# SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS)

**Reaccredited with "B++" Grade by NAAC**

**(Affiliated to Periyar University)**

## SALEM - 16


**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**LEARNING OUTCOME BASED CURRICULUM FRAMEWORK**

**(LOCF)**

**B.Sc. MATHEMATICS**

**2026-2029 BATCH**

# CONTENT

## INTRODUCTION

Mathematics is the study of quantity, structure, space and change, focusing on problem solving, with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The Bachelor's Degree B.Sc. Mathematics is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements expected to be acquired by learners at the end of the Programme. Learning outcomes of Mathematics are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for gaining knowledge of Mathematics.

Bachelor's degree in Mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of Mathematics. This also leads to study of related areas like Computer science, Financial Mathematics, Statistics and many more. Thus, this programme helps learners in building a solid foundation for higher studies in Mathematics. The skills and knowledge gained have intrinsic aesthetics leading to proficiency in analytical reasoning. This can be utilised in Mathematical modelling and solving real life problems.

Students completing this programme will be able to present Mathematics clearly and precisely, make abstract ideas precise by formulating them in the language of Mathematics, describe Mathematical ideas from multiple perspectives and explain fundamental concepts of Mathematics to non-Mathematicians.

Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

| LEARNING OUTCOME - BASED CURRICULUM FRAMEWORK GUIDELINES<br>BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME | |
|---|---|
| **Programme:** | **B.Sc. Mathematics** |
| **Programme Code:** | **UMA** |
| **Duration:** | **3 years [UG]** |
| **Programme Outcomes:** | **PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study<br><br>**PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.<br><br>**PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.<br><br>**PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.<br><br>**PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.<br><br>**PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation<br><br>**PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team<br><br>**PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. |

| | |
|---|---|
| | **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.<br><br>**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 appropriate software for analysis of data.<br><br>**PO11: Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.<br><br>**PO12: Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.<br><br>**PO13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.<br><br>**PO14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the 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 efficient way.<br><br>**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/reskilling. |

## B.Sc. Mathematics

**Programme Specific Outcomes:**

**PSO1:** Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

**PSO2:** Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

**PSO3:** To prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions. To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

**Mapping of Course Learning Outcomes (CLOs)** with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)can be carried out accordingly, assigning the appropriate level in the grids:

| | Pos | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | … | 1 | 2 | … |
| CLO1 | | | | | | | | | | |
| CLO2 | | | | | | | | | | |
| CLO3 | | | | | | | | | | |
| CLO4 | | | | | | | | | | |
| CLO5 | | | | | | | | | | |

**Highlights of the Revamped Curriculum**

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with Viva-Voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

**Value additions in the Revamped Curriculum:**

| Semester | Newly introduced Components | Outcome / Benefits |
|---|---|---|
| **I** | **Foundation Course**<br>To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world. | ● Instil confidence among students<br>● Create interest for the subject |
| **I, II, III, IV** | **Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial) | ● Industry ready graduates<br>● Skilled human resource<br>● Students are equipped with essential skills to make them employable |
| | | ● Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects |
| | | ● Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. |
| | | ● Entrepreneurial skill training will provide an opportunity for independent livelihood<br>● Generates self – employment<br>● Create small scale entrepreneurs<br>● Training to girls leads to women empowerment |
| | | ● Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools |
| **III** | Elective papers-<br>An open choice of topics categorized under Generic and Discipline Centric | ● Strengthening the domain knowledge<br>● Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature<br>● Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background<br>● Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors |

| | | |
|---|---|---|
| **IV** | Industrial Statistics | ● Exposure to industry moulds students into solution providers<br>● Generates Industry ready graduates<br>● Employment opportunities enhanced |
| **II year Vacation activity** | Internship / Industrial Training | ● Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens. |
| **V** | Project with Viva – voce | ● Self-learning is enhanced<br>● Application of the concept to real situation is conceived resulting in tangible outcome |
| **VI** | Introduction of Professional Competency component | ● Curriculum design accommodates all category of learners; 'Mathematics for Advanced Explain' component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers;<br>● 'Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc. |
| **Extra Credits:**<br>**For Advanced Learners / Honours degree** | | ● To cater to the needs of peer learners / research aspirants |
| **Skills acquired from the Courses** | | ● Knowledge, Problem Solving, ability, Professional Competency, Professional Communication and Transferrable Skill. |

## Credit Distribution for UG Programme

| Sem I | Credit | Hr. | Sem II | Credit | Hr. | Sem III | Credit | Hr. | Sem IV | Credit | Hr. | Sem V | Credit | Hr. | Sem VI | Credit | Hr. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part 1. Language – Tamil/Hindi/ Sanskrit | 3 | 6 | Part 1. Language – Tamil/Hindi/ Sanskrit | 3 | 6 | Part 1. Language – Tamil/Hindi/ Sanskrit | 3 | 6 | Part 1. Language – Tamil/Hindi/ Sanskrit | 3 | 6 | 5.1 Core Course – CC IX | 4 | 5 | 6.1 Core Course – CC XIII | 4 | 6 |
| Part 2. English | 3 | 6 | Part 2. English | 3 | 6 | Part 2. English | 3 | 6 | Part 2. English | 3 | 6 | 5.2 Core Course – CC X | 4 | 5 | 6.2 Core Course – CC XIV | 4 | 6 |
| 1.3 Core Course – CC I | 4 | 4 | 2.3 Core Course – CC III | 4 | 5 | 3.3 Core Course – CC V | 4 | 4 | 4.3 Core Course – CC VII | 4 | 4 | 5. 3.Core Course CC -XI | 4 | 4 | 6.3 Core Course – CC XV | 4 | 6 |
| 1.4 Core Course – CC II | 4 | 5 | 2.4 Core Course – CC IV | 4 | 4 | 3.4 Core Course – CC VI | 4 | 5 | 4.4 Core Course – CC VIII | 4 | 4 | 5. 4. Core Course – CC -XII | 3 | 4 | 6.4 Elective - Discipline Specific -IV | 3 | 5 |
| 1.5 Elective I Generic | 3+2 | 3+2 | 2.5 Elective II Generic | 3+2 | 3+2 | 3.5 Elective - Discipline Specific I | 5 | 5 | 4.5 Elective - Discipline Specific II | 3+2 | 3+2 | 5. 4. Elective Course – III Project with Viva-Voce | 4 | 5 | 6.5 Elective Discipline Specific -V | 3 | 5 |
| 1.6 Skill Enhancement Course SEC-1 | 2 | 2 | 2.6 Skill Enhancement Course SEC-2 (IKS) | 2 | 2 | 3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill) | 1 | 1 | 4.6 Skill Enhancement Course SEC-6 | 2 | 2 | 5.5 Elective - Discipline Specific- IV | 2+1 | 3+2 | 6.6 Extension Activity | 1 | - |
| 1.7 Skill Enhancement -(Foundation Course) | 2 | 2 | 2.7 Skill Enhancement Course - SEC-3 | 2 | 2 | 3.7 Skill Enhancement Course SEC-5 | 2 | 2 | 4.7 Skill Enhancement Course SEC-7 | 2 | 2 | 5.7 Value Education | 2 | 2 | 6.7 Professional Competency Skill | 2 | 2 |
| | | | | | | 3.8 E.V.S. 3.9 Health & wellness | - 1 | 1 - | 4.8 E.V.S | 2 | 1 | 5.8 Summer Internship | 2 | - | | | |
| | **23** | **30** | | **23** | **30** | | **23** | **30** | | **25** | **30** | | **26** | **30** | | **21** | **30** |
| **Total - 141 Credits** | | | | | | | | | | | | | | | | | |

**Consolidated Semester wise and Component wise Credit distribution**

| Parts | Sem I | Sem II | Sem III | Sem IV | Sem V | Sem VI | Total Credits |
|---|---|---|---|---|---|---|---|
| **Part I** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part II** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part III** | 13 | 13 | 13 | 13 | 22 | 18 | 92 |
| **Part IV** | 4 | 4 | 4 | 6 | 4 | 3 | 25 |
| **Total** | **23** | **23** | **23** | **25** | **26** | **21** | **141** |

Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the undergraduate programme and the other component. Part IV has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

## Total Credits: 141

### EXTRA CREDITS FOR EXTRA SKILLS

**Total Extra Credits : 28 (20% of the total credits)**

**B.Sc. MATHEMATICS**

**CURRICULUM DESIGN AND SCHEME OF EXAMINATION**

**(APPLICABLE TO STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2026-27)**

**SEMESTER-I**

| Part | Course Code | Course Title | Course Type | Hrs./ Week L/T/P | Credits | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| I | 26ULTC1/ 26ULHC1/ 26ULSC1 | Tamil-I / Hindi-I / Sanskrit-I | Language | 6 | 3 | 30 | 70 | 100 |
| II | 26ULEC1 | General English – I | English | 6 | 3 | 30 | 70 | 100 |
| III | 26UMACC1 | Algebra & Trigonometry | Core Course | 4 | 4 | 30 | 70 | 100 |
| | 26UMACC2 | Differential Calculus and Real Life AI Applications | Core Course | 5 | 4 | 30 | 70 | 100 |
| | 26UMAPGEC1 | Physics – I | Generic Elective | 3 | 3 | 30 | 70 | 100 |
| | 26UMAPGECQ1 | Physics Practical – I | | 2 | 2 | 40 | 60 | 100 |
| IV | 26UMASEC1 | Mathematics for Competitive Examinations | Skill Enhancement Course (NME-I) | 2 | 2 | 30 | 70 | 100 |
| | 26UMASEFC | Bridge Mathematics | Skill Enhancement (Foundation Course) | 2 | 2 | 30 | 70 | 100 |
| **Total** | | | | **30** | **23** | | | |
| ***Extra Skills (Out of College Hours)** | | | | | | ***Credits** | | ***Marks** |
| **Articulation and Idea Fixation** | | | | | | - | | - |
| **Physical Fitness Practice** | | | | | | - | | - |
| **Society Connect Activity** | | | | | | - | | - |

