | Chalk & Talk | Green Board |
| 3.3 | Equivalence and similarity Relations. | 4 | Chalk & Talk, Discussion | Black Board |
| **UNIT -4 FUZZY MEASURES** | | | | |
| 4.1 | General Discussion | 4 | Discussion | Black Board |
| 4.2 | Belief and Plausibility Measures | 4 | Discussion | Black Board |
| 4.3 | Possibility and Necessity Measures. | 4 | Discussion | Black Board |
| **UNIT -5 APPLICATIONS** | | | | |
| 5.1 | General Discussion, natural , Life and Social Sciences | 4 | Discussion | Black Board |
| 5.2 | Engineering | 4 | Discussion | Black Board |
| 5.3 | Medicine and Management and Decision making . | 4 | Discussion | Black Board |

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| **K2** | **4** | **4** | **-** | **-** | **-** | **8** | - | **8** | 20 % |
| **K3** | **2** | **2** | **-** | **5** | **-** | **9** | - | **9** | 22.5 % |
| **K4** | **2** | **2** | **-** | **-** | **5** | **9** | - | **9** | 22.5 % |
| **K5** | **2** | **2** | **5** | **-** | **-** | **9** | - | **9** | 22.5 % |
| **Non Scholastic** | **-** | **-** | **-** | **-** | - | | **5** | **5** | 12.5 % |
| **Total** | **10** | **10** | **5** | **5** | **5** | **35** | **5** | **40** | **100 %** |

**INTERNAL - PG**

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| C1 | - | Test (CIA 1) | 1 | - | 10 Mks |
| C2 | - | Test (CIA 2) | 1 | - | 10 Mks |
| C3 | - | Assignment | 2 * | - | 5 Mks |
| C4 | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| C5 | - | Seminar | 1 | - | 5 Mks |
| C6 | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 | Distinguish crisp sets and Fuzzy sets | K2 | PSO1 |
| CO 2 | Classify operators on Fuzzy sets | K2, K3, | PSO1 & PSO2 |
| CO 3 | Describe Fuzzy relations | K2 & K4 | PSO2 & PSO4 |

| | | | |
|---|---|---|---|
| **CO 4** | Describe Fuzzy Measures | K2, K3 & K4 | PSO3 & PSO4 |
| **CO 5** | Apply Fuzzy sets in real life situations | K3 & K5 | PSO3 & PSO5 |

## Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 |
| CO3 | 2 | 3 | 2 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 |
| CO5 | 2 | 3 | 2 | 2 | 3 |

## Mapping of C0s with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**1. Dr. Mrs. V. Vanitha**

**Forwarded By**

**(A.Paulin Mary)**

**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 | 19PG3ME2 | NUMERICAL ANALYSIS | Core | 4 | 4 |

**COURSE DESCRIPTION**

This course provides knowledge to solve equations using Numerical methods.

**COURSE OBJECTIVES**

To enable the students to solve equations like Algebraic, Transcendental, Differential Equations and Integrals by various Numerical methods.

**UNITS**

**UNIT –I SOLVING SETS OF EQUATIONS (12 HRS.)**

The Elimination Method, The Gaussian Elimination and Gauss- Jordan Method, Iterative Methods - The Relaxation Method.

**UNIT –II INTERPOLATION AND CURVE FITTING (12 HRS.)**

Lagrangian Polynomials, Divided Differences, Interpolation with Cubic Spline, **Least-Square Approximation (self study).**

**UNIT –III NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION (12 HRS.)**

Derivatives form Difference tables, Extrapolation Techniques, The Trapezoidal Rule –A Composite formula, **Simpson's rules (self study).**

**UNIT –IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (12 HRS.)**

**The Taylor – Series method (self study)**, Euler and Modified Euler methods, Runge- Kutta Methods, **Milne's Method (self study)**,

**UNIT –V NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**

**(12 HRS.)**

Introduction, Difference Quotients, Geometrical representation of partial differential quotients.

**TEXT BOOK:**

**1)** Curtis .F. Gerald, Patrick O. Wheatley, *Applied Numerical Analysis*, 5th Edition Pearson Education, New Delhi, 2005.

