

# **VIVEKANANDHA**

## **COLLEGE OF ARTS AND SCIENCES FOR WOMEN**

**[AUTONOMOUS]**

**SPONSORED BY: ANGAMMAL EDUCATIONAL TRUST.**  
*An ISO 9001: 2008 Certified Institution*  
*Affiliated to Periyar University, Approved by AICTE and*  
*Re-Accredited with 'A' Grade by NAAC*  
*Recognized under section 2(f) and 12(B) of UGC Act, 1956*  
Elayampalayam – 637 205. Tiruchengode, Namakkal Dt., TamilNadu

### **DEPARTMENT OF MATHEMATICS**



**Master of Science (Mathematics)**

**SYLLABUS AND REGULATIONS**

**For the Candidates admitted from the year 2022 Onwards**

**UNDER OBE PATTERN**

# VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN

[Autonomous]

ELAYAMPALAYAM, TIRUCHENGODE

## M.Sc. MATHEMATICS - REGULATIONS

(Candidates admitted from 2022 Onwards)

### I. SCOPE OF THE COURSE

**M.Sc. (Mathematics)** is a high profile postgraduate program aimed to create enhanced competence of career positioning tied up with opportunity to become a skilled Mathematician. The program expects a serious commitment of the student to take up challenging study schedules and assignments. The course involves a blend of theoretical education and practical training which run concurrently for a period of two years and equips a student with knowledge, ability, skills and other qualities required for a professional Mathematician.

The uniqueness of the program is its content and topic coverage, the teaching methodology and the faculty. The syllabus has been designed at a level equal to that of professional courses. The teaching methodologies include classroom lectures, industrial visits, orientation, internship, case study and research work. Focus is also on developing soft skills of the students. For Core subjects, Outsource Guest Lectures by Industrialists and Subject Experts will be arranged to enable the students to get wider exposure.

### II. SALIENT FEATURES

- Course is specially designed for a higher level Career Placement.
- Special Guest lectures from Subject Experts will be arranged.
- Special Teaching Oriented Training is part of the Degree Course.
- Course pave the way for enhanced conceptual, analytical & deductive skills to meet the Competitive exams like Banking / TNPSC / IAS / IFS / NET / SET etc.,

### III. OBJECTIVES OF THE COURSE

Mathematics to-day is penetrating all fields of human endeavour and therefore it is necessary to prepare the students to scope with the advanced developments in various fields of Mathematics. The objectives of this course are the following:

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

- b) To Provide wide choice of elective subjects with updated and new areas in various branches of Mathematics to meet the needs of all students.

#### **IV. ELIGIBILITY FOR ADMISSION**

A candidate who has passed B.Sc., Mathematics / B.Sc., Mathematics (Computer Applications) degree of this University or any other University accepted by the Syndicate equivalent there to, subject to such condition as may be prescribed therefore shall be permitted to appear and qualify for the Master of Science (M.Sc.,) Degree Examination in Mathematics of this University after a two academic years and the successful completion of all the courses prescribed.

#### **V. DURATION OF THE COURSE**

- The Programme shall extend over a period of two academic years consisting of four semesters. Each academic year will be divided into two semesters. Each semester consist of 90 working days.
- The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekananda College of Arts And Sciences for Women with the approval of Periyar University.

#### **VI. CONTINUOUS INTERNAL ASSESMENT**

The performance of the students will be assessed continuously and the

Internal Assessment Marks will be as under:

|    |                      |                   |
|----|----------------------|-------------------|
| 1. | Average of two Tests | - 5 Marks         |
| 2. | Model                | - 5 Marks         |
| 3. | Seminar              | - 5 Marks         |
| 4. | Assignment           | - 5 Marks         |
| 5. | Attendance           | - 5 Marks         |
|    | <b>Total</b>         | <b>= 25 Marks</b> |

## **ATTENDANCE PARTICULARS**

| <b>Attendance %</b> | <b>Marks</b> |
|---------------------|--------------|
| 76-80               | 1            |
| 81-85               | 2            |
| 86-90               | 3            |
| 91-95               | 4            |
| 96-100              | 5            |

## **PASSING MINIMUM IN THE EXTERNAL EXAMINATION**

In the University Examinations, the passing minimum shall be 50 % out of 75 Marks (i.e 38 Marks in the External Examinations).

## **VII. ELIGIBILITY FOR EXAMINATION**

A candidate will be permitted to appear for the University Examination only on earning 75 % of attendance and a satisfactory conduct. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed with supporting evidence.

## **VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATE**

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

- a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.
- b) 60% and above but below 75 % shall be declared to have passed the examinations in first class.
- c) 50% and above but below 60% shall be declared to have passed the examinations in second class.
- d) Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of two consecutive academic years from the year of admission only will be eligible for rank.

## **IX. ELIGIBILITY FOR AWARD OF THE DEGREE**

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than two academic years comprising of four semesters and passed the examinations prescribed and fulfilled such conditions have been prescribed therefore.

## **X. PROCEDURE IN THE EVENT OF FAILURE**

If a candidate fails in a particular subject, she may reappear for the End of Semester in the concerned subject in subsequent semesters and shall pass the examination.

## **XI. COMMENCEMENT OF THESE REGULATIONS**

These regulations shall take effect from the academic year 2020-2021 (i.e.,) for the students who are to be admitted to the first year of the programme during the academic year 2020-2021 and thereafter.

## **XII. TRANSITORY PROVISIONS**

Candidates who have undergone the PG programme of study before 2020-2021 shall be permitted to appear for the examinations under those regulations of the year in which the candidates admitted to the programme. Supplementary examination will be conducted within a month. In case of failure she has to complete within 5 years (2+3).

Thereafter, they will be permitted to appear for the examination only under the regulation then in force.

For the deserving candidates, if a student fails in a single subject she can be provided with maximum 5 marks as grace mark subject to the recommendation of the passing board.

## **ABOUT THE COLLEGE**

Vivekanandha College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'VidhyaRathna' Prof.Dr. M. KARUNANITHI, B.Pharm., M.S., Ph.D., D.Litt., sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of TiruchengodeNamakkal Main Road at Elayampalayam, 6 kms away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A' for its successful performance.

As an Autonomous Institution, academic professionals of the college framed Curriculum and Syllabi in consultation with all its stakeholders to cater the needs of the young women to fulfil the women empowerment and present Industrial needs to the local benefits. The students are empowering with confidence and required skills to face the society.

### **OUR VISION**

- To evolve into a center of excellence in higher education through creative and innovative practices to social equity for women.

### **OUR MISSION**

- To provide sufficient learning infrastructure to the students to pursue their studies.
- To provide good opportunity for higher education and conducive environment to the students to acquire education.
- To provide quality academic programs training activities and research facilities.
- To facilitate industry-institute interaction.

# DEPARTMENT OF MATHEMATICS

## VISION

- Empowerment of women through Education.
- To upgrade performance standards in the field of Mathematics in order to be a leading department in academic arena.
- To provide excellence in education for all students. We will assess and design courses and learning experiences that promote the academic achievement and the personal and social growth of students.

## MISSION

- To Promote Quality Education to Women at all levels.
- To provide students experiences in Mathematics that will empower them to succeed in an ever changing society.
- To empower young women to face the challenges of life with courage and commitment.
- To equip them with enhanced employable skills.

## Bloom's Taxonomy Based Assessment Pattern

**K1**-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze;

**K5**- Evaluate;**K6**- Creating.

**Theory: 75 Marks**

**Test- I & II and ESE:**

| Knowledge Level  | Section               | Marks    | Description           | Total |
|------------------|-----------------------|----------|-----------------------|-------|
| <b>K1,K2</b>     | A (Answer all)        | 20x01=20 | MCQ/Define            | 75    |
| <b>K3, K4</b>    | B (Either or pattern) | 05x05=25 | Short Answers         |       |
| <b>K5&amp;K6</b> | C (Answer 3 out of 5) | 03x10=30 | Descriptive/ Detailed |       |

## **Programme Outcomes**

**PO1: Disciplinary knowledge:** The main objective of the syllabus is to give the students a holistic understanding of the subject giving substantial weightage to both the core content and techniques used in Mathematics. The ultimate goal of the syllabus is that the students at the end are able to secure a job. Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques and understanding of the subject.

**PO2: Communication Skills:** To help students think, react, and work in innovative ways stimulated by a higher degree of disciplinary synergies that will promote interdisciplinary innovation and divergent thinking.

**PO3: Critical thinking:** Capacity to apply analytic thought to a body of knowledge; Analyze and evaluate evidence, arguments, claims, and beliefs on the basis of empirical evidence; Identify relevant assumptions or implications; formulate coherent arguments; critically evaluate Practices, policies and theories by following mathematical approach to knowledge development.

**PO4: Problem Solving:** Identify, formulate, Reviewing literature, and analyze Mathematical problems to arrive at substantiated conclusions using the principles of mathematics, natural, and mathematical techniques.

**PO5: Analytical reasoning:** Ability to evaluate the qualitative and relevance of evidence, recognizing logically equivalent statements, analyze and synthesize data from a variety of sources, draw valid conclusions and support them with evidence and examples.

**PO6: Research-related skills:** Use research-based knowledge including design of Mathematical experiments, define problems, formulate hypotheses, test hypotheses, analysis and interpret draw conclusions from data, synthesis of the information to provide valid conclusions. Ability to plan, execute and report the results of an experiment.

**PO7: Cooperation/team work:** Ability to work effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

**PO8: Scientific reasoning:** Ability to analyze, interpret and draw conclusions from qualitative data and critically evaluate ideas from an open minded and reasoned perspective. It might involve observation or assessment of information to arrive at a generalized conclusion, or may involve defining and then testing



a hypothesis to predict specific results. Demonstrate knowledge and understanding of interdisciplinary Problem and mathematical principles and apply these to scientific work.

**PO9: Reflective thinking:** Critical thinking to found new ideas and relate them with similar attributes to help make remembering concepts.

**PO10: Information/ Digital Literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate and use a variety of relevant information sources and use software for analysis of data.

**PO11: Self-directed learning:** To work independently, identify appropriate resources required for a project, and manage the projects through to completion.

**PO12: Multicultural competence:** To beliefs the multicultural perspective is by highlighting particular achievements from various gendered groups. Usually this strategy is used to diversify the mathematics curriculum that typically elevates the Problem. While this approach has some value in diversifying the curriculum, in the absence of a critical stance to teaching math, the approach can fall short of a more comprehensive understanding of the role of multicultural education in math.

**PO13: Moral and Ethical awareness:** Ability to identify ethical principles and commit to professional ethics and responsibilities and norms of the mathematical practice. To avoid unethical behavior such as fabrication, misrepresentation of data not adhering intellectual property rights, unbiased and truthful actions in all aspects of work.

**PO14: Leadership qualities:** Capability for mapping out the tasks of a team and setting direction, formulating an inspiring vision, motivating and inspiring team members to engage with that vision and using management skills to guide people to the right destination ,in a smooth and efficiency way.

**PO15: Lifelong learning:** Ability to acquire knowledge and skills, including “learning how to learn”, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development.

**Programme Specific Outcomes:**

**PS01:** Think in a critical manner. Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand. Formulate and develop mathematical arguments in a logical manner.

**PS02:** Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.

**PS03:** Understand, formulate and use quantitative models arising in social science, business and other contexts.

**Programme Educational Objectives:**

**PEO 1:** To provide students with an awareness of skills in life long learning and self education.

**PEO 2:** To cultivate team work, technical writing, and oral communication skills.

**PEO 3:** To provide students with an appreciation of mathematical impact on society and the Professional responsibilities of mathematician.

**Bloom's Taxonomy**

**K1: Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

**K2: Understanding:** Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

**K3: Applying:** Carrying out or using a procedure for executing, or implementing.

**K4: Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.

**K5: Evaluating:** Making judgments based on criteria and standards through critique and checking.

**K6: Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN**  
**[AUTONOMOUS]**  
**ELAYAMPALAYAM, TIRUCHENGODE -637 205.**  
**DEPARTMENT OF MATHEMATICS**  
**M.Sc. – MATHEMATICS**  
**COURSE PATTERN AND SCHEME OF EXAMINATIONS UNDER OBE**  
**For the Candidates admitted from the year 2022 onwards**

| <b>SEM</b>   | <b>SUBJECT CODE</b>                 | <b>COURSE</b>          | <b>SUBJECT TITLE</b>            | <b>Hrs/<br/>Week</b> | <b>CREDIT</b> | <b>INT.<br/>MARK</b> | <b>EXT.<br/>MARK</b> | <b>TOT.<br/>MARK</b> |
|--------------|-------------------------------------|------------------------|---------------------------------|----------------------|---------------|----------------------|----------------------|----------------------|
| <b>I</b>     | 20P1MA01                            | Core Course-I          | Linear Algebra                  | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P1MA02                            | Core Course-II         | Real Analysis-I                 | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P1MA03                            | Core Course-III        | Number Theory                   | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P1MA04                            | Core Course-IV         | Ordinary Differential Equations | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P1MAE01<br>20P1MAE02<br>21P1MAE09 | Core Based Elective-I  | Elective from Group-A or A1     | 6                    | 4             | 25                   | 75                   | 100                  |
| <b>TOTAL</b> |                                     |                        |                                 | <b>30</b>            | <b>24</b>     | <b>125</b>           | <b>375</b>           | <b>500</b>           |
| <b>II</b>    | 20P2MA05                            | Core Course-V          | Abstract Algebra                | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P2MA06                            | Core Course-VI         | Mechanics                       | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P2MA07                            | Core Course-VII        | Real Analysis-II                | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P2MA08                            | Core Course-VIII       | Partial Differential Equations  | 6                    | 5             | 25                   | 75                   | 100                  |
|              | 20P2MAE03<br>20P2MAE04<br>21P2MAE10 | Core Based Elective-II | Elective from Group-B or B1     | 6                    | 4             | 25                   | 75                   | 100                  |
| <b>TOTAL</b> |                                     |                        |                                 | <b>30</b>            | <b>24</b>     | <b>125</b>           | <b>375</b>           | <b>500</b>           |

|              |                                     |                         |                                        |           |           |            |            |            |
|--------------|-------------------------------------|-------------------------|----------------------------------------|-----------|-----------|------------|------------|------------|
| <b>III</b>   | 20P3MA09                            | Core Course-IX          | Complex Analysis                       | 6         | 5         | 25         | 75         | 100        |
|              | 20P3MA10                            | Core Course-X           | Topology                               | 5         | 5         | 25         | 75         | 100        |
|              | 20P3MA11                            | Core Course-XI          | Numerical Analysis                     | 5         | 4         | 25         | 75         | 100        |
|              | 20P3MA12                            | Core Course-XII         | Graph Theory                           | 4         | 4         | 25         | 75         | 100        |
|              | 20P3MAE05<br>20P3MAE06<br>21P3MAE11 | Core Based Elective-III | Elective From Group-C or C1            | 5         | 4         | 25         | 75         | 100        |
|              | 18P3CSED01                          | EDC                     | Introduction to Information Technology | 3         | 2         | 25         | 75         | 100        |
|              | 21P3HR04                            | Value based education   | Human Rights                           | 2         | 2         | 25         | 75         | 100        |
| <b>TOTAL</b> |                                     |                         |                                        | <b>30</b> | <b>26</b> | <b>175</b> | <b>525</b> | <b>700</b> |

|                    |                                     |                           |                                                 |            |           |            |             |             |
|--------------------|-------------------------------------|---------------------------|-------------------------------------------------|------------|-----------|------------|-------------|-------------|
| <b>IV</b>          | 20P4MA13                            | Core Course-<br>XIII      | Functional Analysis                             | 6          | 5         | 25         | 75          | 100         |
|                    | 20P4MA14                            | Core Course-<br>XIV       | Probability Theory                              | 6          | 4         | 25         | 75          | 100         |
|                    | 20P4MA15                            | Core Course-<br>XV        | Measure Theory and<br>Integration               | 6          | 5         | 25         | 75          | 100         |
|                    | 20P4MAE07<br>20P4MAE08<br>21P4MAE12 | Core Based<br>Elective-IV | Elective from<br>Group-D or D1                  | 6          | 4         | 25         | 75          | 100         |
|                    | 18P4CSSK01                          | Soft Skill                | Essentials of Mat<br>Lab                        | 2          | 2         | 25         | 75          | 100         |
|                    | 20P4MAPR01                          | PROJECT                   | Proje<br>ct                                     | 4          | 4         | 75         | 25          | 100         |
|                    | 22P4MAAL01                          | Self Study<br>Course      | SWAYAM/ Scientific<br>Computing using<br>MATLAB |            | 2*        |            |             | 100*        |
| <b>TOTAL</b>       |                                     |                           |                                                 | <b>30</b>  | <b>24</b> | <b>200</b> | <b>400</b>  | <b>600</b>  |
| <b>GRAND TOTAL</b> |                                     |                           |                                                 | <b>120</b> | <b>98</b> | <b>625</b> | <b>1675</b> | <b>2300</b> |

**\*Extra Credit Course:**

**Self Study Course:**

| S. No | Course code | Course                            |
|-------|-------------|-----------------------------------|
| 1     | 22P4MAAL01  | Scientific Computing using MATLAB |

- The Learners have to complete either any course in SWAYAM in the domain with extra 2 Credits or an equivalent course of SWAYAM framed by the Department as a self study course.
- The above course is offered to the PG willing students who have secured 7.5 and above CGPA upto second Semester only.
- Only External Assessment for 100 Marks.
- It is purely a Self Study Course and will not be considered for computation of Cumulative Grade Point Average (CGPA).