***Extra credits are given for extra skills and courses qualified in MOOC / NPTEL**

## SEMESTER - II

| Part | Course Code | Course Title | Course Type | Hrs./ Week L/T/P | Credits | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| I | 26ULTC2/ 26ULHC2/ 26ULSC2 | Tamil-II / Hindi-II / Sanskrit-II | Language | 6 | 3 | 30 | 70 | 100 |
| II | 26ULEC2 | General English - II | English | 6 | 3 | 30 | 70 | 100 |
| III | 26UMACC3 | Analytical Geometry (Two & Three Dimensions) | Core Course | 4 | 4 | 30 | 70 | 100 |
| | 26UMACC4 | Integral Calculus | Core Course | 3 | 3 | 30 | 70 | 100 |
| | 26UMAPGEC2 | Physics – II | Generic Elective | 3 | 3 | 30 | 70 | 100 |
| | 26UMAPGECQ2 | Physics Practical – II | | 2 | 2 | 40 | 60 | 100 |
| IV | 26UMASEC2 | Quantitative Aptitude for Competitive Examinations | Skill Enhancement Course (NME-II) | 2 | 2 | 30 | 70 | 100 |
| | 26UMASEC3 | History and Development of Indian Mathematics (From Vedic Period to Modern Era) | Skill Enhancement Course (Indian Knowledge System) | 2 | 2 | 30 | 70 | 100 |
| | 26UDMT | Disaster Management | - | 2 | 1 | 30 | 70 | 100 |
| **Total** | | | | **30** | **23** | | | |

| ***Extra Skills (Out of College Hours)** | ***Credits** | ***Marks** |
|---|---|---|
| **Articulation and Idea Fixation** | **1** | **100** |
| **Physical Fitness Practice** | **-** | **-** |
| **Society Connect Activity** | **1** | **-** |

**Level -1: Certificate Course in Vedic Mathematics- I -100 Hours per year- 3 credits**

***Extra credits are given for extra skills and courses qualified in MOOC / NPTEL**

## SEMESTER - III

| Part | Course Code | Course Title | Course Type | Hrs./ Week L/T/P | Credits | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| I | 26ULTC3/ 26ULHC3/ 26ULSC3 | Tamil-III / Hindi-III/ Sanskrit-III | Language | 6 | 3 | 30 | 70 | 100 |
| II | 26ULEC3 | General English – III | English | 6 | 3 | 30 | 70 | 100 |
| III | 26UMACC5 | Vector Calculus and its Applications | Core Course | 4 | 4 | 30 | 70 | 100 |
| | 26UMACC6 | Differential Equations and its Applications | Core Course | 5 | 4 | 30 | 70 | 100 |
| | 26UMADSEC1 | Mathematical Statistics-I | Elective (Discipline) | 5 | 5 | 30 | 70 | 100 |
| IV | 26UMASECQ4 | Statistics with Excel Programming- Practical (Entrepreneurial Skill) | Skill Enhancement Course | 1 | 1 | 40 | 60 | 100 |
| | 26UMASECQ5 | Data Analytics with R-Practical | Skill Enhancement Course | 2 | 2 | 40 | 60 | 100 |
| | 26UEVS | Environmental Studies | | 1 | - | - | - | - |
| | 26UHAWQ | Health and Wellness | | - | 1 | 30 | 70 | 100 |
| **Total** | | | | **30** | **23** | | | |

| ***Extra Skills (Out of College Hours)** | ***Credits** | ***Marks** |
|---|---|---|
| **Life skill - Course I: Communication Skill** | **1** | **100** |
| **Articulation and Idea Fixation** | - | - |
| **Physical Fitness Practice** | - | - |
| **Society Connect Activity** | - | - |

***Extra credits are given for extra skills and courses qualified in MOOC / NPTEL**

## SEMESTER - IV

| Part | Course Code | Course Title | Course Type | Hrs./ Week L/T/P | Credits | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| I | 26ULTC4/ 26ULHC4/ 26ULSC4 | Tamil-IV / Hindi-IV/ Sanskrit-IV | Language | 6 | 3 | 30 | 70 | 100 |
| II | 26ULEC4 | General English - IV | English | 6 | 3 | 30 | 70 | 100 |
| III | 26UMACC7 | Industrial Statistics | Core Course | 4 | 4 | 30 | 70 | 100 |
| | 26UMACC8 | Elements of Mathematical Analysis | Core Course | 4 | 4 | 30 | 70 | 100 |
| | 26UMADSEC2 | Mathematical Statistics-II | Elective Course (Discipline specific) | 3 | 3 | 30 | 70 | 100 |
| | 26UMADSECQ1 | Mathematical Statistics using R Programming – Practical | | 2 | 2 | 40 | 60 | 100 |
| IV | 26UMASECQ6 | Computational Mathematics with MALAB- Practical | Skill Enhancement Course | 2 | 2 | 40 | 60 | 100 |
| | 26UMASECQ7 | LaTeX- Practical | Skill Enhancement Course | 2 | 2 | 40 | 60 | 100 |
| | 26UEVS | Environmental Studies | | 1 | 2 | 30 | 70 | 100 |
| **Total** | | | | **30** | **25** | | | |

| ***Extra Skills (Out of College Hours)** | ***Credits** | ***Marks** |
|---|---|---|
| **Life skill - Course II: Professional Skills** | 1 | 100 |
| **Articulation and Idea Fixation** | 1 | 100 |
| **Physical Fitness Practice** | 1 | - |
| **Society Connect Activity** | 1 | - |

**Level -2: Diploma Course in Vedic Mathematics-II -100 hours per year- 3 Credits**

***Extra credits are given for Extra Skills and courses qualified in MOOC / NPTEL**

## SEMESTER - V

| Part | Course Code | Course Title | Course Type | Hrs. / Week L/T/P | Credits | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| I | 26UMACC9 | Abstract Algebra | Core Course | 5 | 4 | 30 | 70 | 100 |
| II | 26UMACC10 | Real Analysis | Core Course | 5 | 4 | 30 | 70 | 100 |
| | 26UMACC11 | Mathematical Modelling | Core Course | 4 | 4 | 30 | 70 | 100 |
| | 26UMACC12 | Optimization Techniques | Core Course | 4 | 3 | 30 | 70 | 100 |
| | 26UMAPVV | Project & Viva Voce | Elective Course (Discipline specific) | 5 | 4 | 30 | 70 | 100 |
| | 26UMADSEC3A/ 26UMADSEC3B | Biomathematics / Discrete Mathematics | Elective Course (Discipline specific) | 3 | 2 | 30 | 70 | 100 |
| | 26UMADSECQ2A/ 26UMADSECQ2B | Biomathematics - Practical / Discrete Mathematics - Practical | | 2 | 1 | 40 | 60 | 100 |
| IV | 26UVEN | Value Education | Value Education | 2 | 2 | 30 | 70 | 100 |
| | 26UMAI | Internship/Industrial Training | Internship | - | 2 | 30 | 70 | 100 |
| **Total** | | | | **30** | **26** | | | |

| ***Extra Skills (Out of College Hours)** | ***Credits** | *** Marks** |
|---|---|---|
| **Life skill - Course III : Leadership Skills** | 1 | 100 |
| **Physical Fitness Practice** | - | - |
| **Society Connect Activity** | - | - |

**Level -3: Diploma Course in Vedic Mathematics-III -100 hours per year**

***Extra credits are given for extra skills and courses qualified in MOOC / NPTEL**

**SEMESTER - VI**

| Part | Code | Course Title | Course Type | Hrs./ Week L/T/P | Credits | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| III | 26UMACC13 | Linear Algebra | Core Course | 6 | 4 | 30 | 70 | 100 |
| | 26UMACC14 | Complex Analysis | Core Course | 6 | 4 | 30 | 70 | 100 |
| | 26UMACC15 | Mechanics | Core Course | 6 | 4 | 30 | 70 | 100 |
| | 26UMADSEC4A /26UMADSEC4B | Numerical methods with Applications/Graph Theory with Applications | Elective Course (Discipline specific) | 5 | 3 | 30 | 70 | 100 |
| | 26UMADSEC5A /26UMADSEC5B | Introduction to Artificial Intelligence / Difference Equations with Applications | Elective Course (Discipline specific) | 3 | 2 | 30 | 70 | 100 |
| | 26UMADSECQ3 | Introduction to Artificial Intelligence with Python – Practical | | 2 | 1 | 40 | 60 | 100 |
| IV | 26UMAPCSQ | Computational Techniques in Mathematics with Python – Practical | Professional Competency Skill | 2 | 2 | 40 | 60 | 100 |
| | 26UMAEX | Extension Activity | | - | 1 | | | |
| **Total** | | | | **30** | **21** | | | |

| ***Extra Skills (Out of College Hours)** | ***Credits** | *** Marks** |
|---|---|---|
| **Life skill - Course IV : Universal Human Values** | 1 | 100 |
| **Physical Fitness Practice** | - | - |
| **Society Connect Activity** | - | - |

**Level -3: Advanced Diploma Course in Vedic Mathematics-III -100 hours per year**

***Extra credits are given for extra skills and courses qualified in MOOC / NPTEL**

**PEDAGOGICAL APPROACHES**

**TEACHING LEARNING STRATEGIES**

a) **Chalk and talk**
b) **Group -Learning and Teaching**
c) **Individual Learning /Self-Study**
d) **Game Based Learning**
e) **Technology Based Learning**
f) **Peer Teaching**
g) **Learning Through Problem solving**
h) **Project Based Learning**

## METHODS OF EVALUATION AND ASSESSMENT

| **Methods of Evaluation-Theory** | | |
|---|---|---|
| **Internal Evaluation** | Continuous Internal Assessment Test | 30 Marks |
| | Assessment Components | |
| | Model Examination and Attendance | |
| **External Evaluation** | End Semester Examination | 70 Marks |
| | **Total** | **100 Marks** |
| **Methods of Evaluation-Practical** | | |
| **Internal Evaluation** | Laboratory work assessment (best 2 out of 3) | 40 Marks |
| | Viva voce/ Lab quiz, Class Performance | |
| **External Evaluation** | End Semester Examination | 60 Marks |
| | Record | |
| | **Total** | **100 Marks** |
| **REVISED BLOOMS LEVEL** | | |
| **BL1** | Exhibits memory of previously learned material by recalling fundamental facts, terms, basic concept and answers about the selection. | |
| **BL2** | Demonstrate understanding of parts and Idea free organizing, comparing, translating, interpreting, giving descriptors and stating main ideas. | |
| **BL3** | Solve problems in new situation by applying acquired knowledge, facts, techniques and rules in different or new way. | |
| **BL4** | Examine and break information into parts by identifying motives or causes. Make inference and find evidence to support generalizations. | |
| **BL5** | Present and depend opinion by making judgement about information, validity of ideas or quality of work based on a set of criteria. | |
| **BL6** | Compile information together into different way by combining elements in a new pattern or proposing alternative solutions. | |

**Evaluation Pattern**

An academic year is divided into two semesters. The first semester is from June/July to November/December and the second semester is from November/December to April/May. A semester consists of 90 working days.

Evaluation consists of both Continuous Internal Assessment (CIA) and End Semester Examinations (ESE). The entire Undergraduate and Postgraduate Programmes offered by our college have various assessments for continuous internal evaluation. Relevant types of internal assessment are developed suiting the needs and requirements of each specific course. The various assessment components are quiz, snap test, viva-voce, seminar, listening comprehension, reading comprehension, problem solving, map reading, group discussion, panel discussion, assignment, field visit, poster presentation, open book test, writing composition, case study, online test, Book Review, Projects etc.

The CIA marks are read out and signed by the students in the respective classes on the day specified in the calendar. CIA is mandatory for all the students.