**UNIT I :** Chapter 2 : Sections 2.3-2.4 & 2.10-2.11

**UNIT II:** Chapter 3: Sections 3.2-3.4 & 3.7

**UNIT III:** Chapter 5: Sections 5.2, 5.4 & 5.6-5.7

**UNIT IV:** Chapter 6: Sections 6.2- 6.4 & 6.6

**UNIT V:** Chapter 12 : Sections 12.1 – 12.3

**REFERENCES:**

1. R.L. Burden, J. Dougles Faires, *Numerical Analysis*, Thompson Books, USA, 2005.

2. S.S Sastry, *Introductory Methods of Numerical Analysis* , Prentice- Hall of India Pvt. Ltd., New Delhi, 2005.

3. M.K.Jain , S.R.K. Lyengar, R.K. Jain, *Numerical Methods for scientific and Engineering Computation*, 3rd Edition, Wiley Eastern Ltd., New Delhi, 1993.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **SOLVING SETS OF EQUATIONS** | | | |
| 1.1 | The Elimination Method | 4 | Chalk & Talk | Black Board |
| 1.2 | The Gaussian Elimination and Gauss- Jordan Method | 4 | Chalk & Talk | Black Board |
| 1.3 | The Relaxation Method. | 4 | Chalk & Talk | Black Board |
| **UNIT - 2** | **INTERPOLATION AND CURVE FITTING** | | | |
| 2.1 | Lagrangian Polynomials Divided Differences | 4 | Chalk & Talk | Black Board |
| 2.2 | Interpolation with Cubic Spline | 4 | Chalk & Talk | Black Board |
| 2.3 | Least-Square Approximation | 4 | Chalk & Talk, Discussion | Black Board |
| **UNIT -3** | **NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION** | | | |
| 3.1 | Derivatives form Difference tables | 3 | Chalk & Talk | Black Board |
| 3.2 | Extrapolation Techniques | 3 | Chalk & Talk | Black Board |
| 3.3 | The Trapezoidal Rule –A Composite formula | 3 | Chalk & Talk | Black Board |
| 3.4 | Simpson's rules | 3 | Chalk & Talk, Discussion | Black Board |
| **UNIT - 4** | **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS** | | | |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 4.1 | The Taylor – Series method | 3 | Discussion | Black Board |
| 4.2 | Euler and Modified Euler methods | 3 | Discussion | Black Board |
| 4.3 | Runge- Kutta Methods | 4 | Discussion | Black Board |
| 4.4 | Milne's Method | 2 | Discussion | Black Board |
| **UNIT - 5** | **NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS** | | | |
| 5.1 | Difference Quotients | 6 | Discussion | Black Board |
| 5.2 | Geometrical representation of partial differential quotients | 6 | Discussion | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | 35 |
| Non Scholastic | 5 |
| | 40 |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 the various methods of solving simultaneous linear algebraic equations. | K2 | PSO1& PSO2 |
| **CO 2** | Recognize difference operators and apply the concept of interpolation. | K2 | PSO2 & PSO4 |
| **CO 3** | Compute the values of the derivatives at some point using numerical differentiation and integration. | K2 & K4 | PSO4 & PSO5 |
| **CO 4** | Solve problems on higher order differential equations using Euler's, Runge- kutta methods | K2 & K3 | PSO4& PSO5 |
| **CO 5** | Explain Geometrical representation of partial differential quotients. | K2 & K4 | PSO1, PSO2 & PSO3 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 3 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 2 | 2 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 |

## Mapping of C0s with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

1. **Dr. Mrs. C. Prasanna Devi**
2. **Mrs. A. Paulin Mary**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

# II M.Sc. Mathematics

## SEMESTER –IV

***For those who joined in 2019 onwards***

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PG4M13 | COMPLEX ANALYSIS | Core | 6 | 5 |

**COURSE DESCRIPTION**

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

**COURSE OBJECTIVES**

To enable the students to understand the notions complex functions, complex integration, harmonic functions, series, product development and elliptic functions.

**UNITS**

**UNIT –I COMPLEX FUNCTIONS (20 HRS.)**

Spherical Representation of complex numbers, **limits and continuity, analytic functions, polynomials, sequences, series, uniform convergence (self study)**, power series, Abel's limit theorem.

**UNIT –II COMPLEX INTEGRATION (20 HRS.)**

Line integrals as functions of arcs, Cauchy's theorem for a rectangle, the index of a point with respect to a closed curve, the integral formula, higher derivatives, removable singularities, Taylor's theorem, zeros and poles.

**UNIT –III HARMONIC FUNCTIONS (15 HRS.)**

Definition and basic properties, the mean value property, Poisson's formula, Schwartz's theorem.

**UNIT –IV SERIES AND PRODUCT DEVELOPMENTS (15 HRS.)**

Weierstrass's theorem, the Taylor series, the Laurent series, partial fractions and infinite products.

**UNIT –V ELLIPTIC FUNCTIONS (20 HRS.)**

Representation by exponentials, the Fourier Development, functions of finite order, the period module, Unimodular transformation, the canonical basis, general properties of Elliptic functions,**the Wierstrass )-function, the functions ⁄(z) and ⁄(z).**

**TEXT BOOK:**

1. LarsV. Ahlfors, *Complex Analysis*, 3rd McGraw-Hill International Edition,1979

**REFERENCES:**

1. ConwayJ. B, *Functions of one Complex Variable,* Springer-Verlog, International Student Edition, Narosa Publishing Company,2002.

4. Copson, *Introduction to theory of function of a Complex variable,*London Oxford University Press,1962.

3. KarunakaranV, *Complex Analysis,* Second edition, Narosa Publishing House pvt. Ltd. 2005.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **COMPLEX FUNCTIONS** | | | |
| 1.1 | Spherical Representation of complex numbers | 4 | Chalk & Talk | Black Board |
| 1.2 | limits and continuity | 3 | Chalk & Talk, Discussion | Black Board |
| 1.3 | analytic functions, polynomials, sequences | 4 | Chalk & Talk, Discussion | Black Board |
| 1.4 | series, uniform convergence | 3 | Chalk & Talk, Discussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 1.5 | power series, Abel's limit theorem | 6 | Chalk & Talk | Black Board |
| **UNIT -2 COMPLEX INTEGRATION** | | | | |
| 2.1 | Line integrals as functions of arcs | 3 | Chalk & Talk | Black Board |
| 2.2 | Cauchy's theorem for a rectangle | 3 | Chalk & Talk | Black Board |
| 2.3 | The index of a point with respect to a closed curve | 3 | Chalk & Talk | Black Board |
| 2.4 | The integral formula | 3 | Chalk & Talk | Black Board |
| 2.5 | Higher derivatives | 2 | Chalk & Talk | Black Board |
| 2.6 | Removable singularities | 3 | Chalk & Talk | Black Board |
| 2.7 | Taylor's theorem, zeros and poles | 3 | Chalk & Talk | Black Board |
| **UNIT -3 HARMONIC FUNCTIONS** | | | | |
| 3.1 | Definition and basic properties | 5 | Chalk & Talk | Black Board |
| 3.2 | The mean value property | 4 | Chalk & Talk | Black Board |
| 3.3 | Poisson's formula | 3 | Chalk & Talk | Black Board |
| 3.4 | Schwartz's theorem | 3 | Chalk & Talk | Black Board |
| **UNIT -4 SERIES AND PRODUCT DEVELOPMENTS** | | | | |
| 4.1 | Weierstrass's theorem | 5 | Chalk & TalkDiscussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 4.2 | The Taylor series | 3 | Chalk & Talk Discussion | Black Board |
| 4.3 | The Laurent series | 3 | Chalk & Talk Discussion | Black Board |
| 4.4 | Partial fractions and infinite products | 4 | Chalk & Talk Discussion | Black Board |
| **UNIT -5 ELLIPTIC FUNCTIONS** | | | | |
| 5.1 | Representation by exponentials - the Fourier Development - functions of finite order | 4 | Chalk & Talk Discussion | Black Board |
| 5.2 | The period module - Unimodular transformation - the canonical basis | 4 | Chalk & Talk Discussion | Black Board |
| 5.3 | General properties of Elliptic functions | 4 | Chalk & Talk Discussion | Black Board |
| 5.4 | The Wierstrass ⟩-function | 4 | Chalk & Talk Discussion | Black Board |
| 5.5 | The functions ⌈(z) and ⌈(z) | 4 | Chalk & Talk Discussion | Black Board |

# INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | 35 |
| Non Scholastic | 5 |
| | 40 |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 continuous, differentiable and analytic functions. | K2 | PSO1& PSO2 |
| **CO 2** | Explain Cauchy's theorem for rectangle and Cauchy's integral formula | K3& K5 | PSO3 |
| **CO 3** | Summarize the conditions for a complex variable to be harmonic | K2& K3 | PSO5 |
| **CO 4** | Compute analytic functions in series form. | K2 & K3 | PSO2 |
| **CO 5** | Identify the conditions for a function to be elliptic and bring out its properties. | K2& K4 | PSO4 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | **2** | **2** |
| **CO2** | **2** | **2** | **3** | **2** | **2** |
| **CO3** | **2** | **2** | **2** | **2** | **3** |
| **CO4** | **2** | **3** | **2** | **2** | **2** |
| **CO5** | **2** | **2** | **2** | **3** | **2** |

## Mapping of C0s with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

**1. Mrs. M. Teresa Nirmala**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

## II M.Sc. Mathematics

## SEMESTER –IV

***For those who joined in 2019 onwards***

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PG4M14 | STATISTICS | Core | 6 | 5 |

**COURSE DESCRIPTION**

This course provides various concepts of Statistics which can beapplied in real life situations

**COURSE OBJECTIVES**

To enable the students to understand some discrete and continuous distributions, Testing of hypothesis and Estimation

**UNITS**

**UNIT –I SOME SPECIAL DISTRIBUTIONS (20 HRS.)**

The Binomial and Related Distributions – The Poisson distribution – **The Gamma, Chi-square and Beta distributions (self study)** - The Normal distribution .

**UNIT –II T, F DISTRIBUTIONS AND LIMITING DISTRIBUTIONS (20 HRS.)**

**t and F distributions, Expectations of Functions(self study)**, Convergence in Probability, Convergence in Distribution, central Limit theorem.

**UNIT –III SOME ELEMENTARY STATISTICAL INFERENCES (15 HRS.)**

Sampling and Statistics, More on confidence Intervals, Introduction to hypothesis testing, Additional Comments about Statistical Tests.

**UNIT –IV MAXIMUM LIKLELIHOOD METHODS AND SUFFICIENCY (20 HRS.)**

Maximum Likelihood Estimation, Rao-Cramer Lower Bound and efficiency, Maximum Likelihood Tests. Measures of quality of Estimators, A sufficient statistic for a parameter, Properties of a sufficient statistic .

**UNIT –V OPTIMAL TESTS OF HYPOTHESES (15 HRS.)**

Most Powerful Tests, **Uniformly Most Powerful Test(self study)**, Likelihood Ratio Tests.

**TEXT BOOK:**

1. Robert V. Hogg, Joseph W.McKean and Allen T. Craig, *Introduction to mathematical statistics*, Sixth Edition , Pearson Education. Inc. and Dorling Kindersley Publishing, Inc.2007.

**REFERENCES:**

1. John E. Freund, M T.J. Wilmore, *Mathematical Statistics*, Prentice Hall of India,2000.

2. Rohatgi V. K. and A. K. Md. L Saleh, *An Introduction to Probability and Statistics*, 2nd Edition, John Wiley & Sons, New York, 2002.

3. A. M. Mood, F. A. GrayBill and D. C. Bose, *Introduction to the Theory of Statistics*, Third Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2001.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **SOME SPECIAL DISTRIBUTIONS** | | | |
| 1.1 | The Binomial and Related Distributions | 5 | Chalk & Talk | Black Board |
| 1.2 | The Poisson distribution | 5 | Chalk & Talk | Black Board |
| 1.3 | The Gamma, Chi-square and Beta distributions | 5 | Discussion | Black Board |
| 1.4 | The Normal distribution | 5 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -2** | **T, F DISTRIBUTIONS AND LIMITING DISTRIBUTIONS** | | | |
| 2.1 | t and F distributions | 4 | Discussion | Black Board |
| 2.2 | Expectations of Functions | 4 | Discussion | Black Board |
| 2.3 | Convergence in Probability | 4 | Chalk & Talk | Black Board |
| 2.4 | Convergence in Distribution | 4 | Chalk & Talk | Black Board |
| 2.5 | central Limit theorem | 4 | Chalk & Talk | Black Board |
| **UNIT -3** | **SOME ELEMENTARY STATISTICAL INFERENCES** | | | |
| 3.1 | Sampling and Statistics | 4 | Chalk & Talk | Black Board |
| 3.2 | More on confidence Intervals | 4 | Chalk & Talk | Black Board |
| 3.3 | Introduction to hypothesis testing | 4 | Chalk & Talk | Black Board |
| 3.4 | Additional Comments about Statistical Tests | 3 | Chalk & Talk | Black Board |
| **UNIT - 4** | **MAXIMUM LIKLELIHOOD METHODS AND SUFFICIENCY** | | | |
| 4.1 | Maximum Likelihood Estimation | 4 | Discussion | Black Board |
| 4.2 | Rao-Cramer Lower Bound and efficiency | 4 | Discussion | Black Board |
| 4.3 | Maximum Likelihood Tests | 4 | Discussion | Black Board |
| 4.4 | Measures of quality of Estimators | 4 | Discussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 4.5 | A sufficient statistic for a parameter | 2 | Discussion | Black Board |
| 4.6 | Properties of a sufficient statistic | 2 | Discussion | Black Board |
| **UNIT -5 OPTIMAL TESTS OF HYPOTHESES** | | | | |
| 5.1 | Most Powerful Tests | 5 | Discussion | Black Board |
| 5.2 | Uniformly Most Powerful Test | 5 | Discussion | Black Board |
| 5.3 | Likelihood Ratio Tests. | 5 | Discussion | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| **K2** | **4** | **4** | **-** | **-** | **-** | **8** | - | **8** | 20 % |
| **K3** | **2** | **2** | **-** | **5** | **-** | **9** | - | **9** | 22.5 % |
| **K4** | **2** | **2** | **-** | **-** | **5** | **9** | - | **9** | 22.5 % |
| **K5** | **2** | **2** | **5** | **-** | **-** | **9** | - | **9** | 22.5 % |
| **Non Scholastic** | - | - | **-** | **-** | - | | **5** | **5** | 12.5 % |
| **Total** | **10** | **10** | **5** | **5** | **5** | **35** | **5** | **40** | **100 %** |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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** | Classify discrete and continuous distributions | K2 | PSO1& PSO4 |
| **CO 2** | Describe t, F and limiting distributions | K1, K2, & K5 | PSO2& PSO3 |
| **CO 3** | Explain statistical tests | K1 & K3 | PSO3& PSO5 |
| **CO 4** | Summarize maximum likelihood methods | K1, K2, K3 & K5 | PSO5 |
| **CO 5** | Distinguish tests of hypothesis | K2 & K4 | PSO3& PSO5 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **2** | **3** | **2** |
| **CO2** | **2** | **3** | **3** | **2** | **2** |
| **CO3** | **2** | **2** | **3** | **2** | **3** |
| **CO4** | **2** | **3** | **2** | **2** | **3** |
| **CO5** | **2** | **2** | **3** | **2** | **3** |