**Note:**

2\* - Extra Credit

**ELECTIVE PAPERS:**

**GROUP-A**

20P1MAE01 DISCRETE MATHEMATICS

20P1MAE02 FLUID DYNAMICS

**GROUP-B**

20P2MAE03 MATHEMATICAL METHODS

20P2MAE04 COMBINATORIAL MATHEMATICS

**GROUP-C**

20P3MAE05 OPTIMIZATION TECHNIQUES

20P3MAE06 FUZZY SETS AND THEIR APPLICATIONS

**GROUP-D**

20P4MAE07 DIFFERENTIAL GEOMETRY

20P4MAE08 DIFFERENCE EQUATIONS

**GROUP-A1**

21P1MAE09 CRYPTOGRAPHY

**GROUP-B1**

21P2MAE10 NEURAL NETWORKS

**GROUP-C1**

21P3MAE11 CONTROL THEORY

**GROUP-D1**

21P4MAE12 CODING THEORY

## SEMESTER I

|                       |          |                                   |                                        |         |
|-----------------------|----------|-----------------------------------|----------------------------------------|---------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>            | <b>Master of Science (Mathematics)</b> |         |
| <b>Course Code</b>    | 20P1MA01 | <b>Title</b>                      | <b>Batch</b>                           | 2022-24 |
|                       |          | <b>CORE I:<br/>LINEAR ALGEBRA</b> | <b>Semester</b>                        | I       |
| <b>Hrs/Week</b>       | 6        |                                   | <b>Credits</b>                         | 05      |

### Course Outcomes (CO)

| CO Number | CO Statement                                                                          | Knowledge Level |
|-----------|---------------------------------------------------------------------------------------|-----------------|
| CO1       | Understand the concepts of linear transformations and its representation by matrices. | K1, K2          |
| CO2       | Discuss the concepts of polynomials and prime factorization of a polynomial           | K1,K2,K3        |
| CO3       | Demonstrate the properties of determinants and characteristics values.                | K4,K5           |
| CO4       | Analyze the concept of triangulation, diagonalization and decomposition               | K4              |
| CO5       | Evaluate the concept of bilinear Transformation.                                      | K5              |

#### **Unit I : Linear transformations (18 Hrs)**

Linear transformations- the algebra of Linear transformations- Isomorphism- Representation of Transformation by matrices. Chapter - 3 (Sec 3.1 – 3.4)

#### **Unit II : Polynomials (18 Hrs)**

Algebra- the algebra of polynomials- lagrange interpolation- polynomial ideals- the prime factorization of a polynomial. Chapter - 4 (Sec 4.1 – 4.5)

#### **Unit III : Determinants (18 Hrs)**

Commutative rings- determinant functions – permutations & the uniqueness of determinants- additional properties of determinants. Chapter - 5 (Sec 5.1 – 5.4)

#### **Unit IV: Elementary canonical forms (18Hrs)**

Elementary canonical forms- introduction- characteristic values- annihilatory polynomials- invariant subspaces- simultaneous triangulation, simultaneous diagonalization.

Chapter - 6 (Sec 6.1 – 6.5)

#### **Unit V: The rational & Jordan forms (18 Hrs)**

Cyclic subspaces & annihilators – cyclic decompositions & the rational form- the Jordan form.

Chapter - 7 (Sec 7.1 – 7.3)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

**Kenneth Hoffman & Ray Kunze, *Linear algebra* , 2<sup>nd</sup> Edition, Prentice Hall of India Private Limited, New Delhi, 2015.**

**REFERENCE BOOKS:**

- 1. Jim DeFranza and Daniel Gagliardi, *Introduction to Linear Algebra with application*, Indian Edition, 2011.**
- 2. V. Krishnamurthy, *An Introduction to Linear Algebra*, West press Pvt. Ltd., New Delhi, 1938.**
- 3. H. Friedberg, A.J.Insel & L.E.Spence, *Linear Algebra*, PHI learning Pvt. Ltd., New Delhi, 2009.**
- 4. L.A. Geza. Schay, *Introduction to Linear Algebra*, Narosa publishing House, New Delhi, 1998.**

**ONLINE SOURCES:**

1. [www.ejournal.com](http://www.ejournal.com)
2. [www.ebook.com](http://www.ebook.com)
3. [www.freebookcentre.net](http://www.freebookcentre.net)
4. [www.webnotes.com](http://www.webnotes.com)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | L   | S   | S   | S   | S   | M   | S   | L    | S    | L    | L    | L    | S    |
| CO2                    | S   | M   | L   | S   | M   | M   | S   | M   | M   | M    | M    | M    | L    | L    | S    |
| CO3                    | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |
| CO4                    | S   | M   | M   | M   | M   | S   | S   | S   | M   | M    | S    | L    | M    | M    | S    |
| CO5                    | S   | M   | M   | M   | M   | S   | S   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**



|                       |          |                                     |                                        |           |
|-----------------------|----------|-------------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>              | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 20P1MA02 | <b>Title</b>                        | <b>Batch</b>                           | 2022-2024 |
|                       |          | <b>CORE II:<br/>REAL ANALYSIS-I</b> | <b>Semester</b>                        | I         |
| <b>Hrs/Week</b>       | 6        |                                     | <b>Credits</b>                         | 05        |

### Course Outcomes (CO)

| CO Number | CO Statement                                     | Knowledge Level |
|-----------|--------------------------------------------------|-----------------|
| CO1       | To remember countable and uncountable sets       | K1, K2          |
| CO2       | To apply the Convergence in Sequences and Series | K3              |
| CO3       | To demonstrate Power series                      | K4              |
| CO4       | To analyze Continuity and Connectedness.         | K4, K5          |
| CO5       | To Understand the concepts of Differentiation.   | K1,K2           |

#### UNIT I: Basic Topology

(18 Hrs)

Finite, Countable and Uncountable Sets – Metric Spaces – Compact Sets – Connected Sets – Problems (Perfect sets - Omitted) . Chapter- 2 (Page No.24 – 36, 42 - 46)

#### Unit II: Numerical Sequences and Series

(18 Hrs)

Convergent sequences – Subsequences – Cauchy sequences - Upper and lower limits - Some special sequences – Series – Series of non negative terms - The number e - The root and ratio tests – Problems. Chapter - 3 (Page No. 47- 69)

#### Unit III:

(18 Hrs)

Power series - Summation by parts - Absolute convergence - Addition and multiplication of series – Rearrangements – Problems Chapter - 3 (Page No.69 - 82)

#### Unit IV: Continuity:

(18 Hrs)

Limit of Functions – Continuous functions - Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic functions – Infinite limits and Limits at infinity - Problems. Chapter - 4 (Page No.83 - 102)

**UNIT V: Differentiation****(18 Hrs)**

The derivative of a real function – Mean value theorems – The continuity of the Derivative – L’ Hospital’s Rule – Derivatives of Higher order – Taylor’s theorem – Differentiation of Vector-valued functions – Problems.

Chapter - 5( Page No. 103 – 119)

**TOTAL :****90 Hours**

Power point Presentations, Seminar &amp; Assignment

**TEXT BOOK:**

**Walter Rudin, *Principles of Mathematical Analysis*, Third Edition, Mc Graw Hill Book Co., New Delhi, 2013.**

**REFERENCE BOOKS:**

1. **TomM .Apostol, *Mathematical Analysis*, Second Edition, Narosa Publishing House, 2002.**
2. **H.L.Royden, *Real Analysis*, Third Edition, Prentice-Hall of India, New Delhi, 2009**
3. **W.J. Kaczor and M.T. Nowak, “Problems in Mathematical Analysis I – Real Numbers , Sequences and Series”, American Mathematical Society, 2000.**
4. **W.J. Kaczor and M.T. Nowak, “Problems in Mathematical Analysis II – Continuity and Differentiation”, American Mathematical Society, 2000.**

**ONLINE SOURCES :**

1. [www.analysiswebnotes.com](http://www.analysiswebnotes.com)
2. [www.freebookcentre.net](http://www.freebookcentre.net)
3. <http://nptl.ac.in>

**Mapping with Programme Outcomes**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2     | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | S    | L    | M    | M    | S    |
| CO3     | S   | M   | S   | S   | S   | S   | M   | M   | M   | M    | M    | M    | L    | L    | S    |
| CO4     | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |
| CO5     | S   | M   | M   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | M    | S    |

**S - Strong; M - Medium; L – Low**

|                       |          |                                |                                            |           |
|-----------------------|----------|--------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>         | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P1MA03 | <b>Title</b>                   | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE III: NUMBER THEORY</b> | <b>Semester</b>                            | I         |
| <b>Hrs/Week</b>       | 6        |                                | <b>Credits</b>                             | 05        |

### Course Outcomes (CO)

| CO Number | CO Statement                                                            | Knowledge Level |
|-----------|-------------------------------------------------------------------------|-----------------|
| CO1       | To remember the basic ideas about Integers, Primes, Quadratic Residues. | K1, K2          |
| CO2       | Discuss the concepts of Congruence's and Solutions of congruence's      | K3, K4          |
| CO3       | To demonstrate and understanding of Quadratic residues                  | K4, K5          |
| CO4       | To analyze the Mobius inversion formula.                                | K4              |
| CO5       | To Evaluate Diaphantine equations and farey fractions                   | K5              |

#### UNIT I: Divisibility

(18 Hrs)

Introduction - Divisibility-Primes – The Binomial theorem.

Chapter - 1(Sec 1.1. – 1.4)

#### UNIT II: Congruence's

(18 Hrs)

Congruence's-Solutions of congruence's – The Chinese remainder theorem – Prime power moduli –Prime modulus.

Chapter - 2(Sec 2.1. – 2.7)

#### UNIT III: Quadratic reciprocity

(18 Hrs)

Quadratic residues - Quadratic reciprocity -The Jacobi symbol – Binary Quadratic forms.

Chapter - 3(Sec 3.1. – 3.4)

#### UNIT IV: Some functions of Number theory

(18 Hrs)

Greatest integer function - Arithmetic functions - The Mobius inversion formula- The Recurrence functions.

Chapter – 4 (Sec 4.1. – 4.4)

**UNIT V: Some Diophantine equations and farey fractions****(18 Hrs)**The equation  $ax+by=c$  – farey sequences – Rational approximations – Irrational numbers.

Chapter- 5 (Sec 5.1), Chapter - 6 (Sec 6.1 – 6.3)

**TOTAL :****90 Hours**

Power point Presentations, Seminar &amp; Assignment

**TEXT BOOKS :****Ivan Niven and H.S. Zuckerman, *An Introduction to the Theory of Numbers*, 3<sup>rd</sup> edition, Wiley Eastern Ltd, New Delhi, 1989.****REFERENCE BOOKS:**

- 1. D.M. Burton, *Elementary Number theory*, Universal Book Stall, New Delhi 2001**
- 2. K. Ireland and M.Rosen, *A Classical Introduction to Modern Number Theory*, Springer Verlag, New York, 1972.**
- 3. T.M. Apostol, *Introduction to Analytic Number Theory*, Narosa Publication, House, Chennai, 1980.**
- 4. *Elementary Number Theory*, Seventh Edition, MC Graw-Hill Companies, 2015.**

**ONLINE SOURCES:**

1. [www.mheeducation.co.in](http://www.mheeducation.co.in)
2. [www.wiley.com/go/permissions](http://www.wiley.com/go/permissions)
3. <http://www.powershow.com>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | M   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | M    | S    |
| CO2                    | M   | M   | S   | S   | S   | S   | S   | L   | M   | L    | L    | S    | M    | L    | S    |
| CO3                    | M   | M   | S   | S   | S   | S   | M   | L   | L   | L    | S    | M    | S    | S    | S    |
| CO4                    | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |
| CO5                    | S   | M   | M   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | M    | S    |

**S - Strong; M - Medium; L – Low**

|                       |          |                                                     |                                            |           |
|-----------------------|----------|-----------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>                              | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P1MA04 | <b>Title</b>                                        | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE IV: ORDINARY<br/>DIFFERENTIAL EQUATIONS</b> | <b>Semester</b>                            | I         |
| <b>Hrs/Week</b>       | 6        |                                                     | <b>Credits</b>                             | 05        |

### Course Outcomes (CO)

| CO Number | CO Statement                                                     | Knowledge Level |
|-----------|------------------------------------------------------------------|-----------------|
| CO1       | To Remember the Linear Equations with constant coefficients      | K1              |
| CO2       | To gain Knowledge about Non homogeneous equations of orders two. | K1,K2           |
| CO3       | To Solve the Legendre's Equations.                               | K5              |
| CO4       | To analyze linear equations with regular singular points         | K3, K4          |
| CO5       | To Evaluate Method of successive approximations                  | K5              |

#### UNIT I: Linear Equations with Constant Coefficients (18 Hrs)

Introduction -Second order homogeneous equations –Initial value problem- Linear dependence and independence- A formula for the Wronskian.

Chapter –2( Sec 1–5)

#### UNIT II: Linear Equations with Constant Coefficients (18 Hrs)

Non –homogeneous equations of order two – Homogeneous and non –homogeneous equations of order n –Initial value problem- A special method to solve a non-homogeneous equation –Algebra of constant coefficient.

Chapter –2 (Sec 6– 11)

#### UNIT III: Linear Equations with Variable Coefficients (18 Hrs)

Initial value problems for homogeneous equations –Solutions of homogeneous equations - Wronskian and linear independence – Reduction of the order of homogeneous equation – The Legendre equation.

Chapter – 3 ( Sec 1–5)

#### UNIT IV: Linear Equations with Regular Singular points (18 Hrs)

Linear equations with regular singular points – Euler equation-second order equations with regular singular points – solutions and properties of Bessel's equation.

Chapter – 3 (Sec 8) , Chapter- 4( Sec 1 to 4, 7,8)

**UNIT V: First Order Equation – Existence and Uniqueness****(18 Hrs)**

Introduction – Existence and uniqueness of solutions of first order equations – Equations with variable separable – Exact equations – Method of successive approximations – Lipschitz Condition – Convergence of the successive approximations.

Chapter – 8 (Sec 6.1 – 6.6)

**TOTAL :****90 Hours**

|                                                 |
|-------------------------------------------------|
| Power point Presentations, Seminar & Assignment |
|-------------------------------------------------|

**TEXT BOOK :**

**Earl A. Coddington, *An Introduction to Ordinary Differential Equation*, Prentice Hall of India, New Delhi, 2011.**

**REFERENCE BOOKS :**

- R.P. Agarwal and Ramesh C. Gupta, *Essentials of Ordinary Differential Equation*, Mc Graw Hill, New York, 1991.**
- D. Somasundram, *Ordinary Differential Equations*, Narosa Publishing House, Chennai – 2002.**
- D. Raj, D.P. Choudhury and H.I. Freedman, *A Course in Ordinary Differential Equations*, Narosa Publishing House, Chennai – 2004.**

**ONLINE SOURCES:**

- <http://users.math.msu.edu/users/gnagy/teaching/ode.pdf>
- [https://www.cs.bgu.ac.il/~leonid/ode\\_bio\\_files/lonascu\\_lectnotes.pdf](https://www.cs.bgu.ac.il/~leonid/ode_bio_files/lonascu_lectnotes.pdf)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | M   | S   | S   | S   | M   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO2                    | S   | M   | M   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | M    | S    |
| CO3                    | S   | M   | M   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | M    | S    |
| CO4                    | M   | M   | S   | S   | S   | S   | S   | L   | L   | L    | M    | M    | M    | L    | S    |
| CO5                    | S   | M   | S   | S   | S   | M   | S   | M   | M   | L    | S    | L    | L    | L    | M    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                       |                                            |           |
|-----------------------|-----------|-------------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P1MAE01 | <b>Title</b>                                          | <b>Batch</b>                               | 2022-2024 |
|                       |           | <b>GROUP A : ELECTIVE I:<br/>DISCRETE MATHEMATICS</b> | <b>Semester</b>                            | I         |
| <b>Hrs/Week</b>       | 6         |                                                       | <b>Credits</b>                             | 04        |

### Course Outcomes (CO)

| <b>CO Number</b> | <b>CO Statement</b>                                   | <b>Knowledge Level</b> |
|------------------|-------------------------------------------------------|------------------------|
| CO1              | To Remember the basic ideas of foundations and logic. | K1, K2                 |
| CO2              | To Gain knowledge about Permutations and Combinations | K4                     |
| CO3              | Demonstrate the concept of Generating functions.      | K2                     |
| CO4              | To analyze the Boolean Functions and Logic gates.     | K1,K2, K5              |
| CO5              | To Evaluate the theory of Modeling Computation .      | K3,K6                  |

#### **UNIT-I: The Foundations - Logic and proofs (18Hrs)**

Propositional – Applications of Propositional – Propositional Equivalences – Predicates and Quantifiers. Algorithms : The Growth of functions.

Chapter - 1 (Sec 1.1 – 1.3) , Chapter - 3 (Sec 3.1 – 3.2)

#### **UNIT-II: Counting (18 Hrs)**

The Basics of Counting – The Pigeonhole principle – Permutations and Combinations – Generalized Permutations and Combinations – Generating Permutations and Combinations.