**Internal Assessment Modes (Theory Course)**

| | |
|---|---|
| Any six of the assessment components | 15 marks |
| Cycle Test(2) | 5 marks |
| Model Examination | 5 marks |
| Attendance | 5 marks |
| **Total** | **30 marks** |

**Internal Assessment Modes (Practical Course)**

| | |
|---|---|
| Laboratory work assessment (best 2 out of 3) | 20 marks |
| Viva voce/ Lab quiz | 10 marks |
| Class Performance | 10 marks |
| **Total** | **40 marks** |

**Society Connect Project (UG & PG)**

| | |
|---|---|
| Project Assessment | 10 marks |
| Presentation and feedback from the society | 10 marks |
| Participation in discussion | 10 marks |
| **Total** | **30 marks** |

**Internal Assessment Modes (Project)**

| | |
|---|---|
| Project Assessment | 15 marks |
| Participation in discussion | 10 marks |
| Presentation | 5 marks |
| **Total** | **30 marks** |

**PASSING MINIMUM**

The candidate shall be declared to have passed the examination if the candidates secure not less than 28 marks out of 70 marks in the semester examination in each theory course and in total (CIA mark + Theory ESE) not less than 40 marks.

The candidates shall be declared to have passed the examination if she secures not less than 40 marks in total (CIA mark + Practical Exam mark) with minimum of 24 marks out of 60 marks in the Practical Exam conducted by the University. There is no passing minimum for the record notebook. However, submission of the record notebook is necessary. Candidate who does not obtain the required minimum marks for a pass in a Course/Practical shall be declared Re-Appear (RA) and the candidate has to appear and pass the same at a subsequent appearance.

**Theory Course (Revised Bloom's Taxonomy)**

**Question Paper Model for UG**

| **Intended Learning Skills** | **Maximum 70 marks**<br>**Passing Minimum :40%**<br>**Duration: Three hours** |
|---|---|
| Memory Recall/ Example/ Counter Example/Knowledge about the Concept/ Understanding | Part- A (20×1=20 marks)<br>Answer ALL questions<br>Each question carries 1 marks |
| | Four questions from each UNIT |
| | Questions 1 to Questions 20 |
| Description/Application (problem) | Part- B (5×4=20 marks)<br>Answer ALL questions<br>Each question carries 4 marks |
| | **Either-or-Type**<br>Both parts of each question from the same Unit |
| | Questions 21(a) or 21 (b)<br>to<br>Questions 25(a) to 25(b) |
| Analysis/ Create/Evaluation | Part- C (3×10=30 marks)<br>Answer ANY THREE questions<br>Each question carries 10 marks |
| | There shall be FIVE questions covering all the five units |
| | Question 26 to Question 30 |

Each question should carry course outcomes and cognitive level
For instance:

1. [CO1 : $BL_2$] Question xxxx
2. [CO3 : $BL_1$] Question xxxx

## SEMESTER WISE INDEX

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **ALGEBRA & TRIGONOMETRY** | | | | | |
| **Paper Number** | | **CORE I** | | | | | |
| **Category** | **CORE** | **Year** | **I** | **Credits** | **4** | **Course Code** | **26UMACC1** |
| | | **Semester** | **I** | | | | |

| **Instructional Hours per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

| | |
|---|---|
| **Pre-requisite** | $12^{th}$ Standard Mathematics |
| **Objectives of the Course** | 1.Basic ideas on the Theory of Equations, Matrices and Number Theory.<br>2.Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems. |

**Course Outcomes:**

Students will be able to

**CO1:** classify and solve reciprocal equations

**CO2:** find the sum of binomial, exponential and logarithmic series

**CO3:** find Eigen values, eigen vectors, verify Cayley - Hamilton theorem and diagonalize a given matrix

**CO4:** expand the powers and multiples of trigonometric functions in terms of sine and cosine

**CO5:** determine relationship between circular and hyperbolic functions and the summation of trigonometric series

| | |
|---|---|
| **Course Outline** | **Unit – I (Hours: 12)**<br>Reciprocal Equations-Standard form–Increasing or decreasing the roots of a given equation - Removal of terms, Approximate solutions of roots of polynomials by Horner's method – related problems.<br>**Chapter 4 (Sections 32-34), Chapter 5 (Section 45) & Chapter 11 (Section 108)** |
| | **Unit –II (Hours: 12)**<br>Summation of Series: Binomial - Exponential - Logarithmic series (Theorems without proof) – Approximations - related problems.<br>**Chapter 1 (Page 84 - 88, 90 – 103) & Chapter 13 (Page 253)** |
| | **Unit–III (Hours: 12)**<br>Characteristic equation –Eigen values and Eigen Vectors-Similar matrices - Cayley –Hamilton Theorem (Statement only) - Finding powers of square matrix, Inverse of a square matrix up to order 3, Diagonalization of square matrices - related problems.<br>**Chapter 5(Sections5.1 -5.3) & Page 371** |
| | **Unit –IV (Hours: 12)**<br>Expansions of sin nθ, cos nθ in powers of sinθ, cosθ - Expansion of tan nθ in terms of tan θ, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$ –Expansions of $\tan(\theta_1+\theta_2+,.,+\theta_n)$-Expansions of sinθ, cosθ and tanθ in terms of θ - related problems.<br>**Chapters9 (Page 169 - 174) & Chapter 5 (Page 79 - 84)** |

| | |
|---|---|
| | **Unit –V (Hours: 12)**<br>Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities, Summation of trigonometric series - related problems.<br>**Chapter 4 (Page 52-57), Chapter 6 (Page 104 – 107& 110),**<br>**Chapter 10 (Page 197-202),**<br>**Chapter 13 (Page 241 - 245 & 256) &Chapter9 (Page 174 - 178)** |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1. W.S. Burnstine and A.W. Panton, Theory of equations (for Unit I)<br>2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007 (for Unit III)<br>3. C.V.Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003, (for Unit II, IV & V) |
| **Reference Books** | 1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005<br>2. J.Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012.<br>3. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.<br>4. Dr.P.R.Vittal &V.Malini, Algebra, Analytical Geometry &Trigonometry, MarghamPublications,Chennai-17.<br>5. T.K.Manickavasagam Pillai & others, Algebra Volume-I , S.V. Publications,1985. |
| **Web resources** | https://nptel.ac.in/<br>https://yutsumura.com/linear-algebra/the-cayley-hamilton-theorem/<br>https://www.youtube.com/watch?v=V1AKAkGJlN8 |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO2** | 2 | 1 | 3 | 1 | - | - | 3 | 2 | 1 |
| **CO3** | 3 | 1 | 3 | 1 | - | - | 3 | 2 | 1 |
| **CO4** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO5** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |

**Strong-3; Medium-2; Low**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **DIFFERENTIAL CALCULUS AND REAL LIFE AI APPLICATIONS** | | | | | |
| **Paper Number** | | **CORE II** | | | | | |
| **Category** | **CORE** | **Year** | **I** | **Credits** | **4** | **Course Code** | **26UMACC2** |
| | | **Semester** | **I** | | | | |

| **Instructional Hours per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** |
|---|---|---|---|---|
| | **4** | **1** | **-** | **5** |

| | |
|---|---|
| **Pre-requisite** | 12th Standard Mathematics |
| **Objectives of the Course** | 1. The basic skills of differentiation, successive differentiation, and their applications.<br>2. Basic knowledge on the notions of curvature, evolutes, involutes and polar co-ordinates and in solving related problems.<br>3. To develop analytical and computational skills through the study of envelopes and AI-enabled real-life applications of differential calculus. |

**Course Outcomes:**

Students will be able to

**CO1**: find the nth derivative, form equations involving derivatives and apply Leibnitz formula

**CO2**: find the partial derivative and total derivative coefficient

**CO3**: determine maxima and minima of functions of two variables and to use the Lagrange's method of undetermined multipliers

**CO4**: find curvature, radius and centre of curvature, evolutes, involutes, and radius of curvature in polar coordinates.

**CO5**: examine envelope concepts and apply AI-enabled approaches for analyzing real-life Applications

| | |
|---|---|
| **Course Outline** | **Unit–I (Hours: 15)**<br>**Successive Differentiation**<br>Introduction (Review of basic concepts) – The $n^{th}$ derivative – Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the $n^{th}$ derivative of a product – Feynman's method of differentiation<br>**Chapter 3 (Sections 3.1, 3.2 &3.3)** |
| | **Unit–II (Hours: 15)**<br>**Partial Differentiation**<br>Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.<br>**Chapter 11 (Sections 11.3-11.5)** |
| | **Unit–III (Hours: 15)**<br>**Partial Differentiation (Continued)**<br>Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers.<br>**Chapter 11 (Sections 11.3, 11.7, 11.8)** |

| | |
|---|---|
| | **Unit –IV(Hours: 15)**<br>**Curvature**<br>Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutes – Radius of Curvature in Polar Co-ordinates.<br>**Chapter 13 (Sections13.1, 13.2, 13.4, 13.7,13.10)** |
| | **Unit –V (Hours: 15)**<br>**Envelope**<br>Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.<br>**AI -Enabled Real-Life Applications**<br>Evaluation of geometrical optics, engineering design, robotics and motion planning, and smart agriculture through the lens of AI Tools.<br>**Chapter 14 (Sections 14.1 to 14.4)** |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007. (For Unit I, II & III)<br>2. N.P. Bali, Golden Differential Calculus, Laxmi Publications (P) Ltd. 2010. (For Unit IV &V) |
| **Reference Books** | 1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.<br>2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010.<br>3. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York, Inc., 1989.<br>4. T. Apostol, Calculus, Volumes I and II.<br>5. S. Goldberg, Calculus and mathematical analysis. |
| **Web resources** | https://nptel.ac.in/<br>https://www.edx.org/resources/why-math-is-essential-for-ai-ml<br>https://medium.com/@mathz_ai/the-top-5-applications-of-calculus-in-real-life-ede5ec16c80d<br>www.mathpages.com |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO2** | 2 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO3** | 3 | 2 | 3 | 2 | - | - | 3 | 2 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 1 | - | 3 | 2 | 1 |
| **CO5** | 3 | 2 | 3 | 2 | 1 | - | 3 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

| Subject Code | Subject Name | Category | L | T | P | Credits | Inst. Hours | Marks |
|---|---|---|---|---|---|---|---|---|
| **26UMAPGEC1** | **PHYSICS – I** | Generic Elective | | | | 3 | 3 | 70 |

| | |
|---|---|
| **COURSE** | **GENERIC ELECTIVE-I** |
| **COURSE TITLE** | **PHYSICS - I** |
| **CODE** | **26UMAPGEC1** |
| **CREDITS** | **3** |
| **HOURS** | **3** |
| **COURSE OBJECTIVES** | To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics. |