## Mapping of COs with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**1.Dr. Mrs. E. Helena**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

# II M.Sc. Mathematics

## SEMESTER –IV

***For those who joined in 2019 onwards***

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PG4M15 | METHODS OF APPLIED MATHEMATICS | Core | 6 | 5 |

**COURSE DESCRIPTION**

This course provides various methods of Applied Mathematics which will be helpful for the students to attempt NET/SET exams.

**COURSE OBJECTIVES**

To enable the students to study the concepts of Calculus of variations, Boundary value problems, Differential and Integral equations, Fourier transforms.

**UNITS**

**UNIT –I CALCULUS OF VARIATIONS (18 HRS.)**

Calculus of variations-maxima and minima -The simplest case-Natural and Transition boundary conditions-variational notation-more general case.

**UNIT –II BOUNDARY VALUE PROBLEMS (18 HRS.)**

Constraints and Lagrange multipliers-variable end points-sturm liouville problems-small vibrations about equilibrium-variation problems for deformable bodies-Rayleigh-Ritz method.

**UNIT –III DIFFERENTIAL AND INTEGRAL EQUATIONS (18 HRS.)**

Integral equations-Relations between differential and integral equations-Green's function-Fredholm equations with separable kernels.

**UNIT –IV METHODS FOR SOLVING INTEGRAL EQUATIONS (18 HRS.)**

Hilbert Schmidt theory-Iterative methods for solving equations of the second kind.Neumann series-**Fredholm theory-singular integral equations-special devices.(self study)**

**UNIT –V FOURIER TRANSFORMS (18 HRS.)**

Fourier Transform-Fourier sine and cosine transforms-properties - convolution-**solving integral equations- Finite Fourier sine and cosine transforms-Fourier integral theorem-parseval's identity.(self study)**

**TEXT BOOKS:**

1. Hildebrand F.B., *Methods of Applied Mathematics*, Second Edition, PHI, New Delhi,1972.
2. Goyal & Gupta, *Laplace and Fourier Transforms*, Pragati Prakashan, Meerut,1987.

**REFERENCES**

1.Sharma, D. C and Goyal, M. C, *Integral equations,* PHI, New Delhi, 2017

2.Sharma, R. K, *Calculus of variations, Meditech, 2017.*

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **CALCULUS OF VARIATIONS** | | | |
| 1.1 | Calculus of variations | 3 | Chalk & Talk | Black Board |
| 1.2 | Maxima and minima | 3 | Chalk & Talk | Black Board |
| 1.3 | The simplest case | 3 | Chalk & Talk | Black Board |
| 1.4 | Natural and Transition boundary conditions | 3 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 1.5 | Variational notation | 3 | Chalk & Talk | Black Board |
| 1.6 | more general case | 3 | Chalk & Talk | Black Board |
| **UNIT -2** | **BOUNDARY VALUE PROBLEMS** | | | |
| 2.1 | Constraints and Lagrange multipliers | 3 | Chalk & Talk | Black Board |
| 2.2 | variable end points | 3 | Chalk & Talk | Black Board |
| 2.3 | sturm liouville problems | 3 | Chalk & Talk | Black Board |
| 2.4 | small vibrations about equilibrium | 3 | Chalk & Talk | Black Board |
| 2.5 | variational problems for deformable bodies | 3 | Chalk & Talk | Black Board |
| 2.6 | Rayleigh-Ritz method | 3 | Chalk & Talk | Black Board |
| **UNIT -3** | **DIFFERENTIAL AND INTEGRAL EQUATIONS** | | | |
| 3.1 | Integral equations | 5 | Chalk & Talk | Black Board |
| 3.2 | Relations between differential and integral equations | 4 | Chalk & Talk | Black Board |
| 3.3 | Green's function | 5 | Chalk & Talk | Black Board |
| 3.4 | Fredholm equations with separable kernels | 4 | Chalk & Talk | Black Board |
| **UNIT -4 METHODS FOR SOLVING INTEGRAL EQUATIONS** | | | | |
| 4.1 | Hilbert Schmidt theory | 3 | Discussion | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 4.2 | Iterative methods for solving equations of the second kind | 3 | Discussion | Black Board |
| 4.3 | Neumann series | 3 | Discussion | Black Board |
| 4.4 | Fredholm theory | 3 | Discussion | Black Board |
| 4.5 | singular integral equations | 3 | Discussion | Black Board |
| 4.6 | special devices | 3 | Discussion | Black Board |
| **UNIT -5** | **FOURIER TRANSFORMS** | | | |
| 5.1 | Fourier Transform | 3 | Discussion | Black Board |
| 5.2 | Fourier sine and cosine transforms | 3 | Discussion | Black Board |
| 5.3 | convolution | 3 | Discussion | Black Board |
| 5.4 | solving integral equations | 3 | Discussion | Black Board |
| 5.5 | Finite Fourier sine and cosine transforms | 3 | Discussion | Black Board |
| 5.6 | Fourier integral theorem | 1 | Discussion | Black Board |
| 5.7 | parseval's identity | 2 | Discussion | Black Board |

# INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON – SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |

| SCHOLASTIC | | | | | NON – SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 Eulers equation and its applications | K2 | PSO1& PSO2 |
| **CO 2** | Solve variational problems | K2, K3, | PSO4 |
| **CO 3** | Distinguish Integral equations. | K4& K3 | PSO3 |
| **CO 4** | Describe various methods for solving integral equations | K2, K3, K4& | PSO2 &PSO4 |
| **CO 5** | Solving problems using fourier transforms | K2 & K4 | PSO1 &PSO4 |

**Mapping COs Consistency with PSOs**

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 2 | 3 | 2 |
| CO3 | 2 | 2 | 3 | 2 | 3 |
| CO4 | 2 | 3 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 3 | 2 |

**Mapping of COs with POs**

| CO/ PSO | PO1 | PO2 | PO3 | PO4 |
|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 3 |

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

1. **Dr. Mrs. V. Vanitha**
2. **Mrs. A. Paulin Mary**

**Forwarded By**

**(A. Paulin Mary)**

**HOD's**

**Signature & Name**

## II M.Sc Mathematics

## SEMESTER –IV

***For those who joined in 2019 onwards***

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PG4M16 | FUNCTIONAL ANALYSIS | Core | 6 | 5 |

**COURSE DESCRIPTION**

This course enables the students to study the advanced concepts of Functional Analysis.

**COURSE OBJECTIVES**

To enable the students to understand the concepts of Banach spaces, Hilbert spaces and Finite dimensional spectral theory

**UNITS**

**UNIT I: BANACH SPACES (20 HRS.)**

The definition and some examples, continuous linear transformations, the Hahn-Banach theorem.

**UNIT II: BANACH SPACES (CONTINUED) (15 HRS.)**

The natural imbedding of N in N**, the open mapping theorem, the conjugate of an operator.

**UNIT III: HILBERT SPACES (20 HRS.)**

The definition and some simple properties, orthogonal complements, Orthonormal sets, the conjugate space H*.

**UNIT IV: HILBERT SPACES (CONTINUED) (15 HRS.)**

The adjoint of an operator**, self-adjoint operators, normal and unitary operators (Self Study).**

**UNIT V: FINITE DIMENSIONAL SPECTRAL THEORY (20 HRS.)**

**Matrices, determinants (Self Study)** and the spectrum of an operator, the spectral theorem.

**TEXT BOOK:**

1. Simmons. G. F, *Introduction to Topology and Modern Analysis*, Tata McGraw Hill Publishing Company Ltd, edition 2004. (Chapters: **9**, **10**(except 59), **11**(60, 61, 62))

**REFERENCE BOOKS:**


1. Dr.D.Somasundaram, *Functional Analysis*, Viswanathan Printers and Publishers Ltd, 1999.
2. Balmohan V. Limaye, *Functional Analysis*, New Age International Publishers, Revised 2nd Edition, 2006.
3. S. Ponnusamy, *Foundation of Functional Analysis,* Narosa, 2002.


## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **BANACH SPACES** | | | |
| 1.1 | Definition and examples | 8 | Chalk & Talk | Black Board |
| 1.2 | Continuous linear transformations | 8 | Chalk & Talk | Black Board |
| 1.3 | Hahn-Banach theorem | 4 | Chalk & Talk | Black Board |
| **UNIT -2** | **BANACH SPACES (CONTINUED)** | | | |
| 2.1 | The natural imbedding of N in N** | 5 | Chalk & Talk | Black Board |
| 2.2 | Open mapping theorem | 5 | Chalk & Talk | Black Board |
| 2.3 | Conjugate of an operator | 5 | Chalk & Talk | Black Board |
| **UNIT - 3** | **HILBERT SPACES** | | | |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 3.1 | Definition and simple properties | 5 | Chalk & Talk | Black Board |
| 3.2 | Orthogonal complements | 5 | Chalk & Talk | Black Board |
| 3.3 | Orthonormal sets | 5 | Chalk & Talk | Black Board |
| 3.4 | Conjugate space H*. | 5 | Discussions | PPT |
| **UNIT - 4** | **HILBERT SPACES(CONTINUED)** | | | |
| 4.1 | The adjoint of an operator | 5 | Chalk & Talk | Black Board |
| 4.2 | Self-adjoint operators | 4 | Chalk & Talk | Black Board |
| 4.3 | Normal operators | 3 | Chalk & Talk | Black Board |
| 4.4 | Unitary operators | 3 | Discussions | PPT |
| **UNIT -5** | **FINITE DIMENSIONAL SPECTRAL THEORY** | | | |
| 5.1 | Matrices | 4 | Chalk & Talk | Black Board |
| 5.2 | Determinants | 4 | Chalk & Talk | Black Board |
| 5.3 | Spectrum of an operator | 6 | Discussions | PPT |
| 5.4 | The spectral theorem. | 6 | Chalk & Talk | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | 35 |
| Non Scholastic | 5 |
| | 40 |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON – SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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 | Create knowledge with the basic concepts, principles and methods of functional analysis and its applications. | K2 & K3 | PSO2 |
| CO 2 | Analyze the concept of normed spaces, Banach spaces, and the theory of linear operators | K3, K4 & K5 | PSO3 |
| CO 3 | Explain in detail the Hahn-Banach theorem, the open mapping and closed graph theorems | K4 & K5 | PS04 |
| CO 4 | Define and thoroughly explain Hilbert spaces and self-adjoint operators | K2, K3 & K4 | PS02&PSO4 |
| CO 5 | Discuss in detail the study of the spectrum of an operator and its properties | K2 & K4 | PSO5 |

### Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 2 |
| CO4 | 2 | 3 | 2 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 3 |

### Mapping of COs with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

**1.Dr. Sr. A. Fatima Mary**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

# II M.Sc. Mathematics

## SEMESTER –IV

***For those who joined in 2019 onwards***

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PG4ME3 | FORMAL LANGUAGES | Core | 4 | 4 |

**COURSE DESCRIPTION**

This course explains and manipulates the different concepts in Automata Theory and Formal Languages

**COURSE OBJECTIVES**

To introduce some fundamental concepts in automata theory and formal languages including grammar, finite automaton and Regular Grammars

**UNITS**

**UNIT –I GRAMMARS (10 HRS.)**

Alphabets and Languages, Motivation, The Formal Notion of a Grammar, The Types of Grammars.