Chapter - 5 (Sec 5.1 – 5.3, Sec 5.5, 5.6)

#### **UNIT-III: Advanced Counting Techniques (18Hrs)**

Recurrence Relations – Solving Linear Recurrence Relations – Generating Functions.

Chapter - 6 (Sec 6.1, 6.2, 6.4)

#### **UNIT-IV: Boolean Algebra : (18 Hrs)**

Boolean Functions – Representing Boolean Functions – Logic Gates – Minimization of Circuits.

Chapter - 10( Sec 10.1 – 10.4)

**UNIT-V: Modeling Computation****(18 Hrs)**

Finite – State machines with Output – Finite – State machines with no Output – Turing Machines.

Chapter - 12( Sec 12.2, 12.3, 12.5)

**TOTAL :****90 Hours**

Power point Presentations, Seminar &amp; Assignment

**TEXT BOOK :****Kenneth H.Rosen, *Discrete Mathematics and its Applications*, 7<sup>th</sup> Edition, WCB/McGraw Hill Education, New York, 2008.****REFERENCE BOOKS :****1. J.P.Trembley and R.Manohar, *Discrete Mathematical Structures applications to Computer Science*, Tata McGraw Hills, New Delhi, 2013.****2.T.Veerarajan, *Discrete Mathematics with Graph Theory and Combinatorics*, Tata McGraw Hills Publishing Company Limited, 7<sup>th</sup> Reprint, 2008.****3. Prof. V.Sundaresan, K.S. Ganapathy Subramaniyan, K.Ganesan, *Discrete Matheamtics*, Tata McGraw Hill, New Delhi, 2000.****ONLINE SOURCES:**

1. [www.freebookcentre.net/](http://www.freebookcentre.net/)
2. [www.mathsforcollege.com/nm/topics/textbook](http://www.mathsforcollege.com/nm/topics/textbook)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2                    | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO3                    | S   | M   | L   | S   | S   | L   | M   | L   | S   | L    | S    | L    | L    | L    | S    |
| CO4                    | S   | M   | S   | S   | S   | M   | S   | M   | S   | L    | S    | M    | M    | L    | S    |
| CO5                    | L   | L   | S   | M   | S   | M   | L   | S   | M   | M    | L    | L    | L    | L    | S    |

**S - Strong; M - Medium; L – Low**



|                       |           |                                                 |                                            |                 |
|-----------------------|-----------|-------------------------------------------------|--------------------------------------------|-----------------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                          | <b>Master of Science<br/>(Mathematics)</b> |                 |
| <b>Course Code</b>    | 20P1MAE02 | <b>Title</b>                                    | <b>Batch</b>                               | 2022-2024       |
|                       |           | <b>GROUP A : ELECTIVE I:<br/>FLUID DYNAMICS</b> |                                            | <b>Semester</b> |
| <b>Hrs/Week</b>       | 6         |                                                 | <b>Credits</b>                             | 4               |

### Course Outcomes (CO)

| <b>CO Number</b> | <b>CO Statement</b>                                         | <b>Knowledge Level</b> |
|------------------|-------------------------------------------------------------|------------------------|
| CO1              | To know about the kinematics of fluid and its terminology.  | K1, K2                 |
| CO2              | To Gain knowledge in Equations of Motion of a Fluid         | K3, K4                 |
| CO3              | To understand the concepts of Some Three –Dimensional Flows | K2                     |
| CO4              | To analyze Some Two -Dimensional Flows                      | K4                     |
| CO5              | To Evaluate Viscous Flow and connected properties           | K5 ,K6                 |

#### **Unit -I : Kinematics of Fluids in Motion (18 Hrs)**

Real Fluids and Ideal Fluids- Velocity of a Fluid at a Point- Stream lines and path lines:Steady and Unsteady Flows- the Velocity Potential-The Vorticity Vector-Local and Particle Rates of change-the equation of Continuity-Worked Examples-Acceleration of a fluid Conditions at a rigid Boundary.

Chapter -2 (Sec 2.1 – 2.10)

#### **Unit-II : Equations of Motion of a Fluid (18 Hrs)**

Pressure at a Point in a Fluid at Rest-Pressure at a Point in a Moving Fluid-Conditions at a Boundary of Two inviscid Immiscible Fluids-Euler's Equations of Motion –Bernoulli's Equation – Worked Examples-Discussion of the Case of Steady Motion under Conservative Body Forces.

Chapter- 3 (Sec 3.1 – 3.7)

#### **Unit – III: Some Three –Dimensional Flows (18 Hrs)**

Introduction-Sources, Sinks and Doublets-Images in a Rigid Infinite Plane-Axi-Symmetric Flows: Stokes's Stream Function.

Chapter -4 (Sec 4.1 – 4, 4.5)

#### **Unit IV: Some Two -Dimensional Flows (18 Hrs)**

Meaning of Two -Dimensional Flow-Use of Cylindrical Polar Co-ordinates-the Stream Function –the Complex Potential for Two –Dimensional, Irrotational, In Compressible Flow –Complex Velocity Potential for Standard Two –Dimensional flows-Some Worked Examples.

Chapter -5 (Sec 5.1 – 5.6)

**Unit V: Viscous Flow****(18Hrs)**

Stress Components in a Real Fluid –Relations between Cartesian Components of Stress- Translational Motion of Fluid Element-the Rate of Strain Quadric and Principal Stresses- Some Further Properties of the Rate of Strain Quadric-Stress Analysis in Fluid Motion- Relations between Stress and Rate of Strain-the co-efficient of Viscosity and Laminar Flow-the Navier –Stokes Equations of Motion of a Viscous Fluid.

Chapter -5 (Sec 8.1 – 8.9)

**TOTAL :****90 Hours**

Power point Presentations, Seminar &amp; Assignment

**TEXT BOOK :****F.Chorlton, *Text book of Fluid Dynamics*, CBS Publication New Delhi, 2004.****REFERENCE BOOKS:**

1. **G.K.Batchelor, *An Introduction to Fluid Mechanics*, Foundation Books, New Delhi, 2002.**
2. **S.W .Yuan, *Foundations of Fluid Mechanics*, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.**
3. **R.K.Rathy, *An Introduction to Fluid Dynamic*, IBH Publ.Comp. New Delhi, 2002.**

**ONLINE SOURCES:**

1. [www.efluids.com](http://www.efluids.com)
2. [www.springer.com](http://www.springer.com)

**Mapping with Programme Outcomes**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1      | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2      | S   | S   | M   | M   | S   | M   | L   | S   | M   | L    | S    | M    | M    | S    | M    |
| CO3      | S   | M   | L   | S   | S   | L   | M   | L   | S   | L    | S    | L    | L    | L    | S    |
| CO4      | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO5      | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                           |                                        |           |
|-----------------------|-----------|-------------------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                    | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 21P1MAE09 | <b>Title</b>                              | <b>Batch</b>                           | 2022-2024 |
|                       |           | <b>GROUP A1: ELECTIVE I: CRYPTOGRAPHY</b> | <b>Semester</b>                        | I         |
| <b>Hrs/Week</b>       | 6         |                                           | <b>Credits</b>                         | 4         |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                                                                       | <b>Knowledge Level</b> |
|------------------|-----------------------------------------------------------------------------------------------------------|------------------------|
| CO1              | Understand the basic concepts and objective of cryptography and recall the concept of modular arithmetic. | K1 & K2                |
| CO2              | Understand mathematical foundations required for various cryptographic algorithms.                        | K2                     |
| CO3              | Apply the concept and properties of modular arithmetic in various algorithms to find the solution.        | K3 & K5                |
| CO4              | Describe and Analyze existing authentication protocols for two party communications.                      | K4                     |
| CO5              | Evaluate security mechanisms in the theory of networks and apply the appropriate algorithms.              | K3 & K5                |

**Unit: I** **(18 Hrs)**

Introduction – Encryption and Secrecy – The objective of Cryptography - Number Theory – Introduction – Modular Arithmetic.

**Unit :II** **(18 Hrs)**

Integer factorization problem – Pollard’s rho factoring – Elliptic curve factoring – Discrete logarithm problem.

**Unit :III** **(18 Hrs)**

Finite fields – Basic properties – Arithmetic of polynomials – Factoring polynomials over finite fields – Square free factorization.

**Unit :IV** **(18 Hrs)**

Symmetric key encryption – Stream ciphers – Block Ciphers – DES.

**Unit :V** **(18 Hrs)**

Public key cryptography – Concepts of public key cryptography – Modular arithmetic – RSA – Discrete logarithm – Elliptic curve cryptography.

**TOTAL :** **90 Hours**

|                                                      |
|------------------------------------------------------|
| Power point Presentations, Seminar ,Quiz, Assignment |
|------------------------------------------------------|

**TEXT BOOK:**

1. Hans Delfs, Helmut Knebl, Introduction to Cryptography, Springer Verlag, 2002.
2. Alfred J. Menezes, Paul C. Van Oorschot, Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2000.
3. William Stallings, Cryptography and Network Security, Prentice Hall of India, 2000.

**REFERENCE BOOKS :**

- 1 Cryptography and Information Security, Pachghare V.K., PHI Learning Pvt. Ltd., New Delhi, 2009
2. Cryptography and Network Security, Behrouz A. Forouzan and Debdeep Mukhopathyey, 2013, second edition, Mc Graw Hill Education Pvt. Ltd., New Delhi.

**ONLINE SOURCES:**

1. <https://nptel.ac.in/downloads/111106054/>
2. <https://ocw.mit.edu>.
3. <https://swayam.gov.in>
4. [www.freebookcentre.net](http://www.freebookcentre.net)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | M   | L   | M   | M   | L   | M   | M   | L   | M   | S    | M    | M    | M    | L    | S    |
| CO2                    | L   | S   | L   | L   | M   | M   | M   | M   | M   | M    | S    | M    | M    | M    | S    |
| CO3                    | M   | L   | M   | L   | L   | M   | L   | L   | L   | M    | M    | L    | L    | L    | S    |
| CO4                    | M   | M   | M   | L   | M   | L   | L   | S   | M   | S    | M    | M    | M    | M    | S    |
| CO5                    | L   | M   | L   | M   | L   | M   | L   | M   | M   | S    | S    | S    | M    | L    | S    |

**S - Strong; M - Medium; L – Low**

## SEMESTER II

|                       |          |                                     |                                            |           |
|-----------------------|----------|-------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>              | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P2MA05 | <b>Title</b>                        | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE V: ABSTRACT<br/>ALGEBRA</b> | <b>Semester</b>                            | II        |
| <b>Hrs/Week</b>       | 6        |                                     | <b>Credits</b>                             | 05        |

### Course Outcomes (CO)

| <b>CO Number</b> | <b>CO Statement</b>                                                                        | <b>Knowledge Level</b> |
|------------------|--------------------------------------------------------------------------------------------|------------------------|
| CO1              | Remember the concepts of Group theory.                                                     | K1, K2                 |
| CO2              | Understand the concept of a particular Euclidean ring and other forms of Polynomial rings. | K2                     |
| CO3              | Analyze Extension Fields .                                                                 | K4                     |
| CO4              | Apply the concept of fields in Galois theory.                                              | K3, K4                 |
| CO5              | To gain knowledge about Linear transformation.                                             | K2, K3                 |

#### **UNIT-I: Group Theory**

**(18 Hrs)**

Another counting principle – Sylow’s theorem – Direct products

Chapter - 2 (Sec 2.11 to 2.13.)

#### **UNIT-II: Ring Theory**

**(18 Hrs)**

Euclidean rings – A particular Euclidean ring – Polynomial rings – Polynomials over the rational field.

Chapter -3 (Sec 3.7 to 3.10)

#### **UNIT-III: Fields**

**(18 Hrs)**

Extension Fields – Roots of polynomials – More about Roots.

Chapter -5 ( Sec 5.1,5.3 and 5.5.)

#### **UNIT-IV: Fields**

**(18 Hrs)**

Elements of Galois Theory – Finite Fields

Chapter - 5 ( Sec 5.6) , Chapter 7 – (Sec 7.1)

#### **UNIT-V: Linear Transformations**

**(18 Hrs)**

Canonical forms: Triangular form – Trace and Transpose – Hermitian, Unitary and Normal Transformations.

Chapter 6 – (Sec 6.4,6.8 and 6.10)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

**N.Herstein** (II Edition), *Topics in Algebra*, Wiley India Pvt. Ltd., New Delhi, 2016.

**REFERENCE BOOKS:**

1. **J.B.Fraleigh**, *A First Course in Abstract Algebra*, 7<sup>th</sup> Edition, Narosa Publishing House, New Delhi, 2011.
2. **M.Artin**, *Algebra*, Prentice-Hall, Englewood Cliff, 1991.
3. **I.S.Luthar and I.B.S.Passi**, *Algebra*, Narosa Publishing House, New Delhi, 2007.
4. **P.N. Arora**, *Topics in Algebra*, Sultan Chand & sons, Educational Publishers, New Delhi, 2009.

**ONLINE SOURCES:**

1. [www.ejournal.com](http://www.ejournal.com)
2. [www.bookcentre.net](http://www.bookcentre.net)
3. [www.webnotes.com](http://www.webnotes.com)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2                    | S   | M   | L   | S   | S   | L   | M   | L   | S   | L    | S    | L    | L    | L    | S    |
| CO3                    | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO4                    | S   | S   | M   | M   | S   | M   | L   | S   | M   | L    | S    | M    | M    | S    | M    |
| CO5                    | S   | M   | L   | S   | S   | L   | S   | S   | S   | M    | S    | L    | S    | M    | S    |

**S - Strong; M - Medium; L – Low**

|                       |          |                           |                                            |           |
|-----------------------|----------|---------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>    | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P2MA06 | <b>Title</b>              | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE VI: MECHANICS</b> | <b>Semester</b>                            | II        |
| <b>Hrs/Week</b>       | 6        |                           | <b>Credits</b>                             | 05        |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                                  | <b>Knowledge Level</b> |
|------------------|----------------------------------------------------------------------|------------------------|
| CO1              | Remember the concepts of Energy and momentum.                        | K1, K2                 |
| CO2              | Understand the concept of Lagrange's Equations.                      | K2                     |
| CO3              | Analyze Hamilton's Principle.                                        | K4                     |
| CO4              | Apply the concept of Hamilton Principle Function.                    | K3, K4                 |
| CO5              | To gain knowledge about Differential forms and Generating Functions. | K2, K3                 |

**Unit I:** **(18 Hrs)**

Introductory concepts: The Mechanical system – Generalized coordinates – Constraints – Virtual work – Energy and Momentum.

Chapter - 1 (Sec 1.1 – 1.5)

**Unit II:** **(18 Hrs)**

Lagrange's Equations : Derivation of Lagrange's Equations – Examples – Integrals of the motion.

Chapter - 2( Sec 2.1 – 2.3)

**Unit III:** **(18 Hrs)**

Hamilton's Equations: Hamilton's Principle – Hamilton's Equations – Other variational principles.

Chapter - 4 (Sec 4.1 – 4.3)

**Unit IV:** **(18 Hrs)**

Hamilton – Jacobi Theory: Hamilton Principle Function – Hamilton-Jacobi Equation – Separability.

Chapter - 5( Sec 5.1 – 5.3)

**Unit V :** **(18 Hrs)**

Canonical Transformation - Differential forms and Generating Functions – Special Transformations – Lagrange and Poisson Brackets.

Chapter – 6( Sec 6.1 – 6.3)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK :**

**D.T. Greenwood, “Classical Dynamics”,** Dover Publication, New York, 1977.

**REFERENCE BOOKS:**

1. **H. Goldstein, “Classical Mechanics”,** 2nd Edition, Narosa Publishing House, New Delhi.
2. **R.D. Gregory, “Classical Mechanics”,** Cambridge University Press, 2006
3. **F.Gantmacher, Lectures in Analytic Mechanics,** MIR Publilshers, MOSCOW, 1975.
4. **I.M.Gelfand and S.V. Fomin, Calculus of Variations,** Prentice hall.
5. **S.L.Loney, An Elementary Treatise on Staics,** Kalyani Publishers, New Delhi.