| UNITS | COURSE DETAILS |
|---|---|
| **UNIT-I** | **WAVES, OSCILLATIONS AND ULTRASONICS:** simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics: medical field – lithotripsy, ultrasonography – ultrasono imaging- ultrasonics in dentistry – physiotheraphy, opthalmology – advantages of noninvasive surgery – ultrasonics in green chemistry. |
| **UNIT-II** | **PROPERTIES OF MATTER:** *Elasticity*: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum<br>*Viscosity*: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method,<br>*Surface tension*: definition – molecular theory – droplets formation–shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension. |
| **UNIT-III** | **HEAT AND THERMODYNAMICS:** Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde's process of liquefaction of air– liquid Oxygen for medical purpose– importance of cryocoolers – thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process. |

| | |
|---|---|
| **UNIT-IV** | **ELECTRICITY AND MAGNETISM:** potentiometer – principle – measurement of thermoemf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart wifi switches- fuses and circuit breakers in houses |
| **UNIT-V** | **DIGITAL ELECTRONICS AND DIGITAL INDIA:** logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification – overview of Government initiatives: software technological parks under MeitY, NIELIT- semiconductor laboratories under Dept. of Space – an introduction to Digital India |
| **TEXT BOOKS** | 1. R.Murgesan (2001), Allied Physics, S. Chand & Co, New Delhi.<br>2. Brijlal and N.Subramanyam (1994), Waves and Oscillations, Vikas Publishing House, New Delhi.<br>3. Brijlal and N.Subramaniam (1994), Properties of Matter, S.Chand & Co., New Delhi.<br>4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8th edition), S.Chand & Co., New Delhi.<br>5. R.Murugesan (2005), Optics and Spectroscopy, S.Chand & Co, New Delhi.<br>6. A.Subramaniyam, Applied Electronics 2nd Edn., National Publishing Co., Chennai. |
| **REFERENCE BOOKS** | 1. Resnick Halliday and Walker (2018). Fundamentals of Physics (11thedition),<br>2. John Willey and Sons, Asia Pvt. Ltd., Singapore.<br>3. V.R.Khanna and R.S.Bedi (1998), Text book of Sound 1st Edn. Kedharnaath Publish & Co, Meerut.<br>4. N.S.Khare and S.S.Srivastava (1983), Electricity and Magnetism 10thEdn., Atma Ram & Sons, New Delhi.<br>5. D.R.Khannaand H.R. Gulati (1979). Optics, S. Chand & Co.Ltd., New Delhi.<br>6. V.K.Metha (2004). Principles of electronics 6th Edn. S.Chand and company. |
| **WEB LINKS** | 1. https://youtu.be/M_5KYncYNyc<br>2. https://youtu.be/ljJLJgIvaHY<br>3. https://youtu.be/7mGqd9HQ_AU<br>4. https://youtu.be/h5jOAw57OXM<br>5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/<br>6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://www.youtube.com/watch?v=gT8Nth9NWPMhttps://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3shttps://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work |

**METHOD OF EVALUATION:**

| Continuous Internal Assessment | End Semester Examination | Total | Grade |
|---|---|---|---|
| 25 | **75** | **100** | |

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

| | | |
|---|---|---|
| **COURSE OUTCOMES** | **CO1** | explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field. |
| | **CO2** | explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission. |
| | **CO3** | comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology. |
| | **CO4** | articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlate the connection between electric field and magnetic field and analyze the mathematically verify circuits and apply the concepts to construct circuits and study them. |
| | **CO5** | interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits. Acquire information about various Govt. programs/ institutions in this field. |

**MAPPING WITH PROGRAM OUT COMES:**

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | S | S | S | S | S | S | S | S | S | S |
| **CO2** | M | S | S | S | M | S | S | S | S | M |
| **CO3** | M | S | S | S | S | M | S | S | S | S |
| **CO4** | S | S | S | S | S | S | S | M | S | S |
| **CO5** | M | S | S | S | S | S | S | S | S | S |

| | |
|---|---|
| **COURSE** | **GENERIC ELECTIVE –I** |
| **COURSE TITLE** | **PHYSICS PRACTICAL - I** |
| **CODE** | **26UMAPGECQ1** |
| **CREDITS** | **2** |
| **HOURS** | **2** |
| **COURSE OBJECTIVES** | Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results |

**ANY Seven only**

- Young's modulus by non-uniform bending using pin and microscope
- Young's modulus by non-uniform bending using optic lever, scale and telescope
- Rigidity modulus by static torsion method.
- Rigidity modulus by torsional oscillations without mass
- Surface tension and interfacial Surface tension – drop weight method
- Comparison of viscosities of two liquids – burette method
- Specific heat capacity of a liquid – half time correction
- Verification of laws of transverse vibrations using sonometer
- Calibration of low range voltmeter using potentiometer
- Determination of the rmosemf using potentiometer
- Verification of truth tables of basic logic gates using ICs
- Verification of De Morgan's theorems using logic gate ICs.
- Use of NAND as universal building block.

*Note* : Use of digital balance permitted

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">MATHEMATICS FOR COMPETITIVE EXAMINATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">NME I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMASEC1</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. To introduce the basic concepts of Mathematics.<br>2. To make them to find simple and compound interest.<br>3. To promote the problem solving ability to write the competitive examinations.</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: recognize the notions on numbers and averages<br>CO2: understand the concepts of profit and loss, ratio and proportion, partnership, simple interest and compound interest problems<br>CO3: apply the concepts obtained in the course to solve real life problems<br>CO4: infer solutions about the partnership and rate of proportionality appropriately.<br>CO5: analyze the problems on profit and loss and inspect the odd man out series.</td></tr>
<tr><td colspan="2" rowspan="5">Course outline</td><td colspan="7">Unit – I (Hours: 6)<br>Averages, Problems on Numbers.<br>Section-I – Chapter 6 – Solved examples 1-15 only (Page No. 139-141), Chapter 7 - Solved examples 1-15 only (Page No.161-163).</td></tr>
<tr><td colspan="7">Unit – II (Hours: 6)<br>Profit and Loss<br>Section-I – Chapter 11 – Solved examples 1-29 only (Page No.251-256).</td></tr>
<tr><td colspan="7">Unit – III (Hours: 6)<br>Ratio and Proportion, Partnership<br>Section-I – Chapter 12 – Solved examples 1-7 only (Page No.294-296), Chapter 13 (Page No.311-325).</td></tr>
<tr><td colspan="7">Unit – IV (Hours: 6)<br>Simple Interest, Compound Interest<br>Section-I – Chapter 21 – Solved examples 1-12 only (445-447), Chapter 22 – Solved examples 1-15 only (466-470).</td></tr>
<tr><td colspan="7">Unit – V (Hours: 6)<br>Odd Man Out and Series<br>Section-I – Chapter 35 (Page No.649-657).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved.</td></tr>
</table>

| | |
|---|---|
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Dr. R. S. Aggarwal- Quantitative Aptitude for Competitive Examinations (Fully Solved) (Seventh Revised Edition), S. Chand & Company Pvt. Ltd |
| **Reference Books** | Abhijit Guha - Quantitative Aptitude for All Competitive Examinations, McGraw Hill Education, Sixth edition. |
| **Web resources** | 1. https://ncert.nic.in/ncerts/l/gemh108.pdf<br>2. https://ncert.nic.in/textbook/pdf/femh112.pdf?html<br>3. https://ncert.nic.in/ncerts/l/hemh108.pdf |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">BRIDGE MATHEMATICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">FOUNDATION COURSE</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMASEFC</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1.To bridge the gap and facilitate the transition from higher secondary to tertiary education;<br>2.To instill confidence among students and inculcate interest for Mathematics.</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems<br>CO2: find the various sequences and series and solve the problems related to them. Explain the principle of counting.<br>CO3: find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations<br>CO4: explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.<br>CO5: find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="7">UNIT-I: (Hours: 6)<br>Algebra: Binomial theorem, General term, middle term, problems based on these concepts</td></tr>
<tr><td colspan="7">Unit II: (Hours: 6)<br>Sequences and series (Progressions). Fundamental principle of counting. Factorial n.</td></tr>
<tr><td colspan="7">Unit III:(Hours: 6)<br>Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.</td></tr>
<tr><td colspan="7">Unit IV: (Hours: 6)<br>Trigonometry: Introduction to trigonometric ratios, proof of sin(A+B), cos(A+B), tan(A+B) formulae, multiple and sub multiple angles, sin(2A), cos(2A), tan(2A) etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule.</td></tr>
</table>

| | |
|---|---|
| | **Unit V: (Hours: 6)**<br>Calculus: Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives, integration - product rule and substitution method. |
| **Recommended Text** | 1. NCERT class XI and XII text books.<br>2. Any State Board Mathematics text books of class XI and XII |
| **Web resources** | https://nptel.ac.in/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | |
|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** |
| **CO1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **CO2** | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| **CO3** | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| **CO4** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| **CO5** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">ANALYTICAL GEOMETRY (TWO & THREE DIMENSIONS)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">26UMACC3</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>3</td><td colspan="2">1</td><td colspan="2">-</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. Necessary skills to analyze characteristics and properties of two- and three-dimensional geometric shapes.<br>2. To present mathematical arguments about geometric relationships.<br>3. To solve real world problems on geometry and its applications.</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: assimilate the basic concepts of Polar Equations of Straight Line and Circle<br>CO2: understand the concepts of the Ellipse, the Hyperbola and Conic<br>CO3: learn about angle between two planes, Symmetrical form of Equations and solve related problems.<br>CO4: analyse the concepts of straight lines, coplanarity of straight lines and shortest distance between two given lines<br>CO5: explain in detail the system of Spheres.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="7">Unit – I (Hours: 15)<br>Coordinates, Length of Straight Lines and Areas of Triangles: Polar coordinates<br>The Straight Line: Polar Equations and Oblique Coordinates<br>The Circle: Equation to a Tangent<br><br>Chapter 2 (Sections 30-35)<br>Chapter 5 (Sections 88-96)<br>Chapter 8(Sections138-147)</td></tr>
<tr><td colspan="7">Unit –II (Hours: 15)<br><br>The Ellipse: Pole and Polar - Conjugate Diameters.<br>The Hyperbola: Asymptotes<br>Polar Equation to a Conic: Polar Equation to a Tangent, Polar and Normal.<br><br>Chapter 12 (Sections 274-292)<br>Chapter 13 (Sections 312 -327)<br>Chapter 14(Sections 335-347)</td></tr>
<tr><td colspan="7">Unit–III (Hours: 15)<br>The Plane, The Straight line, Volume of the Tetrahedron: Forms of the Equation to a Plane - The General Equation to a Plane - The Distance of a Point from a Plane - The Planes Bisecting the angles between two given Planes - The Equation to a Straight Line - Symmetrical form of Equation.<br><br>Chapter - 3 (Sections 33 - 35, 37 - 40)</td></tr>
</table>