**UNIT –II GRAMMARS (CONTINUED) (10 HRS.)**

The empty sentence, Recursiveness of Context-sensitive Grammars, **Derivation Trees of Context-Free Grammars.(self study)**

**UNIT –III FINITE AUTOMATA (10 HRS.)**

The Finite Automaton, Equivalence Relations and Finite Automata, Nondeterministic Finite Automata

**UNIT –IV FINITE AUTOMATA AND REGULAR GRAMMARS (15 HRS.)**

**Finite Automata and Type3 languages.(self study)**, Properties of Type3 Languages, Solvable Problems concerning Finite Automata

**UNIT –V CONTEXT-FREE GRAMMARS (15 HRS.)**

**Simplification of Context-Free Grammars.(self study)**, Chomsky Normal Form, Greibach Normal Form, Solvability of Finiteness and the *uvwxy* theorem, The self-embedding property.

**TEXT BOOK:**

1. E. Hopcroft and Jeffrey D. Ullman, *Formal Languages and their Relation to Automata,* John, Addison Wesley Publishing Company, 1969.

Chapters: 2 – 4 (Except section 3.7 from page 41 - 44 )

**REFERENCES:**

**1.** John E.Hopcroft and Jeffrey D. Ullman, *Introduction to Automata Theory, Languages and Computation*, Narosa Publishing House, 1999.

2.Alexander Meduna, *Automata and Language,s* Springer, 2000.
3.Rani Siromoney, *Formal Languages*.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1 GRAMMARS** | | | | |
| 1.1 | Alphabets and Languages | 2 | Chalk & Talk | Black Board |
| 1.2 | Motivation | 2 | Chalk & Talk | Black Board |
| 1.3 | The Formal Notion of a Grammar | 3 | Chalk & Talk | Black Board |
| 1.4 | The Types of Grammars | 3 | Chalk & Talk | Black Board |
| **UNIT – 2 GRAMMARS (CONTINUED)** | | | | |
| 2.1 | The empty sentence | 3 | Chalk & Talk | Black Board |
| 2.2 | Recursiveness of Context-sensitive Grammars | 3 | Chalk & Talk | Black Board |
| 2.3 | Derivation Trees of Context-Free Grammars. | 4 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT – 3 FINITE AUTOMATA** | | | | |
| 3.1 | The Finite Automaton | 3 | Chalk & Talk | Black Board |
| 3.2 | Equivalence Relations and Finite Automata | 3 | Chalk & Talk | Black Board |
| 3.3 | Nondeterministic Finite Automata | 4 | Chalk & Talk | Black Board |
| **UNIT – 4 FINITE AUTOMATA AND REGULAR GRAMMARS** | | | | |
| 4.1 | Finite Automata and Type3 languages. | 5 | Discussion | Black Board |
| 4.2 | Properties of Type3 Languages | 5 | Discussion | Black Board |
| 4.3 | Solvable Problems concerning Finite Automata | 5 | Discussion | Black Board |
| **UNIT -5 CONTEXT-FREE GRAMMARS** | | | | |
| 5.1 | Simplification of Context-Free Grammars . | 3 | Discussion | Black Board |
| 5.2 | Chomsky Normal Form | 3 | Discussion | Black Board |
| 5.3 | Greibach Normal Form | 3 | Discussion | Black Board |
| 5.4 | Solvability of Finiteness and the *uvwxy* theorem | 3 | Discussion | Black Board |
| 5.3 | The self-embedding property | 3 | Discussion | Black Board |

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|

| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
|---|---|---|---|---|---|---|---|---|---|
| **K2** | **4** | **4** | **-** | **-** | **-** | **8** | - | **8** | 20 % |
| **K3** | **2** | **2** | **-** | **5** | **-** | **9** | - | **9** | 22.5 % |
| **K4** | **2** | **2** | **-** | **-** | **5** | **9** | - | **9** | 22.5 % |
| **K5** | **2** | **2** | **5** | **-** | **-** | **9** | - | **9** | 22.5 % |
| **Non Scholastic** | **-** | **-** | **-** | **-** | **-** | | **5** | **5** | 12.5 % |
| **Total** | **10** | **10** | **5** | **5** | **5** | **35** | **5** | **40** | **100 %** |

**INTERNAL - PG**

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **CIA** | **ESE** | **Total** |
| **10** | **10** | **5** | **5** | **5** | **5** | **40** | **60** | **100** |

- **PG CIA Components**

| | | | **Nos** | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |

| | | | | | |
|---|---|---|---|---|---|
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## 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** | Design the basic concepts in automata theory and formal languages | K2 | PSO1& PSO2 |
| **CO 2** | Identify different formal language classes and their relationships | K2, K3, | PSO3 |
| **CO 3** | Transform between equivalent deterministic and non-deterministic finite automata, and regular expressions | K2 & K4 | PSO5 |
| **CO 4** | Discuss about the automata, regular expressions and context-free grammars accepting or generating a certain language | K2, K3 & K4 | PSO2 |
| **CO 5** | Simplify the theorems in automata theory using its properties | K3 & K5 | PSO5 |

## Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | 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** | **3** | **2** | **2** | **2** |
| **CO5** | **2** | **2** | **2** | **3** | **2** |

## Mapping of COs with POs

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**1. Dr. Sr. M. Fatima Mary**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

## II M.Sc. Mathematics

## SEMESTER –IV

***For those who joined in 2019 onwards***

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PG4ME4 | ALGEBRAIC GRAPH THEORY | Core | 4 | 4 |

**COURSE DESCRIPTION**

This course enables the students to study some concepts in Algebraic Graph Theory

**COURSE OBJECTIVES**

To study the Automorphism Group of a Graph, Cayley Graphs, Transitive Graphs, Homomorphism and Matrix Theory of Graphs

**UNITS**

**UNIT –I THE AUTOMORPHISM GROUP OF A GRAPH (12 HRS.)**

Definitions - Operations on Permutations Groups - Computing Automorphism Groups of Graphs - Graphs with a Given Automorphism Group.