**ONLINE SOURCES:**

1. <https://www.britannica.com/science/mechanics>
2. <https://www.physics.upenn.edu>
3. [www.khanacademy.org](http://www.khanacademy.org)

**Mapping with Programme Outcomes**

| <b>PO<br/>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1              | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2              | S   | S   | M   | M   | S   | M   | L   | S   | M   | L    | S    | M    | M    | S    | M    |
| CO3              | S   | M   | L   | S   | S   | L   | M   | L   | S   | L    | S    | L    | L    | L    | S    |
| CO4              | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO5              | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**



|                       |          |                                   |                                            |           |
|-----------------------|----------|-----------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>            | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P2MA07 | <b>Title</b>                      | <b>Batch</b>                               | 2022-2024 |
| <b>Hrs/Week</b>       | 6        | <b>CORE VII: REAL ANALYSIS-II</b> | <b>Semester</b>                            | II        |
|                       |          |                                   | <b>Credits</b>                             | 05        |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                                       | <b>Knowledge Level</b> |
|------------------|---------------------------------------------------------------------------|------------------------|
| CO1              | To Remember the concept of Integration and Differentiation.               | K1, K2                 |
| CO2              | To Classify integrals of a bounded function on a closed bounded interval. | K4, k5                 |
| CO3              | To understand sequences and series of functions and its convergence.      | K2, k3                 |
| CO4              | To gain knowledge about Some special functions.                           | K3, K4                 |
| CO5              | To Evaluate Functions of several variables.                               | K5, K6                 |

**UNIT I: Riemann – Stieltjes Integral**

**(18 Hrs)**

Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector-valued functions – Rectifiable curves – Problems  
Chapter - 6 ( Page No: 120 – 142)

**UNIT II: Sequences and Series of Functions**

**(18 Hrs)**

Discussion of main problem – Uniform Convergence - Uniform Convergence and Continuity - Uniform Convergence and Integration – Uniform Convergence and Differentiation – Problems  
Chapter - 7 (Page No: 143 – 154)

**Unit III: Sequences and Series of Functions (contd...)**

**(18 Hrs)**

Equicontinuous families of functions – Stone-Weierstrass Theorems – Algebra of complex valued functions – Problems  
Chapter - 7 ( Page No: 154 – 171)

**Unit IV: Some special functions**

**(18 Hrs)**

Power series – The Exponential and Logarithmic functions – Trigonometric Functions – Fourier series - The Gamma functions – Problems (Algebraic completeness of the complex field -omitted)  
Chapter – 8 (Page No: 172 – 203)

**Unit V: Functions of several variables**

**(18 Hrs)**

Linear transformations – Differentiation – The contraction principle - The inverse function theorem – The implicit function theorem – Problems  
 Chapter – 9 ( Page No: 204 – 227)

**TOTAL :** **90 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

**Walter Rudin, “Principles of Mathematical Analysis”,** 3 rd Edition, McGraw Hill Book Co., Kogaskusha, 1976.

**REFERENCE BOOKS:**

1. **T.M. Apostol, “Mathematical Analysis”,** Narosa Publishers, New Delhi, 1985.
2. **W.J.Kaczor and M.T.Nowak, “Problems in Mathematical Analysis III - Integration”,** American Mathematical Society, 2000.
3. **A. Browder, “Mathematical Analysis, An Introduction”,** Springer-Verlag, New York, 1996.
4. **K.A. Ross, “Elementary Analysis: The Theory of Calculus”,** 2 nd Edition, Springer, New York, 2013.
5. **M. Stoll, “Introduction to Real Analysis”,** 2 nd Edition, Addison-Wesley Longman Inc, 2001.

**ONLINE SOURCES:**

1. [www.analysiswebnotes.com](http://www.analysiswebnotes.com)
2. [www.freebookcentre.net](http://www.freebookcentre.net)
3. <http://nptl.ac.in>

**Mapping with Programme Outcomes**

| <b>PO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO</b> |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| CO1       | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2       | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |
| CO3       | S   | M   | S   | S   | S   | M   | S   | S   | L   | M    | L    | S    | M    | S    | S    |
| CO4       | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | S    | S    | M    | L    | S    |
| CO5       | S   | M   | L   | S   | S   | S   | S   | M   | S   | M    | L    | S    | M    | M    | M    |

**S - Strong; M - Medium; L – Low**

|                       |          |                                                     |                                            |           |
|-----------------------|----------|-----------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>                              | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P2MA08 | <b>Title</b>                                        | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE VIII: PARTIAL<br/>DIFFERENTIAL EQUATONS</b> | <b>Semester</b>                            | II        |
| <b>Hrs/Week</b>       | 6        |                                                     | <b>Credits</b>                             | 05        |

### Course Outcomes (CO)

| <b>CO Number</b> | <b>CO Statement</b>                                      | <b>Knowledge Level</b> |
|------------------|----------------------------------------------------------|------------------------|
| CO1              | To Remember Second order partial differential equations. | K1, K2                 |
| CO2              | Understand the concept of Cauchy problem.                | K2                     |
| CO3              | To Gain knowledge about separation of variables.         | K3, K4                 |
| CO4              | Analyze the boundary value problems.                     | K4, K5                 |
| CO5              | Evaluate the Green's function.                           | K5                     |

#### **Unit I** **(18 Hrs)**

Mathematical Models: The Classical equation – The vibrating string – The vibrating membrane – Conduction of Heat in solids. Classification of second order equations: Second order equations in two independent variables – Canonical forms – equations with constant coefficients – general solution.

Chapter 2: Sections 2.2 – 2.5 (omit 2.4), Chapter 3: Sections 3.1 – 3.4

#### **Unit II** **(18 Hrs)**

The Cauchy problem: The Cauchy problem – Cauchy – Kowalewsky theorem – Homogeneous wave equation – Initial – Boundary value problems – Non-homogeneous boundary conditions – Non-homogeneous wave equation, Riemann Method.

Chapter 4: Sections 4.1 – 4.8 (omit 4.6)

#### **Unit III** **(18 Hrs)**

Methods of separation of variables: Separation of variables – The vibrating string problem – Existence and Uniqueness of solution of the vibrating string problem. The heat conduction problem – existence and uniqueness of solution of the heat conduction problem – The laplace and beam equations.

Chapter 6: Sections 6.2 – 6.6

#### **Unit IV** **(18 Hrs)**

Boundary value problems: Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorems – Dirichlet problems for a circle – Dirichlet problems for a circular annulus – Neumann problem for a circle Dirichlet problem for a rectangle – Neumann problem for a rectangle.

Chapter 8: Sections 8.1 – 8.9 (omit 8.8)

**Unit V****(18 Hrs)**

Green's function: The delta function – Green's function – method of Green's function – Dirichlet problem for the Laplace operator – method of images – method of eigen functions.

Chapter 10: Sections 10.1 – 10.7 (omit 10.5)

**TOTAL :****90 Hours**

|                                                 |
|-------------------------------------------------|
| Power point Presentations, Seminar & Assignment |
|-------------------------------------------------|

**TEXT BOOK:**

**Tyn Myint. U with Lokenath Debnath, *Partial Differential Equations for Scientists and Engineers*, 3rd Edition ,2004.**

**REFERENCE BOOKS:**

1. **I.N.Sneddon, *Elements of Partial Differential Equations*, McGraw Hill, London, 1957.**
2. **L.C.Evans, *Partial Differential Equations*, AMS, Providence, R I, 2003.**
3. **Stanley j. Farlow, *Partial Differential Equations*, Scientist and Engineers, 1982.**
4. **E. C. Zachmanoglou, *Introduction to Partial Differential Equation*, 1976.**

**ONLINE SOURCES:**

1. <https://en.m.wikipedia.org/wiki/partialdifferentials>
2. [Homepage.univ.ac.at/pdeintro](http://Homepage.univ.ac.at/pdeintro)
3. <https://www.math.upenn.edu>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | M   | S   | S   | L   | M   | S   | S   | S    | S    | L    | M    | M    | S    |
| CO2                    | S   | M   | L   | S   | S   | L   | M   | L   | S   | L    | S    | L    | L    | L    | S    |
| CO3                    | M   | M   | S   | S   | S   | S   | S   | L   | L   | L    | M    | M    | M    | L    | S    |
| CO4                    | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |
| CO5                    | S   | M   | S   | S   | S   | S   | M   | M   | M   | M    | S    | L    | L    | L    | M    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                       |                                            |           |
|-----------------------|-----------|-------------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P2MAE03 | <b>Title</b>                                          | <b>Batch</b>                               | 2022-2024 |
|                       |           | <b>GROUP B: ELECTIVE II:<br/>MATHEMATICAL METHODS</b> | <b>Semester</b>                            | II        |
| <b>Hrs/Week</b>       | 6         |                                                       | <b>Credits</b>                             | 04        |

### Course Outcomes (CO)

| <b>CO Number</b> | <b>CO Statement</b>                                                                                         | <b>Knowledge Level</b> |
|------------------|-------------------------------------------------------------------------------------------------------------|------------------------|
| CO1              | To understand the concepts of Variational problems.                                                         | K2                     |
| CO2              | To gain knowledge about Variational Problem.                                                                | K3, K4                 |
| CO3              | To understand various types of integral equation.                                                           | K1, K2                 |
| CO4              | To analyze the Fredholm integral equations.                                                                 | K4                     |
| CO5              | To Evaluate Gram Schmit orthogonalization process and Solution of Fredholm integral equation of first kind. | K5, K6                 |

#### **UNIT – I: Variational problems with fixed boundaries (18 Hrs)**

The concept of variation and its properties- Euler's equation- Variational problems for Functionals- Functionals dependent on higher order derivatives – Functions of several independent variables – Some applications to problems of Mechanics. Chapter- 1 (Sec 1.1- 1.7)

#### **UNIT – II : Variational problems with moving boundaries (18 Hrs)**

Movable boundary for a functional dependent on two functions – one-side variations – Reflection and Refraction of external rays – Diffraction of light rays. Chapter – 2 ( Sec 2.1 – 2.5)

#### **UNIT – III :Integral Equation (18 Hrs)**

Introduction – Types of Kernels – Eigen Values and Eigen Functions – Connection with differential equation – Solution of an integral equation – Initial value problems – Boundary value problems. Chapter – 1( Sec 1.1 – 1.3 & 1.5 – 1.8)

#### **UNIT – IV : Solution of Fredholm integral equation (18 Hrs)**

Second kind with separable kernel – Orthogonality and reality eigen function - Fredholm integral equation with separable kernel - Solution of Fredholm integral equation by successive substitution – Successive approximation – Volterra integral equation - Solution of successive substitution .

Chapter – 2 (Sec 2.1 – 2.3), Chapter – 4 ( Sec 4.1 – 4.5)

**UNIT – V : Hilbert – Schmidt Theory****(18 Hrs)**

Complex Hilbert Space – Orthogonal system of functions – Gram Schmit orthogonlization process - Hilbert – Schmidt Theorem - Solution of Fredholm integral equation of first kind.

Chapter – 3( Sec 3.1 – 3.4 , 3.8 – 3.9)

**TOTAL :****90 Hours**

|                                                 |
|-------------------------------------------------|
| Power point Presentations, Seminar & Assignment |
|-------------------------------------------------|

**TEXT BOOKS:**

1. **A.S. Gupta**, *Calculus of Variations with Application*, Prentice Hall of India, New Delhi, 2005.
2. **Sudir K.Pundir and Rimple Pundir**, *Integral Equations and Boundary Value Problems*, Pragati Prakasam, Meerut, 2005.

**REFERENCE BOOKS:**

1. **F.B.Hildebrand**, *Methods of Applied Mathematics*, Prentice Hall of India Pvt. New Delhi, 1968.
  2. **R.P.Kanwal**, *Linear Integral Equations-Theory and Techniques*, Academic Press, New York, 1971.
  3. **L.Elsgolts**, *Differential Equations and Calculus of Variations*, Mir Publishers, Moscow, 1973.
- Sadri Hassani**, *Mathematical Methods*, pub 2009.

**ONLINE SOURCES:**

1. <http://physics.bgu.ac.il/~gedalin/Teaching/Master/mmp.pdf>
2. <http://home.iitk.ac.in/~dasgupta/Mathbook/Imastertrans.pdf>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | L   | S   | S   | L   | M   | L   | S   | L    | S    | L    | L    | L    | S    |
| CO2                    | S   | S   | M   | M   | S   | M   | L   | S   | M   | L    | S    | M    | M    | S    | M    |
| CO3                    | S   | L   | S   | S   | M   | L   | S   | M   | S   | M    | S    | M    | M    | M    | S    |
| CO4                    | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO5                    | S   | M   | L   | S   | S   | S   | S   | M   | S   | M    | L    | S    | M    | M    | M    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                                |                                            |                 |
|-----------------------|-----------|----------------------------------------------------------------|--------------------------------------------|-----------------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                         | <b>Master of Science<br/>(Mathematics)</b> |                 |
| <b>Course Code</b>    | 20P2MAE04 | <b>Title</b>                                                   | <b>Batch</b>                               | 2022-2024       |
|                       |           | <b>GROUP B: ELECTIVE II:<br/>COMBINATORIAL<br/>MATHEMATICS</b> |                                            | <b>Semester</b> |
| <b>Hrs/Week</b>       | 6         |                                                                | <b>Credits</b>                             | 04              |

### Course Outcomes (CO)

| CO Number | CO Statement                                                    | Knowledge Level |
|-----------|-----------------------------------------------------------------|-----------------|
| CO1       | To Understand the concepts of Permutations and Combinations.    | K1, K2          |
| CO2       | To analyze the concepts of Generating functions                 | K4              |
| CO3       | To solve the problems of recurrence relations with two indices. | K5, K6          |
| CO4       | To gain knowledge in rook polynomials                           | K2, K3          |
| CO5       | To analyze the concept of Polya's theory of counting            | K4, K5          |

#### UNIT-I: (18 Hrs)

Permutations and combinations – distributions of distinct objects – distributions of non distinct objects – Stirlings formula. Chapter 1 (Sec 1.3 -1.7)

#### UNIT-II: (18 Hrs)

Generating functions – generating function for combinations – enumerators for permutations – distributions of distinct objects into non – distinct cells – partitions of integers – the Ferrer's graphs – elementary relations. Chapter 2 (Sec 2.1 -2.7)

#### UNIT-III: (18 Hrs)

Recurrence relation – linear recurrence relations with constant coefficients - solutions by the technique of generating functions – a special class of non linear difference equations – recurrence relations with two indices. Chapter 3 (Sec 3.1 -3.5)

#### UNIT-IV: (18 Hrs)

The principle of inclusion and exclusion – general formula – permutations with restriction on relative positions – derangements – the rook polynomials – permutations with forbidden positions. Chapter 4 (Sec 4.1 -4.7)

#### UNIT-V: (18 Hrs)

Polya's theory of counting – equivalence classes under a permutation group Burnside theorem – equivalence classes of functions – weights and inventories of functions – Polya's fundamental theorem – generation of Polya's theorem. Chapter 5 (Sec 5.3 -5.7)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

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

**REFERENCE BOOKS:**

1. **Marshall Hall Jr, *Combinatorial Theory*, John Wiley & sons, second edition.**

2. **H.J. Rayser, *Combinatorial Mathematics*, Carus Mathematical Monograph.**

**ONLINE SOURCES:**

1. [www.ejournal.com](http://www.ejournal.com)

2. [www.ebook.com](http://www.ebook.com)

3. [www.freebookcentre.net](http://www.freebookcentre.net)

**Mapping with Programme Outcomes**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2     | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO3     | S   | M   | L   | S   | S   | S   | S   | M   | S   | M    | L    | S    | M    | M    | M    |
| CO4     | S   | M   | S   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | L    | S    |
| CO5     | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**



|                       |           |                                |                                        |           |
|-----------------------|-----------|--------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>         | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 21P2MAE10 | <b>Title</b>                   | <b>Batch</b>                           | 2022-2024 |
|                       |           | <b>GROUP B1: ELECTIVE II :</b> | <b>Semester</b>                        | II        |
| <b>Hrs/Week</b>       | 6         | <b>NEURAL NETWORKS</b>         | <b>Credits</b>                         | 4         |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                                                                                          | <b>Knowledge Level</b> |
|------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------|
| CO1              | Understand and analyze different neuron network models                                                                       | K2 &K4                 |
| CO2              | Understand the basic ideas behind most common learning algorithms for multilayerperceptions, radial-basis function networks. | K2                     |
| CO3              | Describe Hebb rule and analyze back propagation algorithm with examples.                                                     | K4                     |
| CO4              | Study convergence and generalization and implement common learning algorithm,                                                | K6                     |
| CO5              | Study directional derivatives and necessary conditions for optimality and toevaluate quadratic functions.                    | K5                     |

**Unit: I**

**Neuron Model and Network Architectures**

**(18 Hrs)**

Mathematical Neuron Model- Network Architectures- Perceptron-Hamming Network- HopfieldNetwork-Learning Rules.

**Unit :II**

**Perceptron Architectures**

**(18 Hrs)**

Perceptron Architectures and Learning Rule with Proof of Convergence. Supervised HebbianLearning -Linear Associator.

**Unit :III**

**Supervised Hebbian Learning**

**(18 Hrs)**

The Hebb Rule-Pseudo inverse Rule-Variations of Hebbian Learning-Back Propagation - Multilayer Perceptrons.

**Unit :IVBack Propagation (18 Hrs)**

Back propagation Algorithm-Convergence and Generalization - Performances Surfaces and Optimum Points-Taylor series.

**Unit :V**

**Performance Surfaces and Performance Optimizations**

**(18 Hrs)**

Directional Derivatives - Minima-Necessary Conditions for Optimality-Quadratic Functions- Performance Optimizations-Steepest Descent-Newton's Method-Conjugate Gradient.

**TOTAL :  
Hours**

**90**

Power point Presentations, Seminar ,Quiz, Assignment

**TEXT BOOK:**

1 Martin T. Hagan, Howard B. Demuth and Mark Beale, Neural Network Design, Vikas Publishing House, New Delhi,2002.

**REFERENCE BOOKS :**

1. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications and Programming Techniques, Pearson Education, 2003.

2. Robert J. Schalkoff, Artificial Neural Network, McGraw-Hill International Edition, 1997.

**ONLINE SOURCES:**

1. <https://nptel.ac.in/downloads/111106054/>

2. <https://ocw.mit.edu>.