| | |
|---|---|
| | **Unit –IV (Hours: 15)**<br><br>**The Plane, The Straight line, Volume of the Tetrahedron:** The Line through two given Points - The Direction Ratios found from the Equations - Constants in the Equation to a Line - The Plane and the Straight Line - The intersection of Three Planes - The Condition that two given Lines should be Coplanar - The Shortest Distance between two given Lines.<br><br>**Chapter - 3 (Sections41 - 45,48 & 49)** |
| | **Unit -V (Hours: 15)**<br><br>**The Sphere:** The Equation to a sphere - Tangents and Tangent Plane to a Sphere - The Radical Plane of two Spheres.<br><br>**Chapter - 5 (Sections 56 -58)** |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill. |
| **Recommended Text** | 1. S. L. Loney, Co-ordinate Geometry (For Units I & II).<br>2. Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions. (For Units III, IV & V) |
| **Reference Books** | 1. Thomas G.B and Finney R. L, Calculus and Analytical Geometry, Pearson Publication, 9th Edition, 2010.<br>2. Manicavachagom Pillay T. K and Natarajan T, A Text book of Analytical Geometry Part I- Two Dimensions, Divya Subramanian for Ananda Book Depot, 1996<br>3. Shanti Narayanan and Mittal P.K, Analytical Solid Geometry, S. Chand Publishing, 2021.<br>4. Vittal P.R and Malini V, Algebra, Analytical Geometry & Trigonometry, Margam Publications, India, 2018<br>5. William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016. |
| **Web resources** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 2 | 2 | 2 | 1 | - | - | 3 | 2 | 1 |
| **CO2** | 2 | 2 | 2 | 1 | - | - | 3 | 2 | 1 |
| **CO3** | 3 | 2 | 2 | 1 | - | - | 3 | 2 | 1 |
| **CO4** | 3 | 2 | 3 | 1 | - | - | 3 | 2 | 1 |
| **CO5** | 3 | 2 | 3 | 1 | - | - | 3 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">INTEGRAL CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">26UMACC4</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>3</td><td colspan="2">-</td><td colspan="2">-</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1.Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.<br>2. Knowledge about beta and gamma functions and the applications.<br>3. Skills to determine Fourier series expansions.</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.<br>CO2: evaluate double and triple integrals and problems using change of order of integration<br>CO3: solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution<br>CO4: explain beta and gamma functions and to use them in solving problems of integration<br>CO5: explain geometric and physical applications of integral calculus</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">Unit – I (Hours: 12)<br>Reduction formulae - Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic function - Bernoulli’s formula, Feyman’s technique of integration.<br>Chapter 6 & 7 (Sections 6.6 &6.7, 7.2-7.4)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit – II (Hours: 12)<br>Multiple Integrals - definition of double integrals -evaluation of double integrals - double integrals in polar coordinates - Change of order of integration.<br>Chapter 14 (Sections 14.1&14.3)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit–III (Hours: 12)<br>Triple integrals - applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces - change of variables - Jacobian.<br>Chapter 14 (Sections 14.5-14.7)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit –IV (Hours: 12)<br>Beta and Gamma functions - infinite integrals - definitions - recurrence formula of Gamma functions - properties of Beta and Gamma functions - relation between Beta and Gamma functions - Applications.<br>Chapter 3(Sections 3.1-3.3)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit –V (Hours: 12)<br>Geometric and Physical Applications of Integral calculus.<br>Chapter 5(Sections 5.1 - 5.8)</td></tr>
</table>

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|---|---|
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved. |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1.H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc.,2002. (For Units I,II,III & V)<br>2.D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd. (For Unit IV) |
| **Reference Books** | 1. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010.<br>2. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2001(second edition). |
| **Web resources** | https://nptel.ac.in/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO2** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO3** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO4** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO5** | 3 | 1 | 3 | - | 2 | 1 | 3 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

| Subject Code | Subject Name | Category | L | T | P | Credits | Inst. Hours | Marks |
|---|---|---|---|---|---|---|---|---|
| **26UMAPGEC2** | **PHYSICS –II** | **Elective** | **2** | **1** | **-** | **3** | **3** | **70** |

| | |
|---|---|
| **COURSE** | **ELECTIVE-II (GE)** |
| **COURSE TITLE** | **PHYSICS –II** |
| **CREDITS** | 3 |
| **COURSE OBJECTIVES** | To understand the basic concepts of optics, modern Physics, Relativity, quantum physics, semiconductor physics and electronics |

| UNITS | COURSE DETAILS |
|---|---|
| **UNIT-I** | **OPTICS:** Interference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light– normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries |
| **UNIT-II** | **ATOMIC PHYSICS:** Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect – Zeeman effect (elementary ideas only). |
| **UNIT-III** | **NUCLEAR PHYSICS:** Nuclear models – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life - radio isotopes and uses – nuclear fission – energy released in fission – chain reaction - atom bomb - nuclear fusion – thermonuclear reactions – differences between fission and fusion (elementary ideas only). |
| **UNIT-IV** | **INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES**: Frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence. |
| **UNIT-V** | **SEMICONDUCTOR PHYSICS:** p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier. |
| **TEXT BOOKS** | 1. R.Murugesan (2005), Allied Physics, S.Chand & Co, New Delhi.<br>2. K.Thangaraj and D.Jayaraman (2004), Allied Physics, Popular Book Depot, Chennai.<br>3. Brijlal and N.Subramanyam (2002), Text book of Optics, S.Chand & Co, New Delhi.<br>4. R.Murugesan (2005), Modern Physics, S.Chand & Co, New Delhi.<br>5. A.Subramaniyam Applied Electronics, 2nd Edn., National Publishing Co., Chennai. |

| | |
|---|---|
| **REFERENCE BOOKS** | 1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11th Edn., John Willey and Sons, Asia Pvt. Ltd., Singapore.<br>2. D.R.Khanna and H.R. Gulati (1979). Optics, S.Chand & Co.Ltd., New Delhi.<br>3. A.Beiser (1997), Concepts of Modern Physics, Tata Mc Graw Hill Publication, New Delhi.<br>4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, New Delhi.<br>5. V.K.Metha (2004), Principles of electronics, 6th Edn. , S.Chand and Company, New Delhi. |
| **WEBLINKS** | *1.* https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo<br>2. https://www.youtube.com/watch?v=JrRrp5F-Qu4<br>3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/<br>4. https://www.atoptics.co.uk/atoptics/blsky.htm -<br>5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects |
| **Board of Studies Date : 02.11.2023** | |

**METHOD OF EVALUATION:**

| Continuous Internal Assessment | End Semester Examination | Total | Grade |
|---|---|---|---|
| 30 | **70** | **100** | |

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

| | | |
|---|---|---|
| **COURSE OUTCOMES** | **CO1** | explain the concepts of interference diffraction using principles of super position of waves and rephrase the concept of polarization based on wave patterns |
| | **CO2** | outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation.. |
| | **CO3** | summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delay rate half-life and mean-life. Interpret nuclear processes like fission and fusion. Understand the importance of nuclear energy in nuclear field. |
| | **CO4** | to describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice versa. |
| | **CO5** | summarize the working of semiconductor devices like junction diode, Zener diode, transistors and full wave bridge rectifer. |

**MAPPING WITH PROGRAM OUT COMES:**

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | S | S | S | S | S | S | S | S | S | S |
| **CO2** | M | S | S | S | M | S | S | S | S | M |
| **CO3** | M | S | S | S | S | M | S | S | S | S |
| **CO4** | S | S | S | S | S | S | S | M | S | S |
| **CO5** | M | S | S | S | S | S | S | S | S | S |

| Subject Code | Subject Name | Category | L | T | P | Credits | Inst. Hours | Marks |
|---|---|---|---|---|---|---|---|---|
| **26UMAPGECQ2** | **PHYSICS PRACTICALS – II** | **Elective** | **-** | **-** | **2** | **2** | **2** | **60** |

| | |
|---|---|
| **COURSE** | **Elective Course (GE)** |
| **COURSE TITLE** | **PHYSICS PRACTICAL – II** |
| **CREDITS** | 2 |
| **COURSE OBJECTIVES** | 1.Apply the concepts of Light, electricity and magnetism and waves,<br>2.Set up experiments to verify theories, quantify and analyse the observations.<br>3.To do error analysis and correlate results |

**Any Eight**

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Specific resistance of a wire using PO box
8. Thermal conductivity of poor conductor using Lee's disc
9. Determination of figure of merit table galvanometer
10. Determination of Earth's magnetic field using field along the axis of a coil
11. Characterisation of Zener diode
12. Construction of Zener/IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block

**Board of Studies Date : 02.11.2023**

**METHOD OF EVALUATION:**

| Continuous Internal Assessment | End Semester Examination | Total | Grade |
|---|---|---|---|
| 30 | **70** | **100** | |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">QUANTITATIVE APTITUDE FOR COMPETITIVE EXAMINATIONS (FOR I B.A / I B.Sc. / I B.Com)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">NME II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMASEC2</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="3">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="3">-</td><td>-</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To introduce the basic concepts of Mathematics.<br>2.To make the students to acquire knowledge on Geometry and solid and plane figures.<br>3.To initiate the students to find the volume and surface area of solids.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: recognize the notions of numbers, H.C.F and L.C.M percentage<br>CO2: understand the concepts of area, volume and surface area.<br>CO3: use the acquire knowledge to solve the problems in numbers, H.C.F and L.C.M and percentage.<br>CO4: calculate the area, volume and surface area for geometrical shapes and solid shapes.<br>CO5: apply the concepts acquired to write the competitive examinations.</td></tr>
<tr><td colspan="2" rowspan="5">Course outline</td><td colspan="6">Unit - I (Hours: 6)<br><br>Operations on Numbers.<br>Section-I - Chapter 1 - Solved examples 1-32 only.(Page No. 1-9 only)</td></tr>
<tr><td colspan="6">Unit – II (Hours: 6)<br><br>H.C.F. and L.C.M of Numbers.<br>Section-I - Chapter 2 (Page No. 30-45 only)</td></tr>
<tr><td colspan="6">Unit - III (Hours: 6)<br><br>Percentage<br>Section-I - Chapter 10 - Solved examples 1-33 only. (Page No.208-214 only)</td></tr>
<tr><td colspan="6">Unit - IV (Hours: 6)<br><br>Area<br>Section-I - Chapter 24 - Solved examples 1-32 only. (Page No. 499-505 only)</td></tr>
<tr><td colspan="6">Unit - V (Hours: 6)<br><br>Volume and Surface Area<br>Section-I - Chapter 25 - Solved examples 1-34 only. (Page No. 549-555 only)</td></tr>
</table>