**UNIT –II CAYLEY GRAPHS (12 HRS.)**

The Cayley Color Graph of a Group Presentation: Definitions - Automorphisms - Properties - Products - Cayley Graphs.

**UNIT –III TRANSITIVE GRAPHS (12 HRS.)**

Vertex Transitive Graphs - Edge Transitive Graphs - Edge Connectivity - Vertex Connectivity

**UNIT –IV HOMOMORPHISM (12 HRS.)**

The Basics of Homomorphism - Cores - Products - The Map Graph - Counting Homomorphisms

**UNIT –V MATRIX THEORY OF GRAPHS (12 HRS.)**

**The Adjacency Matrix, The Incidence Matrix, The Incidence Matrix of an Oriented Graph**

**TEXT BOOKS :**

1. Arthur T.White, Graphs of Groups on Surfaces: Interactions and Models, Elsevier Science B.V., North-Holland, 2001.

**REFERENCES:**

1) Norman Biggs, Algebraic Graph Theory, Cambridge University Press, 1974.
2) L. W. Beineke and Robin Wilson, Topics in Algebraic Graph Theory, Cambridge University Press, 2005.

## COURSE CONTENTS & LECTURE SCHEDULE:

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| **UNIT -1** | **THE AUTOMORPHISM GROUP OF A GRAPH** | | | |
| 1.1 | Definitions | 1 | Chalk & Talk | Black Board |
| 1.2 | Operations on Permutations Groups | 1 | Chalk & Talk | Black Board |
| 1.3 | Computing Automorphism Groups of Graphs | 4 | Chalk & Talk | Black Board |
| 1.4 | Graphs with a Given Automorphism Group | 1 | Chalk & Talk | Black Board |
| **UNIT -2** | **CAYLEY GRAPHS** | | | |
| 2.1 | The Cayley Color Graph of a Group Presentation: Definitions | 3 | Chalk & Talk | Black Board |
| 2.2 | Automorphisms | 3 | Chalk & Talk | Black Board |
| 2.3 | Properties | 2 | Chalk & Talk | Black Board |
| 2.4 | Products | 2 | Chalk & Talk | Black Board |

| Module No. | Topic | No. of Lectures | Teaching Pedagogy | Teaching Aids |
|---|---|---|---|---|
| 2.5 | Cayley Graphs | 2 | Chalk & Talk | Black Board |
| **UNIT -3 TRANSITIVE GRAPHS** | | | | |
| 3.1 | Vertex Transitive Graphs | 3 | Chalk & Talk | Black Board |
| 3.2 | Edge Transitive Graphs | 3 | Chalk & Talk | Black Board |
| 3.3 | Edge Connectivity | 3 | Chalk & Talk | Black Board |
| 3.4 | Vertex Connectivity | 3 | Chalk & Talk | Black Board |
| **UNIT -4 HOMOMORPHISM** | | | | |
| 4.1 | The Basics of Homomorphism | 3 | Discussion | Black Board |
| 4.2 | Cores | 3 | Discussion | Black Board |
| 4.3 | Products | 2 | Discussion | Black Board |
| 4.4 | The Map Graph | 2 | Discussion | Black Board |
| 4.5 | Counting Homomorphisms | 2 | Discussion | Black Board |
| **UNIT -5 MATRIX THEORY OF GRAPHS** | | | | |
| 5.1 | The Adjacency Matrix | 4 | Discussion | Black Board |
| 5.2 | The Incidence Matrix | 4 | Discussion | Black Board |
| 5.3 | The Incidence Matrix of an Oriented Graph | 4 | Discussion | Black Board |

## INTERNAL - PG

| Levels | C1 | C2 | C3 | C4 | C5 | Total Scholastic Marks | Non Scholastic Marks C6 | CIA Total | % of Assessment |
|---|---|---|---|---|---|---|---|---|---|
| | T1<br>10 Mks. | T2<br>10 Mks. | Seminar<br>5 Mks. | Assignment<br>5 Mks | OBT/PPT<br>5 Mks | 35 Mks. | 5 Mks. | 40Mks. | |
| K2 | 4 | 4 | - | - | - | 8 | - | 8 | 20 % |
| K3 | 2 | 2 | - | 5 | - | 9 | - | 9 | 22.5 % |
| K4 | 2 | 2 | - | - | 5 | 9 | - | 9 | 22.5 % |
| K5 | 2 | 2 | 5 | - | - | 9 | - | 9 | 22.5 % |
| Non Scholastic | - | - | - | - | - | | 5 | 5 | 12.5 % |
| Total | 10 | 10 | 5 | 5 | 5 | 35 | 5 | 40 | 100 % |

CIA

| | |
|---|---|
| Scholastic | **35** |
| Non Scholastic | **5** |
| | **40** |

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | **Nos** | | |
|---|---|---|---|---|---|
| **C1** | - | Test (CIA 1) | 1 | - | 10 Mks |
| **C2** | - | Test (CIA 2) | 1 | - | 10 Mks |
| **C3** | - | Assignment | 2 * | - | 5 Mks |
| **C4** | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| **C5** | - | Seminar | 1 | - | 5 Mks |
| **C6** | - | Attendance | | - | 5 Mks |

****The best out of two will be taken into account***

## COURSE OUTCOMES

| NO. | COURSE OUTCOMES | KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY) | PSOs ADDRESSED |
|---|---|---|---|
| **CO 1** | Explain Automorphism Group of a Graph | K2 | PSO1& PSO2 |
| **CO 2** | Describe Cayley Graphs | K3 | PSO3 |
| **CO 3** | Explain Transitive graphs | K2 & K3 | PSO5 |
| **CO 4** | Describe Homomorphism | K3 & K5 | PSO2 |
| **CO 5** | Explain the concept of Matrix Theory | K2 & K4 | PSO4 |

## Mapping COs Consistency with PSOs

| CO/ PSO | PSO1 | 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** | **3** | **2** | **2** | **2** |
| **CO5** | **2** | **2** | **2** | **3** | **2** |

## Mapping of COs with POs

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

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

 Weakly Correlated -**1**

**COURSE DESIGNER:**

**1. A. Sheela Roselin**
**2.Sr. M. Fatima Mary**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

# II M.Sc. Mathematics

## SEMESTER –III & IV

## *For those who joined in 2019 onwards*

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 19PGSLM1 | PROBLEMS IN ADVANCED MATHEMATICS | Core | - | 2 |

**COURSE DESCRIPTION**

This course enables the students to solve problems in various branches of Mathematics.