3. <https://swayam.gov.in>

4. [www.freebookcentre.net](http://www.freebookcentre.net)

**Mapping with Programme Outcomes**

| <b>PO<br/>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1              | S   | L   | M   | M   | M   | L   | M   | S   | S   | M    | M    | M    | M    | L    | S    |
| CO2              | S   | M   | M   | L   | L   | L   | L   | M   | M   | M    | S    | M    | M    | M    | S    |
| CO3              | L   | M   | M   | S   | L   | L   | L   | M   | M   | M    | M    | L    | L    | L    | S    |
| CO4              | M   | M   | L   | L   | M   | L   | L   | L   | M   | S    | M    | M    | M    | M    | S    |
| CO5              | M   | M   | M   | L   | L   | L   | L   | S   | M   | M    | S    | S    | M    | L    | S    |

**S - Strong; M - Medium; L – Low**

### SEMESTER- III

|                       |          |                                      |                                            |           |
|-----------------------|----------|--------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>               | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P3MA09 | <b>Title</b>                         | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE IX: COMPLEX<br/>ANALYSIS</b> | <b>Semester</b>                            | III       |
| <b>Hrs/Week</b>       | 6        |                                      | <b>Credits</b>                             | 05        |

#### Course Outcomes (CO)

| CO Number | CO Statement                                                                                  | Knowledge Level |
|-----------|-----------------------------------------------------------------------------------------------|-----------------|
| CO1       | Understand the concepts of Limits and continuity.                                             | K1, K2          |
| CO2       | Apply Cauchy's theorem for a Rectangle and Cauchy's theorem in a Disk.                        | K3              |
| CO3       | Analyze the Calculus of Residues and Harmonic Functions.                                      | K4, K5          |
| CO4       | Determine Series and Product Development, Partial Fractions and Factorization.                | K5              |
| CO5       | Evaluate the Riemann Mapping Theorem, Conformal Mapping of Polygons and Mapping on Rectangle. | K5, K6          |

**Unit I: (18 Hrs)**

Introduction to the concept of analytic function: Limits and continuity – Analytic functions – Polynomials – Rational functions – Conformality : Arcs and closed curves – Analytic functions in regions – Conformal Mapping – Length and Area – Linear Transformations: The Linear group – The Cross ratio – Elementary Riemann Surfaces.

Chapter – 2 (Sec 1.1 – 1.4), Chapter – 3 (Sec 2.1 – 2.4, 3.1, 3.2, 3.4)

**Unit II: (18 Hrs)**

Complex Integration: Line Integrals Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's theorem for a rectangle - Cauchy's theorem in a disk , Cauchy's Integral formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives Removable singularities, Taylor's Theorem – Zeros and Poles – The Local Mapping – The Maximum principle – chains and cycles.

Chapter – 4 (Sec 1.1 – 1.5, 2.1 – 2.3, 3.1 - 3.4, 4.1)

**Unit III: (18 Hrs)**

The Calculus of Residues: The Residue theorem – The Argument principle – Evaluation of definite integrals, Harmonic functions: The Definitions and basic Properties – Mean value property – Poisson's Formula.

Chapter – 4 (Sec 5.1 – 5.3, 6.1 – 6.3)

**Unit IV: (18 Hrs)**

Series and Product Developments: Weierstrass Theorem – The Taylor Series – The Laurent Series – Partial fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products.

Chapter – 5 (Sec 1.1 – 1.3, 2.1 – 2.3)

**Unit V: (18 Hrs)**

The Riemann Mapping Theorem – Statement and Proff – Boundary Behaviour – Use of the reflection principle – Analytic arcs – Conformal mapping of Polygons: The Behaviour at an angle – The Schwarz – Christoffel Formula – Mapping on a rectangle.

Chapter – 6 (Sec 1.1 – 1.4, 2.1 – 2.3)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

L.V. Ahlfors, *Complex Analysis*, Mc Graw Hill, New York, 2016.

**REFERENCE BOOKS:**

1. Walter Rudin, *Real and Complex Analysis*, McGraw. Hill Book Company.
2. Tristan neetham, *Visual complex analysis*, clarentan press, Oxford.
3. S.Arumugam, A.Thangapandi Issac, A.Somasundaram, *Complex Analysis*, Scitech Publications(India), Pvt.Ltd., Chennai, 2014.
4. A.R.Vasishtha, Vipin Vasishtha, *Complex Analysis*, Krishna Prakashan Media, Ltd, 2002.

**ONLINE SOURCES:**

1. [www.freebookcentre.net](http://www.freebookcentre.net)
2. [www.nptel.ac.in/courses/complex](http://www.nptel.ac.in/courses/complex)
3. <https://www.math.upenn.edu>

**Mapping with Programme Outcomes**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | S   | M   | M   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | M    | S    |
| CO2     | M   | M   | S   | S   | S   | M   | S   | L   | L   | L    | M    | L    | M    | M    | S    |
| CO3     | M   | M   | S   | S   | S   | S   | M   | L   | L   | L    | S    | M    | S    | S    | S    |
| CO4     | M   | M   | S   | S   | S   | S   | S   | L   | L   | L    | M    | M    | M    | L    | S    |
| CO5     | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | M    | M    | M    | L    | S    |

**S - Strong; M - Medium; L – Low**

|                       |          |                         |                                            |           |
|-----------------------|----------|-------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>  | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P3MA10 | <b>Title</b>            | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE X: TOPOLOGY</b> | <b>Semester</b>                            | III       |
| <b>Hrs/Week</b>       | 5        |                         | <b>Credits</b>                             | 5         |

### Course Outcomes (CO)

| <b>CO Number</b> | <b>CO Statement</b>                                                           | <b>Knowledge Level</b> |
|------------------|-------------------------------------------------------------------------------|------------------------|
| CO1              | To recall the basic ideas about Topology, Open set, Closed set.               | K1                     |
| CO2              | Discuss the concepts Topological spaces, order topology and product topology. | K2, K3                 |
| CO3              | To analyze the Connectedness.                                                 | K4                     |
| CO4              | To Gain knowledge in Compactness.                                             | K3, K4                 |
| CO5              | To Evaluate Countability axioms and Separation axioms.                        | K5                     |

#### Unit-I: Topological spaces

(15 hrs)

Topological spaces - Basis for a Topology - The order topology - Product topology on  $X \times Y$  - The subspace topology - Closed sets and Limit points.

Chapter – 2 (Sec 12-17)

#### Unit-II: Continuous Functions

(15 hrs)

Continuous functions - The product topology - The metric topology.

Chapter – 2 (Sec 18-21)

#### Unit-III: Connectedness

(15 hrs)

Connected spaces - Connected subspaces of the real line - Components and local connectedness.

Chapter – 3 (Sec 23-25)

#### Unit-IV: Compactness

(15 hrs)

Compact spaces - Compact subspaces of the real line - limit point compactness - local compactness.

Chapter – 3 (Sec 26-29)

#### Unit-V: Countability and separation axioms

(15 hrs)

The Countability axioms - The separation axioms - Normal spaces - The Urysohn lemma - The Urysohn metrization theorem - The Tietze extension theorem.

Chapter – 4 Sections 30-35

**TOTAL :**

**75 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

**James R. Munkres, “Topology”,** Second Edition, Prentice Hall of India Private Limited, New Delhi, 2014.

**REFERENCE BOOKS:**

1. **J. Dugundji, “Topology”,** Allyn and Bacon, 1975.
2. **George F.Simmons, “Introduction to Topology and Modern Analysis”,** McGraw Hill 2006.
3. **S.T.Hu, “Elements of general topology”,** Holden day,Inc,New York, 1988.
4. **K. Chandrasekara Rao, “Topology”,** Narosa Publishing House, Pvt., Ltd., 2009.

**ONLINE SOURCES:**

1. <https://nptel.ac.in/downloads/111106054/>
2. <https://ocw.mit.edu>.
3. <https://swayam.gov.in>
4. [www.freebookcentre.net](http://www.freebookcentre.net)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2                    | S   | M   | L   | S   | S   | L   | S   | S   | S   | M    | S    | L    | S    | M    | S    |
| CO3                    | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO4                    | S   | S   | M   | M   | S   | M   | L   | S   | M   | L    | S    | M    | M    | S    | M    |
| CO5                    | S   | M   | S   | S   | S   | S   | M   | M   | M   | M    | S    | L    | L    | L    | M    |

**S - Strong; M - Medium; L – Low**

|                       |          |                                              |                                            |           |
|-----------------------|----------|----------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>                       | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P3MA11 | <b>Title</b>                                 | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE PAPER XI:<br/>NUMERICAL ANALYSIS</b> | <b>Semester</b>                            | III       |
| <b>Hrs/Week</b>       | 5        |                                              | <b>Credits</b>                             | 4         |

### Course Outcomes (CO)

| CO Number | CO Statement                                                                          | Knowledge Level |
|-----------|---------------------------------------------------------------------------------------|-----------------|
| CO1       | To recall the basic concepts of Newton's method, Trapezoidal rule and Simpson's rules | K1, K2          |
| CO2       | To understand various types of methods to solve the Differential Equations.           | K2              |
| CO3       | To solve the problems of ODE.                                                         | K5, K6          |
| CO4       | To gain knowledge in Boundary Value Problems And Characteristic Value Problems        | K3, K4          |
| CO5       | To Analyze the concept of Numerical Solution Of Partial Differential Equations        | K4, K5          |

#### Unit I: Solution Of Nonlinear Equations (15 Hrs)

Newton's method – Convergence of Newton's method – Bairstow's Method for quadratic factors. **Numerical Differentiation And Integration:** Derivatives from Differences tables – Higher order derivatives – Divided difference, Central-Difference formulas – Composite formula of Trapezoidal rule – Romberg integration – Simpson's rules. Chapter 1

#### Unit II : Solution Of System Of Equations (15 Hrs)

The Elimination method – Gauss and Gauss Jordan methods – LU Decomposition method – Matrix inversion by Gauss-Jordan method – Methods of Iteration – Jacobi and Gauss Seidal Iteration – Relaxation method – Systems of Nonlinear equations. Chapter 2

#### Unit III: Solution Of Ordinary Differential Equations (15 Hrs)

Taylor series method – Euler and Modified Euler methods – Rungekutta methods – Multistep methods – Milne's method – Adams Moulton method. Chapter 6

#### Unit IV: Boundary Value Problems And Characteristic Value Problems (15 Hrs)

The shooting method – solution through a set of equations – Derivative boundary conditions – Characteristic value problems – Eigen values of a matrix by Iteration – The power method. Chapter 6

#### Unit V: Numerical Solution Of Partial Differential Equations (15 Hrs)

(Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations) Representation as a difference equation – Laplace's equation on a rectangular region – Iterative methods for Laplace equation – The Poisson equation – Derivative boundary conditions – Solving the equation for time-dependent heat flow (i) The Explicit method (ii) The Crank Nicolson method – solving the wave equation by Finite Differences. Chapter 8

**TOTAL :**

**75 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

**C.F.Gerald and P.O.Wheatley, “Applied Numerical Analysis”,** Fifth Edition, Addison Wesley, (1998).

**REFERENCE BOOKS :**

1. **M.K. Venkatraman, “Numerical Methods in Science and Technology”,** National Publishers Company, 2<sup>nd</sup> Edition,(1992).

2. **S.C. Chapra and P.C. Raymond, “Numerical Methods for Engineers”,** tata McGraw Hill, (2000)

3. **P. Kandasamy et al., “Numerical Methods”,**S.Chand & Company Ltd.(2003).

**ONLINE SOURCES:**

1. <https://nptel.ac.in/downloads/111106054/>

2. <https://ocw.mit.edu>.

3. <https://swayam.gov.in>

4. [www.freebookcentre.net](http://www.freebookcentre.net)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | L   | S   | S   | M   | M   | M   | M   | L    | S    | M    | L    | L    | S    |
| CO2                    | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO3                    | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |
| CO4                    | S   | M   | S   | S   | S   | S   | L   | S   | L   | L    | S    | L    | M    | M    | S    |
| CO5                    | M   | M   | S   | S   | S   | S   | M   | L   | L   | L    | S    | M    | S    | S    | S    |

**S - Strong; M - Medium; L – Low**



|                       |          |                               |                                        |           |
|-----------------------|----------|-------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>        | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 20P3MA12 | <b>Title</b>                  | <b>Batch</b>                           | 2022-2024 |
|                       |          | <b>CORE XII: GRAPH THEORY</b> | <b>Semester</b>                        | III       |
| <b>Hrs/Week</b>       | 4        |                               | <b>Credits</b>                         | 4         |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                        | <b>Knowledge Level</b> |
|------------------|------------------------------------------------------------|------------------------|
| CO1              | To Understand the concepts of related to Graphs and Trees. | K1, K2                 |
| CO2              | To gain knowledge about connectivity and trees.            | K3, K4                 |
| CO3              | To apply the Concept in Matchings and colorings            | K3                     |
| CO4              | To analyze Graph Colorings.                                | K4                     |
| CO5              | To Evaluate Planarity.                                     | K5, K6                 |

**Unit I:** (12 Hrs)

**Basic Results:** Introduction-Basic Concepts-Subgraphs-Degrees of Vertices - Paths and Connectedness - Automorphism of a Simple Graph. Directed Graphs: Introduction-Basic Concepts-Tournaments.

Chapter 1 (Sec 1.1 – 1.6), Chapter 2 (Sec 2.1 – 2.3)

**Unit II:** (12 Hrs)

**Connectivity and Trees:** Connectivity: Introduction-Vertex cut and Edge Cut-Connectivity and Edge Connectivity. Trees: Introduction-Definition, Characterization and Simple Properties-Centers and Centroids- Cutting the Number of Spanning Trees-Cayley's Formula.

Chapter 3 (Sec 3.1 – 3.3), Chapter 4(4.1 – 4.4)

**Unit III:** (12 Hrs)

**Independent Sets, Matchings and Cycles:** Independent Sets and Matchings: Introduction-Vertex-Independent Sets and Vertex Coverings-Edge-Independent sets-Matchings and Factors-Matchings in Bipartite Graphs. Cycles: Introduction-Eulerian Graphs - Hamiltonian Graphs.

Chapter 5 (Sec 5.1 – 5.5), Chapter 6(6.1 – 6.3)

**Unit IV:** (12 Hrs)

**Graph Colorings:** Introduction-Vertex colorings-Critical Graphs-Edge colorings of Graphs-Kirkman's Schoolgirl- Problem-Chromatic Polynomials.

Chapter 7(7.1 – 7.3,7.6,7.8,7.9),

**UNIT V:** (12 Hrs)

**Planarity:** Introduction- Planar and Nonplanar Graphs –Euler Formula and its Consequences and  $K_{3,3}$  are Nonplanar Graphs – Dual of a Plane Graph- The Four-Color Theorem and the Heawood Five-Color Theorem-Hamiltonian Plane Graphs-Tait Coloring.

Chapter 8(8.1 – 8.6,8.8,8.9)

**TOTAL :**

**60 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

**R.Balakrishnan and K.Ranganathan, “Text Book of Graph Theory”, (2nd Edition), Springer, 2012.**

**REFERENCE BOOKS:**

1. **J.A.Bondy and U.S.R. Murty, “Graph Theory with Applications”, 1982.**
2. **Narasing Deo, “Graph Theory with Application to Engineering and Computer Science”, Prentice Hall of India, 2003.**
3. **F. Harary, “Graph Theory”, Addison – Wesley Pub. Co. The Mass. 1969.** 4. **L. R.. Foulds, Graph Theory Application, Narosa Publ. House, Chennai, 1933.**
4. **K.R.Partha sarathy “Introduction to graph theory”, Prentice Hall of India, 2003.**

**ONLINE SOURCES :**

1. <https://nptel.ac.in/downloads/111106054/>
2. <https://ocw.mit.edu>.
3. <https://swayam.gov.in>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | L   | S   | S   | M   | M   | M   | M   | L    | S    | M    | L    | L    | S    |
| CO2                    | S   | L   | S   | S   | S   | S   | S   | S   | M   | L    | S    | L    | S    | M    | S    |
| CO3                    | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | L    | L    | M    | M    | M    |
| CO4                    | M   | M   | S   | S   | S   | S   | S   | L   | L   | L    | M    | M    | M    | L    | S    |
| CO5                    | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                               |                                            |           |
|-----------------------|-----------|---------------------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                        | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P3MAE05 | <b>Title</b>                                                  | <b>Batch</b>                               | 2022-2024 |
|                       |           | <b>GROUP C: ELECTIVE III:<br/>OPTIMIZATION<br/>TECHNIQUES</b> | <b>Semester</b>                            | III       |
| <b>Hrs/Week</b>       | 5         |                                                               | <b>Credits</b>                             | 4         |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                                         | <b>Knowledge Level</b> |
|------------------|-----------------------------------------------------------------------------|------------------------|
| CO1              | To understand the concepts of duality in Linear programming problem.        | K1, K2                 |
| CO2              | To know about decision analysis and games.                                  | K2, K3                 |
| CO3              | To apply the idea about Simulation modeling through Monte Carlo simulation. | K3, K4                 |
| CO4              | To analyze Non linear programming problem.                                  | K4                     |
| CO5              | To Evaluate Quadratic programming problem.                                  | K5                     |

**Unit I: Duality Linear Programming (15 Hrs)**

General Primal-Dual – Formulating a Dual problem – Duality and Simplex Method – Dual Simplex Method.

Chapter 4 (Sec 4.1 – 4.3)

**Unit II: Decision analysis and games (15 Hrs)**

Decision environment – Decision making under certainty (Analytical Hierarchy approach) Decision making under risk – Expected value criterion – Variations of the expected value criterion – Decision under uncertainty -Game theory – optimal solution of two – Person Zero – Sum games – Solution of mixed strategy games.