| | |
|---|---|
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved. |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Dr. R. S. Aggarwal- Quantitative Aptitude for Competitive Examinations (Fully Solved) (Seventh Revised Edition), S. Chand & Company Pvt. Ltd |
| **Reference Books** | Rajesh Verma, Fast Track Objective Arithmetic, Arihant Publications India Limited, New Delhi, Completely Revised Edition. |
| **Web resources** | 1. http://ncert.nic.in/ncerts/l/iemh113.pdf<br>2. https://yoursmahboob.files.wordpress.com/2016/12/quantramandeepbook-1.pdf |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">HISTORY AND DEVELOPMENT OF INDIAN MATHEMATICS (FROM VEDIC PERIOD TO MODERN ERA)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">SEC III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMASEC3</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. Understand the Ancient Beginnings<br>2. Grasp the Classical Period Contributions<br>3. Realize the Colonial Period and Modern Developments</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: understand the foundational contributions of ancient India during the Vedic period, including the concept of zero, arithmetic operations, and basic geometry.<br>CO2: explore the classical period advancements, such as the Brahmas phutasiddhanta, the Aryabhata, and their influence on algebra, trigonometry, and astronomy.<br>CO3: analyze the medieval era's contributions, including the works of Mathematicians like Bhaskar Acharya and his pioneering concept in calculus and continuous functions.<br>CO4: recognize the interactions between Indian and global mathematics during the colonial period, leading to integrated and expanded mathematical knowledge.<br>CO5: realize the modern era's contributions, where Indian mathematics like Ramanujan made profound discoveries and India's ongoing role in the global mathematical community.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">Unit – I (Hours:6)<br>Introduction of Mathematics -Evolution of Vedic Mathematics - Features of Vedic Mathematics - Importance of Vedic Mathematics - Sutras - Sub sutras.</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit –II(Hours:6)<br>Baudhayana-Apastamba-yajnavalkya-panini-Aryabhata-varahamihira- Brahmagupta- Bhaskara- Mahavira-Sridharacharya- Bhaskara-II-Madhava of Sangamagrama-Nilakantha somayaji-Jyeshtadeva-Parameshvara-Ramanujan.</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit–III (Hours:6)<br>Birth of Zero - Mathematics in Vedas- A Generalized<br>Approach for finding the Nth order roots of Numbers.</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit-IV (Hours:6)<br>A Greedy Algorithm Hidden in Sulbasutra- Sankaras Geometrical Approach to Citrabhanus Ekavimsati Prasnottara.</td></tr>
</table>

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|---|---|
| | **Unit –V(Hours:6)**<br>Vedic Mathematics in Modern Era - Vedic Mathematics in Computer: A survey -Vedic Mathematics- The cosmic software for implementation of fast Algorithms - Analysis of digital signal processing Algorithms based on Vedic Mathematics - Role of Vedic Mathematics in driving optimal solutions for Real Life Problems**.** |
| **Recommended Text** | Proceedings of the National Workshop on Ancient Indian Mathematics with special reference to Vedic Mathematics and Astronomy.<br>Rashtriya Sanskrit Vidyapeetha 2011. |
| **Web resources** | https://nptel.ac.in/ |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">VECTOR CALCULUS AND ITS APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">26UMACC5</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="3">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td>3</td><td colspan="3">1</td><td>-</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. Knowledge about differentiation of vectors and on differential operators. Knowledge about derivatives of vector functions.<br>2. Skills in evaluating line, surface and volume integrals.<br>3. The ability to analyze the physical applications of derivatives of vectors.</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: find the derivative of vector and sum of vectors, product of scalar and vector point function and to Determine derivatives of scalar and vector products<br>CO2: applications of the operator ‘del’ and to Explain soleonidal and ir-rotational vectors<br>CO3: solve simple line integrals<br>CO4: solve surface integrals and volume integrals<br>CO5: verify the theorems of Gauss, Stoke’s and Green’s(Two Dimension)</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">Unit – I (Hours: 12)<br>Vector point function - Scalar point function - Derivative of a vector and derivative of a sum of vectors - Derivative of a product of a scalar and a vector point function - Derivative of a scalar product and vector product.<br>Chapter 1(Sections1.1 -1.5)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit –II (Hours: 12)<br>The vector operator ‘del’, The gradient of a scalar point function - Divergence of a vector - Curl of a vector - solenoidal and irrotational vectors – simple applications.<br>Chapter 2(Sections2.1 -2.7)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit–III (Hours: 12)<br>Laplacian operator, Vector identities - Line integral - simple problems.<br>Chapter 2(Sections2.8) & Chapter 3(Sections 3.1 -3.4)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit –IV (Hours: 12)<br>Surface integral - Volume integral – Applications<br>Chapter 3(Sections 3.5,3.6)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit –V (Hours: 12)<br>Gauss divergence Theorem, Stoke’s Theorem, Green’s Theorem in two dimensions – Applications to real life situations.<br>Chapter 4(Sections 4.1 -4.5)</td></tr>
</table>

| | |
|---|---|
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1.P. Duraipandian and Laxmi Duraipandian, Vector Analysis Revised Edition, Emerald publishers, Chennai<br>2. J.C. Susan ,Vector Calculus, , (4th Edn.) Pearson Education, Boston, 2012. |
| **Reference Books** | 1.A. Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014.<br>2.J.E. Marsden and A. Tromba ,Vector Calculus, , ($5^{th}$edn.) W.H. Freeman, New York, 1988. |
| **Web resources** | https://nptel.ac.in/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 2 | 3 | 1 | - | - | 3 | 2 | 1 |
| **CO2** | 3 | 2 | 3 | 1 | 2 | - | 3 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | - | 3 | 3 | 1 |

**Strong-3; Medium-2; Low-1**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS** | | | | | |
| **Paper Number** | | **CORE VI** | | | | | |
| **Category** | **CORE** | **Year** | **II** | **Credits** | **4** | **Course Code** | **26UMACC6** |
| | | **Semester** | **III** | | | | |
| **Instructional Hours per week** | | **Lecture** | **Tutorial** | | **Lab Practice** | | **Total** |
| | | **4** | **1** | | **--** | | **5** |
| **Pre-requisite** | | $12^{th}$ Standard Mathematics | | | | | |
| **Objectives of the Course** | | 1. Knowledge about the methods of solving Ordinary and Partial Differential Equations.<br>2. The understanding of how Differential Equations can be used as a powerful tool in solving problems in science. | | | | | |

**Course Outcomes :**

Students will be able to

**CO1:** determine solutions of homogeneous equations, non- homogeneous equations of degree one in two variables, solve Bernoulli's equations and exact differential equations.

**CO2:** find the solutions of equations of first order but not of higher degree and to Determine particular integrals of algebraic, exponential, trigonometric functions and their products.

**CO3:** find solutions of simultaneous linear differential equations, linear equations of second order and to find solutions using the method of variations of parameters.

**CO 4:** form a PDE by eliminating arbitrary constants and arbitrary functions, find complete, singular and general integrals, to solve Lagrange's equations

**CO 5:** explain standard forms and Solve Differential equations using Charpit's method.

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|---|---|
| **Course Outline** | **UNIT-I: (Hours: 15)**<br>Ordinary Differential Equations: Variable separable - Homogeneous Equation-Non-Homogeneous Equations of first degree in two variables - Linear Equation - Bernoulli's Equation-Exact differential equations.<br>**(Chapter2: Sections 1 to 6)** |
| | **UNIT-II: (Hours: 15)**<br>Equation of first order but of higher degree: Equation solvable for dy/dx-Equation solvable for y-Equation solvable for x- Clairauts' form - Linear Equations with constant coefficients-Particular integrals of algebraic, exponential, trigonometric functions and their products.<br>**(Chapter4: Sections 1,2 ,3 and Chapter5: 1 to 4)** |
| | **UNIT-III: (Hours: 15)**<br>Simultaneous linear differential equations- Linear Equations of the Second Order -Complete solution in terms of a known integrals-Reduction to the Normal form-Change of the Independent Variable-Method of Variation of Parameters.<br>**(Chapter 6 and Chapter 8: Sections 1 to 4)** |

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| | **UNIT-IV: (Hours: 15)**<br>Partial differential equation: Formation of PDE by Eliminating arbitrary constants and arbitrary functions- complete integral – singular integral- General integral- Lagrange's Linear Equations – Simple Applications.<br>**(Chapter12: 1,2,3, and 4)** |
| | **UNIT-V: (Hours: 15)**<br>Special methods – Standard forms- Charpit's Method- Simple Applications.<br>**(Chapter12: 5, and 6)** |
| **Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper)** | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| **Skills acquired from this course** | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1. Narayanan S and Manicavachagam Pillay T.K. Differential equations and its application, 2006, S. Viswananthan Printers Pvt. Ltd.<br>2. G.F. Simmons, Differential equations with applications and historical notes, 2nd Ed, Tata Mcgraw Hill Publications, 1991. |
| **Reference Books** | 1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.<br>2. I.Sneddon, Elements of Partial Differential Equations, McGraw- Hill, International Edition, 1967.<br>3. D.A. Murray, Introductory course in Differential Equations, Orient and Longman<br>4. H.T. H.Piaggio, Elementary Treaties on Differential Equations and their applications, C.B.S Publisher & Distributors, Delhi,1985.<br>5. Horst R. Beyer, Calculus and Analysis, Wiley, 2010.<br>6. Braun, M. Differential Equations and their Applications. (3rd Edn.), Springer- Verlag, New York. 1983.<br>7. TynMyint-U and Lognath Debnath. Linear Partial Differential Equations for Scientists and Engineers. (4th Edn.) Birhauser, Berlin. 2007.<br>8. Boyce, W.E. and R.C.DiPrima. Elementary Differential Equations and Boundary Value Problems. (7th Edn.) John Wiley and Sons, Inc., New York. 2001.<br>9. Sundrapandian, V. Ordinary and Partial Differential Equations, Tata McGraw Hill Education Pvt.Ltd. New Delhi, 2013 |
| **Website and e-Learning Source** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 3 | 2 | 1 | - | 3 | 2 | 1 |
| **CO2** | 3 | 1 | 3 | 2 | 1 | - | 3 | 2 | 1 |
| **CO3** | 3 | 1 | 3 | 2 | 1 | - | 3 | 3 | 1 |
| **CO4** | 3 | 1 | 3 | 2 | 2 | 1 | 3 | 3 | 1 |
| **CO5** | 3 | 1 | 3 | 2 | 2 | 1 | 3 | 3 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL STATISTICS - I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE – I (DISCIPLINE SPECIFIC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSEC1</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td>-</td><td colspan="2">-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basics of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To introduce the basic concepts of random variables, probability distribution and measures.<br>2. To introduce the statistical concepts and develop analytical skills.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: identify characteristic functions, probability generating functions, and conditional expectation to analyze probabilistic properties and evaluate random phenomena.<br>CO2: explain correlation and regression concepts to apply statistical techniques and assess variable relationships and solve real life oriented concept problems.<br>CO3: describe least square methods while examining curve fitting models to justify statistical predictions.<br>CO4: interpret binomial, Poisson, and normal distributions through comparing probability models to validate statistical outcomes.<br>CO5: classify measures of averages, dispersion, and skewness to investigate data characteristics and recommend appropriate statistical measures for solving society connected problems.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit – I (Hours: 12)<br>Characteristic Functions: Definition, Properties of characteristic function, Moments from the characteristic function, Inversion theorem, Probability generating function – Definition, Probability generating function of Binomial distribution and Poisson distribution, Additive Property, Relation between PGF and MGF and examples.<br>Cumulants: Definition, examples, Additive Property of Cumulants.<br>Conditional Expectation: Definition, Theorems on conditional expectation and examples<br>Part I: Chapter 6 (Page No.: 6.1 – 6.46)<br>Part I: Chapter 7 (Page No.: 7.1 – 7.11)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit – II (Hours: 12)<br>Correlation: Definition, Rank correlation, Properties of correlation coefficient, Limitations, Examples.<br>Regression – Derivation of Regression lines, Properties of regression coefficients, Examples.<br>Part I: Chapter 8 (Page No.:8.20 - 8.47)<br>Part I: Chapter 9 (Page No.: 9.1 - 9.24)</td></tr>
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| | **Unit - III (Hours: 12)**<br><br>**Curve Fitting**: Method of least square - Fitting of a straight line and second-degree Parabola, Fitting of Power Curve and Exponential Curves - Simple Problems.<br>**Part I: Chapter 10 (Page No.: 10.1 – 10.14)** |
| | **Unit - IV (Hours: 12)**<br><br>**Binomial Distribution**: Definition, Binomial frequency distribution and Examples.<br>**Poisson Distribution**: Definition and Examples of Poisson Distribution.<br>**Normal distribution**: Definition, standard normal probability distribution and Examples.<br><br>**Part I: Chapter 12 (Page No.: 12.1 – 12.16)**<br>**Part I: Chapter 13 (Page No.: 13.1 – 13.12)**<br>**Part I: Chapter 16 (Page No.: 16.1, 16.13 - 16.27)** |
| | **Unit –V (Hours: 12)**<br><br>**Measures of Averages:** Definitions - Mean, Median, Mode, Geometric mean, Harmonic mean - Merits and demerits.<br>**Measures of Dispersion:** Range, Quartile deviation, Mean deviation and their coefficients - Standard deviation - Co-efficient of Variation - Merits and demerits.<br>**Measure of Skewness**: Karl Pearson's and Bowley's Coefficient of Skewness.<br><br>**Part II: Chapter 5 (Page No.: 5.1 – 5.22)**<br>**Part II: Chapter 6 (Page No.: 6.1 – 6.37)**<br>**Part II: Chapter 7 (Page No.: 7.1 – 7.18)** |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved. |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1. Vittal P. R, Mathematical Statistics, Margham Publications, Chennai. (For Units I - V) |