**COURSE OBJECTIVES**

To study the problem solving techniques in Analysis, Algebra and Differential equations.

**UNITS**

**UNIT –I PROBLEMS IN REAL ANALYSIS**

Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation

**UNIT-II: PROBLEMS IN COMPLEX ANALYSIS**

Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues.

**UNIT-III: PROBLEMS IN ALGEBRA**

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Fields, Field extensions.

**UNIT-IV: PROBLEMS IN LINEAR ALGEBRA**

Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Inner Product spaces

**UNIT-V: PROBLEMS IN DIFFERENTIAL EQUATIONS**

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs

**REFERENCE BOOKS:**

1. Walter Rudin, Principles of Mathematical Analysis, Third Edition, McGraw-Hill International Book Company, New York, 1976

2. John B. Conway, Functions of one Complex Variable, Second Edition, Springer Graduate Texts in Mathematics, New York, 1978

3. Joseph .A. Gallian , Contemporary Abstract Algebra , 7Th Edition Katherine Tegen Books

4. Seymour Lipschutz and Marc Lipson, Schaum's Outlines Linear Algebra Third Edition

5. Gilbert Strang , Introduction to Linear Algebra Fourth Edition, Wellesley Cambridge Press

6. Earl A. Coddington, An Introduction to Ordinary Differential Equations, Prentice-Hall of India, New Delhi, 1992

7. M.D. Raisinghania, Advanced Differential Equations, S. Chand and Company Ltd, New Delhi, 2001

## EVALUATION PATTERN

| SCHOLASTIC | | | | | NON - SCHOLASTIC | MARKS | | |
|---|---|---|---|---|---|---|---|---|
| C1 | C2 | C3 | C4 | C5 | C6 | CIA | ESE | Total |
| 10 | 10 | 5 | 5 | 5 | 5 | 40 | 60 | 100 |

- **PG CIA Components**

| | | | Nos | | |
|---|---|---|---|---|---|
| C1 | - | Test (CIA 1) | 1 | - | 10 Mks |
| C2 | - | Test (CIA 2) | 1 | - | 10 Mks |
| C3 | - | Assignment | 2 * | - | 5 Mks |
| C4 | - | Open Book Test/PPT | 2 * | - | 5 Mks |
| C5 | - | Seminar | 1 | - | 5 Mks |
| C6 | - | Attendance | | - | 5 Mks |

***The best out of two will be taken into account***

## COURSE OUTCOMES

| NO. | COURSE OUTCOMES | KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY) | PSOs ADDRESSED |
|---|---|---|---|
| CO 1 | Solve problems in Real Analysis | K2 | PSO1& PSO2 |
| CO 2 | Solve problems in Complex Analysis | K2 | PSO3 |
| CO 3 | Solve problems in Algebra | K2 & K3 | PSO5 |
| CO 4 | Solve problems in Linear Algebra | K3 & K5 | PSO2 |

| | | | |
|---|---|---|---|
| **CO 5** | Solve problems in Differential Equations | K3 & K4 | PSO4 |

**Mapping COs Consistency with PSOs**

| CO/ PSO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 3 |
| CO4 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 |

**Mapping of COs with POs**

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

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

□ Weakly Correlated -**1**

**COURSE DESIGNER:**

**Department staff members**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**

# I M.Sc. Mathematics
## SEMESTER –II
## *For those who joined in 2021 onwards*

| PROGRAMME CODE | COURSE CODE | COURSE TITLE | CATEGORY | HRS/WEEK | CREDITS |
|---|---|---|---|---|---|
| PSMA | 21PGSLLM1 | VERBAL AND NUMERICAL APTITUDE FOR NATIONAL EXAMINATIONS | Core | - | 2 |

**COURSE DESCRIPTION**

This course aims to creating positive attitude among students and motivate them to clear competitive exams to reach their life goals.

**COURSE OBJECTIVES**

To motivate the students to participate in NET & SET exams, help them for post-examination preparation and to enthuse them to crack NET & SET exams

**UNITS**

**UNIT – I TEACHING AND RESEARCH APTITUDE**

Reading Comprehension - Teaching Aptitude - Teaching aids and evaluation system - Research Aptitude, Research Ethics and Thesis writing

**UNIT – II VERBAL REASONING**

General Abbreviations and terminology - Letter series and codes - Relationships and classification - Verbal Analogy and classification

**UNIT – III MATHEMATICAL REASONING AND APTITUDE**

Types of reasoning - Number series - Mathematical Aptitude -Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages.

**UNIT – IV LOGICAL REASONING**

Understanding the Structure of Arguments: argument forms, Structure of categorical propositions, Mood and Figure, Formal and Informal fallacies, Classical square of opposition - Evaluating and distinguishing deductive and inductive reasoning – Analogies - Venn Diagram: Simple and multiple uses for establishing validity of arguments.

**UNIT – V DATA INTERPRETATION**

Sources, acquisition and classification of data - Quantitative and Qualitative data - Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of data - Data and Governance.

**REFERENCES**

1. Raghu R. Alla& K. Anusha,QuickNET Sure Success SeriesCBSE UGC NET/JRF/SET Teaching & Research Aptitude (General Paper – I), 2019 Edition.
2. K.V.S.MadaanNTA UGC Paper I Teaching and Research Aptitude , Third Edition.

**COURSE DESIGNER:**

**1. Dr.A.Paulin Mary**

**Forwarded By**

**(A.Paulin Mary)**

**HOD's**

**Signature & Name**