Chapter 13 (Sec 13.1 – 13.4)

**Unit III: Simulation modeling (15 Hrs)**

What is simulation – Monte Carlo simulation – Types of simulation – Elements of discrete event simulation – Generic definition of events – Sampling from probability distributions - Methods for gathering statistical observations – Sub interval method – Replication method – Regenerative (Cycle) method – Simulation languages.

Chapter 16 (Sec 16.1 – 16.7)

**Unit IV: Nonlinear Programming Problem (15 Hrs)**

Formulation – General NLPP – Constrained optimization with equality constraints - Constrained optimization with inequality constraints.

Chapter 27 (Sec 27.1 – 27.7)

**Unit V: Nonlinear programming Methods (15 Hrs)**

Graphical solution – Khun-Tucker Conditions with non-negative constraints - Quadratic programming – Wolfe’s method - Separable convex programming - Geometric programming.

Chapter 28 (Sec 28.1 – 28.5, 28.8), Chapter 29 (Sec 29.1 – 29.4)

**TOTAL:**

**75 Hours**

Power point Presentations, Seminar ,Quiz, Assignment

**TEXT BOOK:**

1. H.A. Taha, “*Operation Research an Introduction*”, Prentice Hall India, 2003.(Unit I , II , & III)
2. Kanti swarup, P.K. Gupta and Man Mohan , “*Operations Research*”, Sultan Chand & Sons, 2015. (Unit IV & V)

**REFERENCE BOOKS:**

1. F.S. Hillier and G.J. Lieberman, “*Introduction to Operation Research*”, Mc Graw Hill Book Company, 1989.
2. Philips D.T.Ravindra A. and J. Solbery,“*Operations Research*”, *Principles and Practice*, John Wiley and Sons, New York.
3. B.E.Gillett, *Operations research – A Computer Oriented Algorithmic Approach*,TMH Edition, New Delhi, 1976.

**ONLINE SOURCES:**

1. <https://nptel.ac.in/downloads/111106054/>
2. <https://ocw.mit.edu>.
3. <https://swayam.gov.in>

**Mapping with Programme Outcomes**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2     | S   | M   | S   | S   | S   | M   | S   | S   | L   | M    | L    | S    | M    | S    | S    |
| CO3     | S   | S   | M   | M   | S   | M   | L   | S   | M   | L    | S    | M    | M    | S    | M    |
| CO4     | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | S    | S    | M    | L    | S    |
| CO5     | S   | M   | L   | S   | S   | S   | S   | M   | S   | L    | S    | M    | M    | M    | M    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                                         |                                            |           |
|-----------------------|-----------|-------------------------------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                                  | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P3MAE06 | <b>Title</b>                                                            | <b>Batch</b>                               | 2022-2024 |
|                       |           | <b>GROUP C: ELECTIVE III:<br/>FUZZY SETS AND THEIR<br/>APPLICATIONS</b> | <b>Semester</b>                            | III       |
| <b>Hrs/Week</b>       | 5         |                                                                         | <b>Credits</b>                             | 4         |

### Course Outcomes (CO)

| CO Number | CO Statement                                       | Knowledge Level |
|-----------|----------------------------------------------------|-----------------|
| CO1       | To understand the basic concepts of fuzzy sets.    | K1, K2          |
| CO2       | To know about fuzzy complements and intersections. | K2, K3          |
| CO3       | To apply the idea about linguistic variables.      | K3, K4          |
| CO4       | To analyze the binary relations of fuzzy .         | K4              |
| CO5       | To Evaluate ranking methods.                       | K5              |

#### **UNIT-I: From Classical Sets To Fuzzy Sets , Fuzzy Sets Verses Crisp Sets (15 Hrs)**

Fuzzy sets : Basic types – Fuzzy sets : Basic Concepts – Additional Properties – cuts – Extension Principle for fuzzy sets. Chapter 1(Sec: 1.3, 1.4), Chapter 2(Sec:2.1, 2.3)

#### **UNIT-II: Operations On Fuzzy Sets (15 Hrs)**

Types of operations – Fuzzy complements- Fuzzy Intersections : t – Norms – Fuzzy Unions – conforms- Combinations of Operations. Chapter 3(Sec: 3.1- 3.5)

#### **UNIT-III: Fuzzy Arithmetic (15Hrs)**

Fuzzy Numbers – Linguistic Variables – Arithmetic Operations On Intervals – Arithmetic Operations On Fuzzy Numbers. Chapter 4(Sec: 4.1- 4.4)

#### **UNIT-IV: Fuzzy Relations (15 Hrs)**

Binary Fuzzy Relations- Binary Relations On A Single Set –Fuzzy Equivalence Relations-Fuzzy Compatibility Relations- Fuzzy Ordering Relations-Fuzzy Morphisms. Chapter 5 (Sec: 5.3- 5.8)

#### **UNIT-V : Fuzzy decision making (15 Hrs)**

Individual Decision Making- Multi person Decision Making- Ranking Methods- Fuzzy Linear Programming. Chapter 15 (Sec: 15.2, 15.3, 15.6, 15.7)

**TOTAL:**

**75 Hours**

Power point Presentations, Seminar ,Quiz, Assignment

**TEXT BOOK:**

**George J.klir and Bo Yuan, *Fuzzy Sets and Fuzzy Logic Theory and Applications*, Prentice Hall of India, (2005).**

**REFERENCE BOOKS:**

1. **H.J.Zimmermann, *Fuzzy set theory and its applications* , Allied publishers limited (1991).**
2. **M.Ganesh, *Introduction to Fuzzy sets and Fuzzy logic*, Prentice Hall of India , New Delhi, 2006.**

**ONLINE SOURCES:**

- [www.ejournal.com](http://www.ejournal.com)
- [www.ebook.com](http://www.ebook.com)
- [www.freebookcentre.net](http://www.freebookcentre.net)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | M   | M   | S   | S   | S   | S   | M   | M   | L   | S    | S    | M    | M    | S    | S    |
| CO2                    | M   | M   | S   | S   | S   | M   | S   | M   | M   | L    | M    | M    | M    | M    | S    |
| CO3                    | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |
| CO4                    | M   | M   | S   | S   | S   | S   | S   | L   | M   | L    | L    | S    | M    | L    | S    |
| CO5                    | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                |                                        |           |
|-----------------------|-----------|------------------------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                         | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 21P3MAE11 | <b>Title</b>                                   | <b>Batch</b>                           | 2022-2024 |
|                       |           | <b>GROUP C1: ELECTIVE III : CONTROL THEORY</b> | <b>Semester</b>                        | III       |
| <b>Hrs/Week</b>       | 5         |                                                | <b>Credits</b>                         | 4         |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                                                                                                              | <b>Knowledge Level</b> |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| CO1              | Explain observability and estimate the observability of constant coefficientsystem, linear, nonlinear system, and discuss reconstruction kernel. | K2                     |
| CO2              | Apply controllability criteria to constant coefficient system, linear, nonlinear system, and explain steering function.                          | K3                     |
| CO3              | Analyze the stability of linear system, linear time varying system, perturbed linearsystem and nonlinear system.                                 | K4                     |
| CO4              | Evaluate stabilizabilization via linear feedback control, Bass method.                                                                           | K5                     |
| CO5              | Analyze controllable subspace, and stabilization with restricted feedback.                                                                       | K4                     |

**UNIT – I: Observability (15 Hrs)**

Linear Systems – Observability Grammian – Constant coefficient systems – Reconstruction kernel – Nonlinear Systems.

**UNIT - II : Controllability (15 Hrs)**

Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems.

**UNIT – III : Stability (15 Hrs)**

Stability – Uniform Stability – Asymptotic Stability of Linear Systems.

**Unit – IV : Perturbed Linear Systems (15 Hrs)**

Linear time varying systems – Perturbed linear systems – Nonlinear systems.

**UNIT - V : Stabilizability (15 Hrs)**

Stabilization via linear feedback control – Bass method – Controllable subspace – Stabilizationwith restricted feedback.

**TOTAL : ( 75 Hours)**

Power point Presentations, Seminar & Assignment

**TEXT BOOK :**

K. Balachandran and J. P. Dauer, Elements of Control Theory, Narosa, New Delhi, 1999.

**REFERENCE BOOKS:**

1. R. Conti, Linear Differential Equations and Control, Academic Press, London, 1976.
2. R. F. Curtain and A. J. Pritchard, Functional Analysis and Modern Applied Mathematics, Academic Press, New York, 1977.
3. J. Klamka, Controllability of Dynamical Systems, Kluwer Academic Publisher, Dordrecht, 1991.
4. D. L. Russell, Mathematics of Finite Dimensional Control Systems, Marcel Dekker, New York, 1979.
5. E. B. Lee and L. Markus, Foundations of optimal Control Theory, John Wiley, New York, 1967.

**ONLINE SOURCES:**

1. <https://ocw.mit.edu>.
2. <https://nptel.ac.in>
3. <https://swayam.gov.in>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | M   | L   | S   | S   | M   | L   | M   | M    | S    | M    | L    | M    | S    |
| CO2                    | M   | M   | S   | M   | M   | M   | M   | M   | M   | S    | S    | M    | L    | L    | S    |
| CO3                    | S   | S   | M   | M   | M   | M   | S   | S   | S   | S    | S    | L    | S    | M    | S    |
| CO4                    | M   | M   | S   | S   | S   | S   | L   | M   | S   | M    | S    | L    | S    | S    | S    |
| CO5                    | S   | S   | M   | S   | M   | M   | L   | M   | M   | M    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**



|                       |           |                                                            |                                            |           |
|-----------------------|-----------|------------------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                     | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 18P3CED01 | <b>Title</b>                                               | <b>Batch</b>                               | 2022-2024 |
|                       |           | <b>EDC: INTRODUCTION TO<br/>INFORMATION<br/>TECHNOLOGY</b> | <b>Semester</b>                            | III       |
| <b>Hrs/Week</b>       | 3         |                                                            | <b>Credits</b>                             | 2         |

### Course Outcomes (CO)

| <b>CO Number</b> | <b>CO Statement</b>                                                   | <b>Knowledge Level</b> |
|------------------|-----------------------------------------------------------------------|------------------------|
| CO1              | To learn about difference between data and information.               | K1, K2                 |
| CO2              | To gain knowledge about the Hardware and Software concepts.           | K1,K2                  |
| CO3              | To understand about Multimedia concepts in a computer.                | K2                     |
| CO4              | To create awareness about computer network and communication systems. | K5, K6                 |
| CO5              | To develop the internet technologies and WWW ideas.                   | K6                     |

#### **UNIT I**

**(9 Hours)**

**INTRODUCTION TO COMPUTER:** Introduction- What is Computer?-Types of Computers- Organization of Basic computers- Applications of Computers-Limitations of Computers. **Data Representation in Computers:** Bits and Bytes-Number systems for Data Representation-Coding Schemes- Conversations of Numbers-Binary Arithmetic.

#### **UNIT II**

**(9 Hours)**

**HARDWARE DEVICES:** Introduction-Input devices-Output devices-Storage devices.  
**SOFTWARECONCEPTS:** Introduction-System software-Utility Software-Application Software.

#### **UNIT III**

**(9 Hours)**

**MULTIMIDIA:** Introduction- What is Multimedia?-Applications of Multimedia-Components of Multimedia-Hardware for Multimedia-Software Multimedia-Graphics Files.

#### **UNIT IV**

**(9 Hours)**

**DATA COMMUNICATION AND COMPUTER NETWORK:**Introduction-Data Communication-Transmission Media-Multiplexing-Switching-Computer Network-Network Topologies-Communication Protocols-Network Devices.

#### **UNIT V**

**(9 Hours)**

**INTERNET BASICS:**Introduction-Evolution of Internet-Basics Internet Terms-Getting Connected to internet-Internet Applications-E-Mail Introduction-Data Over internet- Internet and viruses.

#### **TOTAL :**

**45 Hours**

|                                                                             |
|-----------------------------------------------------------------------------|
| Power point Presentations, Seminar ,Quiz, Assignment, Animation video Class |
|-----------------------------------------------------------------------------|

**TEXT BOOKS:**

1. “Computer Fundamentals and Applications”, by Ashok Arora, VIKAS Publishing House PVT LTD, 2015.
2. “Introduction to Computer Science” IITL Education Solutions Limited, Second Edition. 2011.

**REFERENCE BOOKS:**

1. “Introduction to Information Technology” Xpress Learning, IITL Education Solutions Limited, 2012.
2. “Data Communication and Computer Network”, by Brijendra Singh, Second Edition, Prentice Hall of India PVT LTD, 2006.
3. “Introduction to Computers” by Gary B. Shelly, Thomas J Cashman & Misty E. Vermaat, Eighth Edition, 2011.

**ONLINE SOURCES:**

1. <https://homepage.cs.uri.edu/faculty/wolfe/book/Readings/Reading03.htm>
2. <https://www.computerhope.com/issues/ch000039.htm>
3. <https://www.omicsonline.org/conferences-list/multimedia-tools-and-applications>
4. <https://www.lucidchart.com/pages/templates/network-diagram/network-topology-diagram-template>
5. <https://www.sciencedirect.com/topics/computer-science/internet-architecture>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | M   | S   | M   | M   | M   | L   | M   | S    | S    | M    | L    | M    | S    |
| CO2                    | S   | L   | M   | M   | M   | S   | S   | S   | S   | S    | S    | M    | L    | M    | S    |
| CO3                    | S   | M   | M   | S   | S   | S   | M   | S   | M   | S    | S    | M    | S    | M    | S    |
| CO4                    | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | M    | M    | M    | M    | S    |
| CO5                    | M   | M   | S   | S   | S   | S   | M   | M   | L   | S    | S    | M    | M    | S    | S    |

**S - Strong; M - Medium; L – Low**

|                       |          |                               |                                        |           |
|-----------------------|----------|-------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>        | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 21P3HR04 | <b>Title</b>                  | <b>Batch</b>                           | 2022-2024 |
|                       |          | <b>VALUE BASED</b>            | <b>Semester</b>                        | III       |
| <b>Hrs/Week</b>       | 2        | <b>EDUCATION:HUMAN RIGHTS</b> | <b>Credits</b>                         | 2         |

### Course Outcomes (CO)

| CO Number | CO Statement                                                                                                | Knowledge Level |
|-----------|-------------------------------------------------------------------------------------------------------------|-----------------|
| CO1       | To create awareness, conviction & commitment to values for improving the quality of life through education. | K6              |
| CO2       | Discuss the concepts Characteristics of Human Rights.                                                       | K5              |
| CO3       | To demonstrate an understanding of Indian Constitutional Guarantee on Human Rights                          | K4,K5           |
| CO4       | To analyze Human Rights for Women .                                                                         | K3,K4           |
| CO5       | To Evaluate Human Rights in Emerging Sectors.                                                               | K5,K6           |

#### Unit-I: Introduction To Human Rights

(6 Hrs)

Definitions – Characteristics of Human Rights – Principles of Human Rights – Theories of Human Rights – Theory of Natural Rights, Social welfare Theory, Legal Theory – Classification of Human Rights- International instruments of Human Rights: Universal Declaration of Human Rights (1948) – International Covenant on Civil, Economic, Social & Cultural and Political Rights.

#### Unit-II: Indian Constitutional Guarantee on Human Rights

(6 Hrs)

Fundamental rights part III of the constitution – Directive principles part IV of the constitution – The Criminal Procedure Code, 1973 – Protection of Civil Rights Act, 1955 as amended in 1976 – The Scheduled Caste and Scheduled Tribe (Prevention of Atrocities) Act, 1989 – Optional Protocol to International Covenant on Civil & Political Rights.

#### Unit-III: Implementing Agencies of Human Rights in India

(6 Hrs)

National Human Rights Commission (N.H.R.C) – State Human Rights Commission (S.H.R.C) – National Commission for Women, 1990 – National Commission for Minorities - National Commission for Scheduled Caste and Scheduled Tribe (S.C & S.T) – Their powers and functions.

#### Unit-IV: Human Rights for Women

(6 Hrs)

Constitutional Provisions : Articles 14, 15, 15(3), 16, 39(a), 39(b), 39(c) & 42 of the constitutions – Legal Provisions : The Employees State Insurance Act, 1948, The Family Courts Act, 1954, The Special Marriage Act, 1954, The Hindu Marriage Act, 1955, The Maternity Benefit Act, 1961 (Amended in 1955), Dowry Prohibition Act, 1961, The Equal Remuneration Act, 1976, The Prohibition of Child Marriage Act, 2006, The Factories (Amendment) Act, 1986, The Protection of Women from Domestic Violence Act, 2005.

**Unit-V: Human Rights in Emerging Sectors****(6 Hrs)**

Instruments on the Rights of Children – Refugees and Human Rights – Certain incidents that pose a threat to Human Rights – Educational Rights – Rights to Employment – Right to Information Act, 2005.

**TOTAL :****30 Hours**

|                                                 |
|-------------------------------------------------|
| Power point Presentations, Seminar & Assignment |
|-------------------------------------------------|

**TEXT BOOK:**

Brian Orend, *Human Rights : Concepts and Context* – 2002.

**REFERENCE BOOKS:**

1. Arun Rai, *National Human Rights Commission of India: Formation, Functioning & Future Prospects*, Atlantic Publishers, Delhi.
2. Brinder Pal Singh Sehgal, *Human Rights in India : Problems and Perspectives*.