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|---|---|
| **Reference Books** | 1. Gupta S. C and Kapoor V. K, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi(11th edition)2004.<br>2. Gupta. S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.<br>3. Sancheti D. C and Kapoor V. K, Statistics (7th Edition), Sultan Chand & Sons, New Delhi, 2005.<br>4. Robert V. Hogg, Allen T. Craig, Joseph W. Mc Kean, Introduction to mathematical statistics, Pearson Education.<br>5. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.<br>6. Marek Fisz, Probability theory and Mathematical Statistics, John Wiley and Sons.<br>7. Rohatgi V. K, An Introduction to Probability theory and Mathematical Statistics, Wiley Eastern Ltd., Publishers, New Delhi.<br>8. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>9. Hoel P. G, Introduction to Mathematical Statistics, Asia Publishing House, New Delhi. |
| **Web resources** | https://nptel.ac.in/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 1 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">STATISTICS WITH EXCEL PROGRAMMING (PRACTICAL)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">SEC – IV</td></tr>
<tr><td>Category</td><td>Skill enhancement (Entrepreneurial based)</td><td>Year</td><td>II</td><td>Credit</td><td>1</td><td>Course Code</td><td>26UMASECQ4</td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="3">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>-</td><td colspan="3">--</td><td colspan="2">1</td><td>1</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">To Acquire the knowledge of Statistics with Excel Programming</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1 : handle distribution of data and analyses the characteristics of data using Excel.<br>CO2 : find Normal distribution, common distribution shapes, Correlation Coefficient and plot graphs using Excel.<br>CO3 : create Time-Series Graphs, Dot plots, Stem plots, Bar Charts, Pie Charts using Excel.<br>CO4 : compute Mean and Median using Excel.<br>CO5 : compute Mode, Midrange, Weighted Mean using Excel.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">UNIT – I (Hours : 3)<br>Distribution of data- Characteristics of data- Frequency distribution- Procedure for Constructing a Frequency Distribution-Using Excel to Construct a Frequency Distribution-Relative Frequency Distribution-Cumulative Frequency Distribution.<br>Chapter 2 ( Page No. 58 - 70)</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-II (Hours : 3)<br>Histograms-Relative Frequency Histogram-Normal Distribution-Common Distribution Shapes-Skewness-Using XLSTAT for Histograms-Graphs-Using Excel to Construct a Scatterplot-Correlation Coefficient.<br>Chapter 2 (Page No. 70 - 81)</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-III (Hours : 3)<br>Time-Series Graph-Dot plots-Using XLSTAT for Stem plots-Bar Graphs-Using Excel to Create Bar Graphs-Pareto Charts-Pie Charts-Using Excel to Create Pie Charts-Frequency Polygon-Using Excel to Create Frequency Polygons.<br>Chapter 2 (Page No. 81 - 98)</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-IV (Hours : 3)<br>Descriptive statistics – Measures of Center – Mean -Using Excel to Calculate the Mean-Median-Using Excel to Find the Median.<br>Chapter 3 (Page No. 110 - 114)</td></tr>
</table>

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|---|---|
| | **UNIT-V (Hours : 3)**<br>Mode-Using Excel to Find the Mode-Midrange-Using Excel to Calculate the Midrange-Weighted Mean-Using Excel for Descriptive Statistics.<br>**Chapter 3 (Page No. 114 - 125)** |
| **Recommended Text** | Mario F. Triola, "Elementary Statistics Using Excel", Fifth Edition, Pearson New International Edition, 2014. |
| **Reference Books** | 1. E. Balagurusamy, "Computer Oriented Statistical and Numerical Methods", Macmillan Publishers India Limited, 2000.<br>2. V. K. Rohatgi, A. M. E. Saleh, "An introduction to probability and statistics", John Wiley & Sons, 2015.<br>3. B. Held, B. Moriarty&T. Rchardson, "Microsoft Excel Functions andFormulas", Stylus Publishing, LLC, 2019.<br>4. N. J. Salkind, "Excel statistics: A quick guide", Sage Publications, 2015.<br>5. J. Schmuller, "Statistical analysis with Excel for dummies", John wiley & sons, 2013. |
| **Website and e-Learning Source** | https://nptel.ac.in |

**Mapping of Cos with POs and PSOs**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO2** | 2 | 1 | 3 | 1 | - | - | 3 | 2 | 1 |
| **CO3** | 3 | 1 | 3 | 1 | - | - | 3 | 2 | 1 |
| **CO4** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |
| **CO5** | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DATA ANALYTICS WITH R – PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SEC V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMASECQ5</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">-</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To familiarize the operations on vectors and matrices using R studio<br>2. To understand computations on Big Data analytics and correlation using R studio</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: understand the operations on vectors using R<br>CO2: interpret basic operations on matrices using R<br>CO3: apply commands on data frames to understand various operations on it using R<br>CO4: solve Correlation problems with R<br>CO5: analyse the operations on Big Data tables using R</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit- I (Hours:6)<br>Getting started with R: Installation – Getting started with the R interface<br><br>R Nuts and Bolts – Entering Input – Evaluation – R objects – Numbers – creating vectors – Matrices – Lists – Factors – Missing values – Data frames –Names – Summary<br><br>Pages 11 to 22</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit –II (Hours:6)<br>Getting Data In and Out of R<br><br>Reading and Writing Data – Reading Data Files with read.table() – Reading in Larger Datasets with read.table – Calculating Memory Requirements for R Objects<br><br>Pages 23 to 26</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit–III (Hours:6)<br>Vectorized Operations: Vectorized Matrix Operations<br>Dates and Times : Dates in R - Times in R - Operations on Dates and Times<br>Pages 43 to 48</td></tr>
</table>

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|---|---|
| | **Unit-IV (Hours:6)**<br>**Coding Standards for R Loop Functions**<br>Looping on the Command Line - lapply() - sapply() - split() - Splitting a Data Frame - tapply - apply() - Col/Row Sums and Means - Other Ways to Apply - mapply() - Vectorizing a function<br>**Pages 88 to 106** |
| | **Unit –V(Hours:6)**<br>**Data Analysis Case Study: Changes in Fine Particle**<br>Synopsis - Loading and Processing the Raw Data - Results<br>**Pages 131 to 133** |
| **Recommended Text** | Roger D. Peng, R Programming for Data Science. |
| **Web resources** | https://www.google.com/url?sa=t&source=web&rct=j&url=https://sites.calvin.edu/scofield/courses/m143/materials/RcmdsFromClass.pdf&ved=2ahUKEwjD9butqeTyAhU-7XMBHf7nDvcQFnoECAMQBg&usg=AOvVaw2cqS0mj02xNYei1l59OIq6 |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">INDUSTRIAL STATISTICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">26UMACC7</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture<br>4</td><td colspan="2">Tutorial<br>--</td><td>Lab Practice<br>--</td><td>Total<br>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. Enable students to understand and apply statistical techniques and data.<br>2. Knowledge about the methods of solving Industrial problems using statistics.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO 1: understand the concepts of Combinatorial and basic probability methods with few examples.<br>CO 2: define Sample spaces, probability distributions, Continuous Random variables and The Probability of event.<br>CO 3: describe Independent Events and problems.<br>CO 4: solve problems on Probability Distributions and Random variables.<br>CO 5: describe Conditional Distributions and Mathematical Expectations with moments.<br>.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Introduction- Combinatorial Methods- Binomial coefficients.<br>(Chapter1: Section-1.1, 1.2, 1.3.)</td></tr>
<tr><td colspan="6">UNIT-II: Probability - Introduction-Sample spaces- Events –The Probability of event- Some Rules of Probability.<br>(Chapter2: Section-2.1, 2.2, 2.3, 2.4, 2.5.)</td></tr>
<tr><td colspan="6">UNIT-III: Conditional Probability- Independent Events-Baye‘s Theorem(Only problems).<br>(Chapter2: Section-2.6, 2.7, 2.8.)</td></tr>
<tr><td colspan="6">UNIT-IV: Probability Distributions and Probability Densities- Introduction - Probability Distributions-Continuous Random variables- Probability Density functions-Multivariate Distributions.<br>(Chapter3: Section-3.1, 3.2, 3.3, 3.4, 3.5.)</td></tr>
<tr><td colspan="6">UNIT-V: Marginal Distributions- Conditional Distributions- Mathematical Expectations- Introduction- The Expected value of a Random variable- Moments.<br>(Chapter3: Section-3.6, 3.7 and Chapter4: Section- 4.1, 4.2, 4.3.)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication, Transferrable Skill and designing mathematical models towards solving mathematical Applications</td></tr>
</table>

| | |
|---|---|
| **Recommended Text** | Fruend John E, Mathematical Statistics, Prentice Hall of India, New Delhi. |
| **Reference Books** | 1. Papoulis A. Probability, Random Variables and Stochastic process, Tata McGraw Hill Education Pvt. Ltd., New Delhi<br>2. Baisnab A., Jas M., Elements of Probability and Statistics, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 1993. |
| **Website and e-Learning Source** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 1 |
| **CO2** | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 |
| **CO4** | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 1 |
| **CO5** | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 |