**ONLINE SOURCES:**

1. <https://www.tutorialspoint.com>
2. <https://en.wikipedia.org/wiki/HumanRights>
3. <http://web.mit.edu/>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | M   | M   | S   | S   | S   | S   | M   | M   | L   | S    | S    | M    | M    | S    | S    |
| CO2                    | M   | M   | S   | S   | S   | M   | S   | M   | M   | L    | M    | M    | M    | M    | S    |
| CO3                    | S   | M   | S   | S   | S   | M   | M   | S   | M   | L    | L    | L    | M    | M    | S    |
| CO4                    | M   | M   | S   | S   | S   | S   | S   | L   | M   | L    | L    | S    | M    | L    | S    |
| CO5                    | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**

## SEMESTER- IV

|                       |          |                                           |                                            |           |
|-----------------------|----------|-------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>                    | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P4MA13 | <b>Title</b>                              | <b>Batch</b>                               | 2022-2024 |
|                       |          | <b>CORE XIII: FUNCTIONAL<br/>ANALYSIS</b> | <b>Semester</b>                            | IV        |
| <b>Hrs/Week</b>       | 6        |                                           | <b>Credits</b>                             | 5         |

### Course Outcomes (CO)

| CO Number | CO Statement                                                | Knowledge Level |
|-----------|-------------------------------------------------------------|-----------------|
| CO1       | To understand the concept of Banach spaces.                 | K1, K2          |
| CO2       | To apply the Concept in Hilbert spaces.                     | K3              |
| CO3       | To demonstrate Orthogonal complements.                      | K4, K5          |
| CO4       | To analyzeself adjoint operators.                           | K4              |
| CO5       | To gain knowledge about Finite dimensional spectral theory. | K2, K3          |

**Unit I:** **(18 Hrs)**

Banach spaces: The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem.

Chapter 9 (Sec 46 - 48)

**Unit II:** **(18 Hrs)**

The natural imbedding of  $\mathbb{N}$  in  $\mathbb{N}^{**}$  - The open mapping theorem- The conjugate of an operator.  
Hilbert spaces: The definition and some simple properties.

Chapter 9 (Sec 49 - 51), Chapter 10 (Sec 52)

**Unit III:** **(18 Hrs)**

Orthogonal complements - Orthonormal sets- The Conjugate space  $H^*$  - The adjoint of an operator.

Chapter 10 (Sec 53 - 56)

**Unit IV:** **(18 Hrs)**

Self-adjoint operators – Normal and unitary operators – Projections.

Chapter 10 (Sec 57 - 59)

**Unit V:** **(18 Hrs)**

Finite dimensional spectral theory: Matrices –The spectral theorem – General preliminaries on Banach's Algebra: The definition and some examples - Regular and singular elements.

Chapter 11 (Sec 60,62), Chapter 12 (Sec 64,65)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar & Assignment

**TEXT BOOK:**

**G.F. Simmons, *Introduction to Topology and Modern Analysis*, TATA McGraw –Hill Book Company, New Delhi, 1963, 5<sup>th</sup> Reprint 2006.**

**REFERENCE BOOKS :**

1. **Dr. D. Somasundaram, *Functional Analysis*, S.Viswanathan Pvt.Ltd, 2008.**
2. **G. Bachman and L. Narici, *Functional Analysis*, Academic Press, New York, 2000.**
3. **H.C. Goffman and G. Fedrick, *First Course in Functional Analysis*, Prentice Hall of India, New Delhi, 2000.**
4. **E. Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley & Sons, New York, 1978.**
5. **E.S.Shubi, *Functional Analysis*, Springer International Edition, India, 2009.**

**ONLINE SOURCES:**

1. <https://ocw.mit.edu>
2. [www.sciencedirect.com](http://www.sciencedirect.com)
3. [www.elsevier.com](http://www.elsevier.com)
4. [www.khanacademy.org](http://www.khanacademy.org)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | S   | S   | S   | S   | L   | M   | L   | L    | S    | M    | M    | M    | S    |
| CO2                    | M   | M   | S   | S   | S   | M   | S   | L   | L   | L    | M    | L    | M    | M    | S    |
| CO3                    | M   | M   | S   | S   | S   | S   | M   | L   | L   | L    | S    | M    | S    | S    | S    |
| CO4                    | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO5                    | S   | M   | S   | S   | S   | M   | S   | S   | L   | M    | L    | S    | M    | S    | S    |

**S - Strong; M - Medium; L – Low**

|                       |          |                                     |                                        |           |
|-----------------------|----------|-------------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc     | <b>Programme Title</b>              | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 20P4MA14 | <b>Title</b>                        | <b>Batch</b>                           | 2022-2024 |
|                       |          | <b>CORE XIV: PROBABILITY THEORY</b> | <b>Semester</b>                        | IV        |
| <b>Hrs/Week</b>       | 6        |                                     | <b>Credits</b>                         | 4         |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                             | <b>Knowledge Level</b> |
|------------------|-----------------------------------------------------------------|------------------------|
| CO1              | To given the basic concept of Probability theory.               | K1, K2                 |
| CO2              | To understand the concept of moments.                           | K2, K3                 |
| CO3              | To analyze the characteristic functions                         | K4                     |
| CO4              | To apply the concepts of discrete and continuous distributions. | K3, K4                 |
| CO5              | To gain knowledge about Bernoulli Law of Large Numbers.         | K4, K5                 |

**Unit I: (18 Hrs)**

Random Events and Random variables – Random events – Probability axioms – Combinatorial formulae – Conditional Probability - Bayes Theorem – Independent events – Random variables – Distribution function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.

Chapter 1 (Sec 1.1 – 1.7), Chapter 2 (Sec 2.1 – 2.9)

**Unit II: (18 Hrs)**

Parameters of the distribution – Expectation – Moments – The Chebyshev inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.

Chapter 3 (Sec 3.1 – 3.8)

**Unit III: (18 Hrs)**

Characteristic functions – Properties of Characteristic functions - Characteristic functions and moments – Semi-invariants - Characteristic function of the sum of the independent random variables – Determination of distribution function by the characteristic function – Probability generating functions.

Chapter 4 (Sec 4.1 – 4.7)

**Unit IV: (18 Hrs)**

Some probability distributions – One point, two point, Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.

Chapter 5 (Sec 5.1 – 5.10)

**Unit V: (18 Hrs)**

Limit theorems – Stochastic convergence – Bernoulli Law of Large Numbers – Convergence of sequence of distribution functions – Levy-Crammer Theorem – De Moivre Laplace theorem – Borel-Cantelli Lemma – Kolmogorov inequality and Kolmogorov Strong Law of Large numbers.

Chapter 6 (Sec 6.1 – 6.4, 6.6 - 6.9, 6.11, 6.12)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar ,Quiz, Assignment

**TEXT BOOK:**

**M. Fisz, “Probability theory and Mathematical Statistics”, John Wiley and Sons, 1963.**

**REFERENCE BOOKS:**

1. B.R.BHAT “ **Modern Probability theory: an introductory** ” 4<sup>th</sup> edition,new age international publisher, 2007.
2. R.B. Ash, “**Real Analysis and Probability**”, Academic Press, 1972.
3. K. L. Chung, “**A course in Probability**”, Academic press, 1974.
4. Y.S.Chow and H. Teicher, “**Probability Theory**”, Springer Verlag, 1988.
5. V. K. Rohatgi, “**An Introduction to Probability Theory and Mathematical Statistics**”, Wiley Eastern Ltd., 2015.

**ONLINE SOURCES:**

1. <https://nptel.ac.in>
2. <https://www.britannica.com/topic/probability-theory>
3. <https://en.m.wikibooks.org>
4. <http://study.com/academy/lesson/basic-probability-theory-rules-formulas.html>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | S   | S   | M   | L   | M   | L   | M   | L    | S    | L    | L    | L    | S    |
| CO2                    | S   | M   | S   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | L    | S    |
| CO3                    | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO4                    | S   | L   | S   | S   | S   | S   | S   | S   | M   | L    | S    | L    | S    | M    | S    |
| CO5                    | S   | M   | S   | S   | M   | S   | L   | S   | M   | L    | S    | L    | S    | S    | S    |

**S - Strong; M - Medium; L – Low**



|                       |                 |                                                |                                        |           |
|-----------------------|-----------------|------------------------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc            | <b>Programme Title</b>                         | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | <b>20P4MA15</b> | <b>Title</b>                                   | <b>Batch</b>                           | 2022-2024 |
|                       |                 | <b>CORE XV :MEASURE THEORY AND INTEGRATION</b> | <b>Semester</b>                        | III       |
| <b>Hrs/Week</b>       | 6               |                                                | <b>Credits</b>                         | 5         |

### Course Outcomes (CO)

| CO Number | CO Statement                                              | Knowledge Level |
|-----------|-----------------------------------------------------------|-----------------|
| CO1       | To Know about the Measurable functions and its Properties | K1              |
| CO2       | To understand the Riemann integral.                       | K1, K2          |
| CO3       | To gain knowledge about Monotone functions.               | K3, K4          |
| CO4       | To analyze the Radon-Nikodym Theroem.                     | K4, K5          |
| CO5       | To evaluate Measure and outer measure.                    | K5,K6           |

#### **UNIT – I: Lebesgue Measure (18Hrs)**

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

Chapter 3 (Sec 1 – 3, 5,6)

#### **UNIT - II : Lebesgue Integral (18 Hrs)**

The Riemann Integral-the Lebesgue Integral of a Bounded Function over a Set of Finite Measure-the integral of a Nonnegative Function –the General Lebesgue Integral.

Chapter 4 (Sec 1 – 4)

#### **UNIT – III : Differentiation and Integration (18 Hrs)**

Differentiation of Monotone Functions- Functions of Bounded Variation-Differentiation of an Integral- Absolute continuity.

Chapter 5 (Sec 1 – 4)

#### **Unit – IV :General Measure and Integration (18 Hrs)**

Measure and Integration- Measure Spaces- Measurable Functions- Integration-Signed measures-the Radon-Nikodym Theroem.

Chapter 11 (Sec 1 – 3, 5,6)

#### **UNIT - V : Measure and Outer Measure (18 Hrs)**

Outer Measure and Measurability-the Extension Theorem-Product Measures.

Chapter 12 (Sec 1, 2,4)

#### **TOTAL : ( 90 Hours)**

Power point Presentations, Seminar & Assignment

**TEXT BOOK :**

**H. L. Royden**, “*Real Analysis*”, 3<sup>rd</sup> Edition, Prentice Hall of India Private Ltd., New Delhi-110001, 2009.

**REFERENCE BOOKS:**

1. **G.de.Barra**, “*Measure Theory and Integration*”, WILEY Eastern Ltd,1981.
  2. **P.K.Jain and V.P.Gupta**, “*Lebesgue Measure and integration*”, New Age INT(P)Ltd., 2000.
  3. **Walter Rudin**,“*Real and Complex Analysis*”s, Tata Mc Graw Hill Publ.Co.Ltd.,1966.
- Simmons G.F**, “*Topology and Modern Analysis*”, Mc Graw Hill Book Company, 1963.

**ONLINE SOURCES:**

1. <https://ocw.mit.edu>.
2. <https://nptel.ac.in>
3. <https://swayam.gov.in>

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | S   | M   | M   | M   | M   | M   | L   | M   | M   | S    | S    | M    | L    | M    | S    |
| CO2                    | S   | M   | L   | S   | S   | M   | M   | M   | M   | L    | S    | M    | L    | L    | S    |
| CO3                    | S   | L   | S   | S   | S   | S   | S   | S   | M   | L    | S    | L    | S    | M    | S    |
| CO4                    | S   | M   | S   | S   | M   | S   | L   | S   | M   | L    | S    | L    | S    | S    | S    |
| CO5                    | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                        |                                            |           |
|-----------------------|-----------|--------------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                 | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P4MAE07 | <b>Title</b>                                           | <b>Batch</b>                               | 2022-2024 |
|                       |           | <b>GROUP D: ELECTIVE IV:<br/>DIFFERENTIAL GEOMETRY</b> | <b>Semester</b>                            | IV        |
| <b>Hrs/Week</b>       | 6         |                                                        | <b>Credits</b>                             | 4         |

**Course Outcomes (CO)**

| <b>CO Number</b> | <b>CO Statement</b>                                                 | <b>Knowledge Level</b> |
|------------------|---------------------------------------------------------------------|------------------------|
| CO1              | To gain the knowledge about space curves                            | K3, K4                 |
| CO2              | To understand the concept of theory of surfaces.                    | K1, K2                 |
| CO3              | To apply the concepts to global analysis and topology of manifolds. | K2, K3                 |
| CO4              | To determine the new techniques of differential geometric methods.  | K5, K6                 |
| CO5              | To focus on Geodesic on a surface.                                  | K4, K5                 |

**Unit: I**

**(18 Hrs)**

Theory of Space Curves: Introduction – Representation of space curves –Unique parametric representation of a space curve –Arc length – Tangent and osculating plane –Principle normal and binormal–Curvature and torsion – The curvature and torsion of a curve as the intersection of two surfaces.

Chapter I (Sec 1.1 - 1.7,1.9 )

**Unit :II**

**(18 Hrs)**

Theory of Space Curves (Contd): Contact between curves and surfaces-Osculating circle and osculating sphere –Locus of centres of spherical curvature – Tangent surfaces – Involutives and Evolutes – Intrinsic equations of space curves – Fundamental Existence theorem for space curves.

Chapter I ( Sec 1.10 - 1.13 ,1.16 - 1.17)

**Unit :III**

**(18 Hrs)**

The first fundamental form and Local Intrinsic properties of a surface: Introduction - Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – The first fundamental form - Direction coefficients on a surface.

Chapter II (Sec 2.1 - 2.10)

**Unit :IV**

**(18 Hrs)**

The first fundamental form and Local Intrinsic properties of a surface (Contd) and geodesic on a surface: Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties – Introduction - Geodesics and their differential equations – Canonical Geodesic equations.

Chapter II ( Sec 2.11 - 2.15) , Chapter III (Sec 3.1 - 3.3 )

**Unit :V****(18 Hrs)**

Geodesic on a surface: Normal property of Geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesics parallels – Geodesic curvature – Gauss Bonnet Theorems – Gaussian curvature.

Chapter III ( Sec 3.5 - 3.8, 3.10- 3.12 )

**TOTAL :****90 Hours**

|                                                      |
|------------------------------------------------------|
| Power point Presentations, Seminar ,Quiz, Assignment |
|------------------------------------------------------|

**TEXT BOOK:**

1. **D. Somasundaram, *Differential Geometry***, Narosa Publ.House, Chennai-2006.

**REFERENCE BOOKS :**

1. **T.Wilmore, *An Introduction to Differential Geometry***, Clarendan Press, Oxford, 2015.
2. **D.T. Struik, *Lectures on classical Differential Geometry***, Addison-Wesely, Mass 2006
3. **J.A. Thorpe, *Elementary Topics in Differential Geometry***, Springer-Verlag, New York, 1979.
4. **Erwin Kreyszig, *Differential Geometry, Dover publications***, INC, New York 2000.

**ONLINE SOURCES:**

1. <https://nptel.ac.in/downloads/111106054/>
2. <https://ocw.mit.edu>.
3. <https://swayam.gov.in>
4. [www.freebookcentre.net](http://www.freebookcentre.net)

**Mapping with Programme Outcomes**

| <b>PO</b><br><b>CO</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1                    | M   | M   | S   | S   | S   | S   | S   | L   | L   | L    | M    | M    | M    | L    | S    |
| CO2                    | S   | M   | S   | S   | S   | S   | L   | M   | L   | L    | S    | M    | M    | M    | S    |
| CO3                    | S   | M   | S   | S   | S   | M   | L   | M   | L   | L    | M    | L    | L    | L    | S    |
| CO4                    | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | M    | M    | M    | M    | S    |
| CO5                    | S   | M   | S   | S   | S   | S   | M   | M   | M   | L    | S    | S    | M    | L    | S    |

**S - Strong; M - Medium; L – Low**

|                       |           |                                                       |                                            |           |
|-----------------------|-----------|-------------------------------------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc      | <b>Programme Title</b>                                | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | 20P4MAE08 | <b>Title</b>                                          | <b>Batch</b>                               | 2022-2024 |
|                       |           | <b>GROUP D: ELECTIVE IV:<br/>DIFFERENCE EQUATIONS</b> | <b>Semester</b>                            | IV        |
| <b>Hrs/Week</b>       | 6         |                                                       | <b>Credits</b>                             | 4         |

### Course Outcomes (CO)

| CO Number | CO Statement                                        | Knowledge Level |
|-----------|-----------------------------------------------------|-----------------|
| CO1       | To learn about difference operator.                 | K2, K4          |
| CO2       | To gain knowledge about the first order equations.. | K1, K2          |
| CO3       | To understand the concept of z-transform.           | K3              |
| CO4       | To determine the stability of linear systems .      | K5, K6          |
| CO5       | To develop asymptotic analysis of sums.             | K4, K5          |

#### UNIT-I: Difference Calculus

(18 Hrs)

Difference operator – Summation – Generating function – Approximate summation.

Chapter 2(Sec 2.1 - 2.3)

#### UNIT-II: Linear Difference Equations

(18 Hrs)

First order equations – general results for linear equations.

Chapter 3(Sec 3.1 - 3.2)

#### UNIT-III: Linear Difference Equations (Contd.)

(18 Hrs)

Equations with constant coefficients – Equations with variable coefficients –z- transform.

Chapter 3 (Sec 3.3 - 3.5, 3.7)

#### UNIT-IV:

(18 Hrs)

Initial value problems for linear systems – Stability of linear systems.

Chapter 4(Sec 4.1, 4.2)

#### UNIT-V:

(18 Hrs)

Asymptotic analysis of sums – linear equations.

Chapter 5(Sec 5.1 – 5.3)

**TOTAL :**

**90 Hours**

Power point Presentations, Seminar ,Quiz, Assignment

**TEXT BOOK :**

1.W.G.Kelly and A.C.Peterson, *Difference Equations*, Academic press, New York, 1991.

**REFERENCE BOOKS:**

1. S.N.Elaydi, *An Introduction to Difference Equations*, Springer – Verlag, New York, 1990.

2.R.Mickens, *Difference Equations*, Van Nostrand Reinhold, New York, 1990.

3.R.P.Agarwal, *Difference Equations and Inequalities*, Marcel Dekkar, New York, 1992.

**ONLINE SOURCES:**

- [www.ejournal.com](http://www.ejournal.com)
- [www.ebook.com](http://www.ebook.com)
- [www.freebookcentre.net](http://www.freebookcentre.net)

**MappingwithProgramme Outcomes**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1      | S   | M   | S   | S   | S   | S   | L   | M   | L   | L    | S    | M    | M    | M    | S    |
| CO2      | M   | M   | S   | S   | S   | M   | S   | L   | L   | L    | M    | L    | M    | M    | S    |
| CO3      | M   | M   | S   | S   | S   | S   | M   | L   | L   | L    | S    | M    | S    | S    | S    |
| CO4      | S   | L   | S   | M   | M   | L   | L   | M   | M   | L    | M    | L    | L    | L    | S    |
| CO5      | S   | M   | S   | S   | S   | M   | S   | S   | L   | M    | L    | S    | M    | S    | S    |

**S - Strong; M - Medium; L – Low**

|                       |                  |                                              |                                        |           |
|-----------------------|------------------|----------------------------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc             | <b>Programme Title</b>                       | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | <b>21P4MAE12</b> | <b>Title</b>                                 | <b>Batch</b>                           | 2022-2024 |
|                       |                  | <b>GROUP D1: ELECTIVE IV : CODING THEORY</b> | <b>Semester</b>                        | IV        |
| <b>Hrs/Week</b>       | 6                |                                              | <b>Credits</b>                         | 4         |

### Course Outcomes (CO)

| CO Number | CO Statement                                                                                                | Knowledge Level |
|-----------|-------------------------------------------------------------------------------------------------------------|-----------------|
| CO1       | To impart the knowledge of Combinatorial theory                                                             | K1              |
| CO2       | To introduce different types of coding system                                                               | K1, K2          |
| CO3       | To make the students to understand the generalization and construction of certain specialized coding system | K3, K4          |
| CO4       | To study different characteristics of coding.                                                               | K4, K5          |
| CO5       | To make familiar with cyclic codes and its some properties                                                  | K5, K6          |

**UNIT – I: Mathematical Background: (18Hrs)**

Algebra – Krawtchouk Polynomials – Combinatorial theory-Shannon’s Theorem: Introduction - Shannon’s Theorem.

**UNIT - II : Linear codes: (18 Hrs)**

Block codes – Linear codes – Hamming codes - Majority logic decoding –Weight Enumerators – The Lee metric.

**UNIT – III : Some good codes: (18 Hrs)**

Hadamard codes and generalizations – The binary Golay code – The ternary Golay code- Constructing codes from other codes - Reed-Muller code – Kerdockcodes.

**Unit – IV : Bound on codes: (18 Hrs)**

The Gilbert bound – Upper bounds – Cyclic codes: Definitions- Generator matrix and check polynomial – Zeros of a cyclic code.

**UNIT - V :****(18 Hrs)**

The idempotent of a cyclic code – Other Representations of cyclic codes – BCH codes  
 – Decoding BCH codes- Binary cyclic codes of length  $2n$  ( $n$  odd).

**TOTAL :****( 90 Hours)**

|                                                 |
|-------------------------------------------------|
| Power point Presentations, Seminar & Assignment |
|-------------------------------------------------|

**TEXT BOOK :**

Introduction to Coding Theory by J. H. Van Lint

**REFERENCE BOOKS:**

1. **A first course in coding theory by Raymond Hill**
2. **Coding and Information Theory by Steven Roman**

**ONLINE SOURCES:**

1. <https://ocw.mit.edu>.
2. <https://nptel.ac.in>
3. <https://swayam.gov.in>

**Mapping with Programme Outcomes**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1      | S   | M   | M   | M   | M   | M   | L   | M   | M   | S    | S    | M    | L    | M    | S    |
| CO2      | S   | M   | L   | S   | S   | M   | M   | M   | M   | L    | S    | M    | L    | L    | S    |
| CO3      | S   | L   | S   | S   | S   | S   | S   | S   | M   | L    | S    | L    | S    | M    | S    |
| CO4      | S   | M   | S   | S   | M   | S   | L   | S   | M   | L    | S    | L    | S    | S    | S    |
| CO5      | S   | M   | S   | S   | S   | S   | M   | S   | M   | L    | S    | M    | M    | M    | S    |

**S - Strong; M - Medium; L – Low**



|                       |            |                             |                                        |           |
|-----------------------|------------|-----------------------------|----------------------------------------|-----------|
| <b>Programme code</b> | M.Sc       | <b>Programme Title</b>      | <b>Master of Science (Mathematics)</b> |           |
| <b>Course Code</b>    | 18P4CSSK01 | <b>Title</b>                | <b>Batch</b>                           | 2022-2024 |
|                       |            | <b>ESSENTIALS OF MATLAB</b> | <b>Semester</b>                        | IV        |
| <b>Hrs/Week</b>       | 2          |                             | <b>Credits</b>                         | 2         |

### Course Outcomes (CO)

| CO Number | CO Statement                                                                                                  | Knowledge Level |
|-----------|---------------------------------------------------------------------------------------------------------------|-----------------|
| CO1       | To learn about how to approach for solving mathematics problem by using matlab software and simulation tools. | K1, K2          |
| CO2       | To understand about creating arrays in MATLAB.                                                                | K2              |
| CO3       | To create awareness about Mathematical operations with arrays in MATLAB.                                      | K6              |
| CO4       | To gain knowledge about 2D and 3D plots.                                                                      | K1,K2           |
| CO5       | To develop the programming for mathematical problems.                                                         | K5, K6          |

#### Unit-I: Starting With Matlab:

(6 Hrs)

Starting Matlab, Matlab Windows - Working In The Command Window - Arithmetic Operations With Scalars - Display Formats -Elementary Math Built-In Functions- Defining Scalar Variables- Useful Commands For Managing Variables -Script Files -Examples Of Matlab Applications Problems.

#### Unit-II: Creating Arrays:

(6 Hrs)

Creating A One-Dimensional Array (Vector)-Creating A Two-Dimensional Array (Matrix) - Notes About Variables In Matlab -The Transpose Operator - Array Addressing -Using A Colon : In Addressing Arrays- Adding Elements To Existing Variables -Deleting Elements - Built-In Functions For Handling Arrays -Strings And Strings As Variables.

#### Unit-III:Mathematical Operations with Arrays:

(6 Hrs)

Addition and Subtraction-Array multiplication-Array Division-Element-By-Element Operations - Using Arrays In Matlab Built-In Math Functions- Built-In Functions For Analyzing Arrays-Generation Of Random Numbers.

#### Unit-IV:Two-Dimensional Plots:

(6 Hrs)

The Plot Command - The Fplot Command -Plotting Multiple Graphs In The Same Plot- Plots With Special Graphics –Histograms. **Three-Dimensional Plots** :Line Plots -Mesh And Surface Plots - Plots With Special Graphics-The View Command.

#### Unit-V:Programming in Matlab:

(6 Hrs)

Relational And Logical Operators - Conditional statements-The Switch-Case Statement-Loops - For-End Loops -While-End Loops - Nested Loops And Nested Conditional Statements-The Break And Continue Commands.

**TOTAL :**

**30 Hours**

Power point Presentations, Seminar ,Quiz, Assignment, Animation video Class

**TEXT BOOKS:**

Amos Gilat, *MATLAB: An introduction with Applications*, 5<sup>th</sup> Edition, JOHN WILEY & SONS, INC.

**REFERENCE BOOKS:**

1. S.Swapna Kumar, *MATLAB Easy way of Learning*, Lenina SVB, PHI Publications.
2. Rudra Pratap, *Getting Started with MATLAB*, OXFORD University Press.
3. Khalid Sayood and Richard C. Dorf, *Learning Programming Using MATLAB* (Synthesis Lectures on Electrical Engineering), Morgan & claypool publishers.
4. D. Hanselman and B Littlefield, *Mastering Matlab 7*, Pearson Education.
5. A.Gilat, *Matlab: An Introduction with Applications*, John Wiley and Sons, 2004

**ONLINE SOURCES:**

1. [www.mathworks.com](http://www.mathworks.com)
2. <https://www.tutorialspoint.com/matlab/>
3. <https://en.wikipedia.org/wiki/MATLAB>

**Mapping with Programme Outcomes**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | S   | M   | S   | S   | S   | S   | M   | S   | S   | S    | S    | M    | M    | M    | S    |
| CO2     | S   | M   | S   | S   | S   | S   | M   | S   | S   | S    | M    | M    | M    | S    | S    |
| CO3     | S   | M   | S   | S   | S   | S   | S   | S   | M   | S    | S    | M    | M    | S    | S    |
| CO4     | S   | M   | M   | S   | S   | S   | S   | S   | S   | S    | M    | L    | M    | M    | S    |
| CO5     | M   | M   | S   | S   | S   | S   | S   | S   | S   | M    | M    | M    | M    | S    | S    |

**S - Strong; M - Medium; L – Low**

|                       |                   |                        |                                            |           |
|-----------------------|-------------------|------------------------|--------------------------------------------|-----------|
| <b>Programme code</b> | M.Sc              | <b>Programme Title</b> | <b>Master of Science<br/>(Mathematics)</b> |           |
| <b>Course Code</b>    | <b>20P4MAPR01</b> | <b>Title</b>           | <b>Batch</b>                               | 2022-2024 |
|                       |                   | <b>PROJECT</b>         | <b>Semester</b>                            | IV        |
| <b>Hrs/Week</b>       | 4                 |                        | <b>Credits</b>                             | 4         |

**Topic:**

The Topic of the dissertation shall be assigned to the candidate before the beginning of third semester and a copy of the same should be submitted to the examination to approval.

**No. of Copies Project/Dissertation:**

The students should prepare three copies of dissertation and submit the same for the evaluation by examiners. After evaluation one copy is to be retained in the college library and one copy is to be submitted to the COE cell and one copy can be held by the student.

**Format to be followed:**

The formats/certificates for project/dissertation to be submitted to the students is given below:

**Format for the preparation of project work:**

- a) Title page
- b) Bonafide certificate
- c) Acknowledgement
- d) Table of contents

**CONTENTS**

| <b>Chapter No.</b> | <b>Title</b>          | <b>Page No</b> |
|--------------------|-----------------------|----------------|
| 1                  | Introduction          |                |
| 2                  | Title of the Chapters |                |
| 3                  | Conclusion            |                |
| 4                  | References            |                |

**Format of the Title Page:**

**TITLE OF THE PROJECT/DISSERTATION**

Project /Dissertation submitted in partial fulfillment of the requirement for the Degree of Master of Science in

**MATHEMATICS**

**By**

Student's Name :

Register Number :

College :

Year :

**Format of the Certificate:**

This is to certify that the dissertation entitled .....submitted in partial fulfillment of the requirement of the degree of Master of Science in MATHEMATICS ,is a record of bonafide research work carried out by.....under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree ,diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journals or magazines.

**Signature of the Guide**

Date:

Place:

| Sem | Course Code | EQUIVALENT COURSE FOR SWAYAM<br>SCIENTIFIC COMPUTING USING<br>MATLAB | Total Marks:100<br>(ESE) | Hours Per<br>Week | Credits |
|-----|-------------|----------------------------------------------------------------------|--------------------------|-------------------|---------|
| IV  | 22P4MAAL01  |                                                                      |                          | -                 | 2*      |

### Course Objectives

To enable the students to

1. Gain knowledge in the Mathematical software MATLAB for high-performance numerical computations and visualization
2. Learn MATLAB built-in functions provided to solve all type of scientific problems.

### Course Outcomes (CO): On completion of the course, students should be able to

|      |                                                                     |         |
|------|---------------------------------------------------------------------|---------|
| CO 1 | Know about the basic concepts of MATLAB.                            | K1 – K5 |
| CO 2 | Operate on matrices and vectors in MATLAB.                          | K1 – K5 |
| CO 3 | Work with command line functions and Built-in functions of MATLAB . | K1 – K5 |
| CO 4 | Save and load data in MATLAB.                                       | K1 – K5 |
| CO 5 | Utilize scripts and functions in MATLAB.                            | K1 – K5 |

**K1: Recall; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate.**

| Unit –I                                                                                                               | Introduction |
|-----------------------------------------------------------------------------------------------------------------------|--------------|
| Basics of MATLAB:MATLAB windows – Online-help - Input – Output - File types – Platform dependence – General commands. |              |
| <b>Chapter 1 – Section 1.6</b>                                                                                        |              |

| Unit – II                                                                                          | Interactive computation |
|----------------------------------------------------------------------------------------------------|-------------------------|
| Matrices and vectors: Input – Indexing (or subscripting) – Matrix manipulation – Creating vectors. |                         |
| Matrix and array operations: Arithmetic operations – Relational operations – Logical operations –  |                         |
| Elementary math functions – Matrix functions – Character strings.                                  |                         |
| <b>Chapter 3 - Sections: 3.1, 3.2</b>                                                              |                         |

| Unit – III                                                                                                                                        | Interactive computation |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| A special Note on Array Operations: Vectorization.                                                                                                |                         |
| Command Line Functions: Inlinefunctions – Anonymous functions.                                                                                    |                         |
| Using Built-in functions and On-line help: Example 1: Finding the determinant of a matrix – Example 2:<br>Finding eigen values and eigen vectors. |                         |
| <b>Chapter 3 - Sections: 3.3 – 3.5</b>                                                                                                            |                         |

**Unit – IV****Interactive computation**

Saving and Loading Data: Saving into and loading from the binary Mat-files – Importing data files –

Recording a session with diary – Plotting Simple Graphs.

**Chapter 3 - Sections: 3.6, 3.7**

**Unit – V****Programming in MATLAB: Scripts and Functions**

Script Files Function Files: Executing a function – More on functions – Subfunctions – Compiled (Parsed) functions:

The p-code – The profiler.

**Chapter 4 - Sections: 4.1, 4.2**

**TEXT BOOK**

1. RudraPratap, “Getting Started with MATLAB 7”, Oxford University Press, Indian Edition, New Delhi, 2007.

**REFERENCE BOOKS**

1. William John Palm, “Introduction to Matlab 7 for Engineers”, McGraw-Hill Professional, 2005.
2. Y.Kirani Singh and B.B.Chaudhuri, “MATLAB Programming”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

**WEB RESOURCES**

1. <http://web.itu.edu.tr/guneshasa/cfd/matlab.pdf>
2. <https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf>
3. <https://web.stanford.edu/class/ee262/software/getstart.pdf>

**QUESTION PAPER PATTERN**

**Time: 3 hours**

**Max. Marks: 100**

**SECTION-A(10 X 10 = 100 Marks)**  
Answer ANY TEN out of TWELVE questions

**Mapping of COs with POs and PSOs**

| PO/PSO<br>CO | PO   |      |      |      |      |      |      | PSO   |       |       |       |       |
|--------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
|              | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO1          | L    | M    | -    | -    | -    | -    | S    | M     | S     | S     | L     | L     |
| CO2          | L    | M    | -    | -    | -    | -    | S    | M     | S     | S     | L     | L     |
| CO3          | L    | M    | -    | -    | -    | -    | S    | M     | S     | S     | L     | L     |
| CO4          | L    | M    | -    | -    | -    | L    | S    | M     | S     | S     | L     | L     |
| CO5          | L    | M    | -    | -    | -    | L    | S    | M     | S     | S     | L     | L     |

**S - Strong, M - Medium, L - Low**

## QUESTION PAPER PATTERN -PG

### Bloom's Taxonomy Based Assessment Pattern

**K1**-Remembering; **K2**- Understanding; **K3**- Applying;  
**K4**-Analyzing;**K5**-Evaluating;**K6**- Creating;

**Theory: 75 Marks**

**Test- I & II and ESE:**

| Knowledge Level   | Section               | Marks    | Description           | Total |
|-------------------|-----------------------|----------|-----------------------|-------|
| <b>K1</b>         | A (Answer all)        | 20x01=20 | MCQ/Define            | 75    |
| <b>K2&amp; K3</b> | B (Either or pattern) | 05x05=25 | Short Answers         |       |
| <b>K4&amp; K5</b> | C (Answer 3out of 5)  | 03x10=30 | Descriptive/ Detailed |       |

**Project: 100 Marks**

I: Internal : 75 Marks

II: External : 25 Marks