**Strong-3; Medium-2; Low-1**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **ELEMENTS OF MATHEMATICAL ANALYSIS** | | | | | |
| **Paper Number** | | **CORE VIII** | | | | | |
| **Category** | **CORE** | **Year** | **II** | **Credits** | **4** | **Course Code** | **26UMACC8** |
| | | **Semester** | **IV** | | | | |
| **Instructional Hours per week** | | **Lecture** | **Tutorial** | | | **Lab Practice** | **Total** |
| | | **3** | **1** | | | **-** | **4** |
| **Pre-requisite** | | $12^{th}$ Standard Mathematics | | | | | |
| **Objectives of the Course** | | 1. Identify and characterize sets and functions and understand, test and analyze the convergence and divergence of sequences, series.<br>2. Understand metric spaces with suitable examples | | | | | |

**Course Outcomes:**

Students will be able to

**CO1:** explain in detail about sets and functions, equivalence and countability and the LUB axiom

**CO2:** explain Sequence and Subsequence of real numbers and to find the limit of sequence to test for convergent, divergent, bounded and monotone sequences

**CO3:** explain the operations on convergent and divergent sequences and to Explain the concepts of limit superior and limit inferior and the notion of Cauchy sequences

**CO4:** classify the series of real numbers and the alternating series and their convergence and divergence, the conditional convergence and absolute convergence and solve problems on convergence of the sequences

**CO5:** explain about the metric spaces and functions continuous on a Metric space

| | |
|---|---|
| **Course Outline** | **Unit – I (Hours: 12)**<br>Sets and Functions: Sets and elements- Operations on sets- functions- real valued functions- equivalence-countability- real numbers- least upper bounds.<br>**Chapter 1(Sections1.1 -1.7)** |
| | **Unit –II (Hours: 12)**<br>Sequences of Real Numbers: Definition of a sequence and subsequence-limit of a sequence – convergent sequences–divergent sequences- bounded sequences-monotone sequences<br>**Chapter 2(Sections2.1 -2.6)** |
| | **Unit–III (Hours: 12)**<br>Operations on convergent sequences – operations on divergent sequences – limit superior and limit inferior-Cauchy sequences.<br>**Chapter 2(Sections2.7-2.10)** |
| | **Unit –IV (Hours: 12)**<br>Series of Real Numbers: Convergence and divergence – series with non –negative terms-alternating series-conditional convergence and absolute convergence- tests for absolute convergence.<br>**Chapter 3(Sections 3.1-3.4 &3.6)** |
| | **Unit –V (Hours: 12)**<br>Limits and Metric Spaces: Limit of a function on a real line - Metric spaces - Limits in metric spaces – Continuous Functions on Metric Spaces: Function continuous at a point on there a line-Function continuous on a metric space.<br>**Chapter 4(Sections 4.1 -4.3) Chapter 5(Sections:5.1,5.3)** |

| | |
|---|---|
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Richard R.Gold Berg, Methods of Real Analysis, Oxford & IBH. Publications ,New Delhi,2017. |
| **Reference Books** | 1. Ethan D. Bloch, The Real Numbers and Real Analysis, Springer, 2011.<br>2.G.M. The fundamentals of Mathematical Analysis, vol I. Pergamon Press, New York, 1965.<br>3. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.<br>4. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.<br>5. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.<br>6. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003. |
| **Web resources** | https://nptel.ac.in/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| **CO1** | 3 | 2 | 3 | 1 | 1 | 1 | 3 | 2 | 1 |
| **CO2** | 3 | 2 | 3 | 1 | 1 | 1 | 3 | 2 | 1 |
| **CO3** | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 2 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 2 | 1 |
| **CO5** | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL STATISTICS – II</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE – II (DISCIPLINE SPECIFIC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSEC2</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">3</td><td>-</td><td colspan="2">-</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basics of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To understand the concepts of sampling distribution and moments of t-distribution.<br>2. To acquire knowledge about statistical hypothesis and error values<br>3. To gain knowledge about the testing of significance for Large samples and Small samples</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: learn the concepts of sampling distribution, Estimation and testing of hypothesis.<br>CO2: understand the notions of Student t distribution, moments of chi-square, t-test and F-distribution.<br>CO3: estimate the error value and standard error for mean and test the hypothesis for them and validate the claims<br>CO4: analyse the properties of Maximum Likelihood estimators, chi-square, t and F distributions and solve the related problems.<br>CO5: derive the distribution of chi-square, t and F distribution and defend its applications for small samples.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit – I (Hours: 12)<br>Sampling Distribution: Sampling distribution, Sampling distribution of $\underline{X}$, chi-square distribution, MGF of $\chi^2$ - distribution, characteristic function of $\chi^2$, Additive property, Relation between moments. Student t distribution, Moments of t distribution, limiting form of t-distribution and properties F – distribution, Moments of F-distribution.<br>Chapter 22 (Page No.: 22.1 - 22.40)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit – II (Hours: 12)<br>Estimation: Point Estimation: Estimator and estimate, unbiased estimator, Examples, Efficiency, Cramer – Rao inequality, and Rao – Blackwell theorem, Method of maximum likelihood, Properties of ML estimators and Examples.<br>Chapter 23 (Page No.: 23.1 - 23.25, 23.46 - 23.56)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - III (Hours: 12)<br>Large Samples: Population, Parameter and statistic, sampling distribution, Characteristic of sampling distribution, standard error of the mean, test of hypothesis – Procedure, One tail test, two tail test, test for a specified mean, test for equality of two means, test for a specified proportion, test for equality of two proportions.<br>Chapter 24 (Page No.: 24.1 – 24.41)</td></tr>
</table>

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|---|---|
| | **Unit - IV (Hours: 12)**<br>**Small samples:** t Test, uses of t – test, Properties of sampling distribution of t, Test for a specified Mean, Test of significance for the difference between two population means, confidence interval for small samples. F – test, Procedure for equality of two population variances.<br>**Chapter 25 (Page No. :25.1 –25.30)**<br>**Chapter 26 (Page No. :26.1 –26.12))** |
| | **Unit –V (Hours: 12)**<br>**Small samples:** chi-square test, Additive property, Pearsons' statistic, uses of $\chi^2$- test, Test for independence of Attributes, Test for a specified Population Variance, Test of Independence of attributes.<br>**Chapter 27 (Page No.:27.1 – 27.46)** |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved. |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Vittal P. R, Mathematical Statistics, Margham Publications, Chennai. (For Units I - V) |
| **Reference Books** | 1. Gupta S. C and Kapoor V. K, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi(11th edition)2004.<br>2. J. N. Kapur & H. C. Saxena, Mathematical Statistics, S Chand & Company<br>3. Richard W. Hamming (2004) Methods of Mathematics Applied to Calculus, Probability, and Statistics, Dover Publications, New York |
| **Web resources** | https://ocw.mit.edu/courses/18-655-mathematical-statistics-spring-2016/<br>https://archive.nptel.ac.in/courses/111/105/111105043/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| **CO1** | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 1 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">MATHEMATICAL STATISTICS USING R PROGRAMMING – PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE – II (DISCIPLINE SPECIFIC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSECQ1</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td colspan="2">2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Basics of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. To provide a strong foundation on the practical applications of R-studio<br>2. To critically evaluate data and determine the most appropriate statistical models for specific scenarios<br>3. To apply the knowledge of regression analysis in solving real-world problems</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: recall and understand the basics of R, including data entry, vectors and other computations<br>CO2: apply the knowledge of R Studio to real-world problems with the use of chi-squared tests, correlation coefficients and regression analysis.<br>CO3: analyze data and perform advanced statistical tests, such as hypothesis testing, chi-squared tests and regression analysis, to draw meaningful conclusions.<br>CO4: evaluate the appropriateness of various statistical data, including hypothesis testing and chi-squared tests.<br>CO5: create and execute complex statistical computations, including correlation and regression models, and report the findings.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">Unit – I<br>Data: Starting R-Entering data with c- Data is a vector – Problems.<br>(Page No: 1-7)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit – II<br>Bivariate Data: Handling bivariate categorical data, Handling bivariate data: categorical vs. numerical, Bivariate data: numerical vs. numerical, Linear regression, Problems.<br>(Page No:19-22)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit - III<br>Hypothesis Testing: Testing a population parameter, Testing a mean, Tests for the median, Problems.<br>(Page No: 66-68)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit - IV (Hours: 12)<br>Chi Square Tests: The Chi-Squared Distribution, Chi-Squared Goodness of Fit Tests, Chi-Squared Tests for Independence, Chi-Squared Tests for Homogeneity, Problems.<br>(Page No: 72-76)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit –V<br>Regression Analysis: Simple Linear Regression Model-Testing the Assumption of the Model-Statistical Inference, Problems.<br>(Page No: 77-83)</td></tr>
</table>

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|---|---|
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/ GATE/ TNPSC/ others to be solved. |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Simple R - Using R for Introductory Statistics by John Verzani. |
| **Reference Books** | Statistics – An Introduction using R by Michael J. Crawley, Wiley Publications |
| **Web resources** | https://www.geeksforgeeks.org/r-statistics/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Computational Mathematics with MATLAB- PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SEC VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SKILL ENHANCEMENT COURSE</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>26UMASECQ6</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="3"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td colspan="2">2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Fundamentals of Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To impart knowledge on solving mathematical problems using Matlab</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: apply Matlab to compute determinants, eigenvalues, and eigenvectors, and evaluate the properties of hyperbolic and inverse hyperbolic functions<br>CO2: execute Matlab commands to compute partial derivatives and determine critical points, maxima, minima, and envelopes of curves<br>CO3: apply Matlab to calculate distances between points, angles between two plans and volume of the Tetrahedron<br>CO4: implement numerical integration methods in MATLAB for single, double, and triple integrals<br>CO5: apply Matlab to solve differential equations with initial conditions</td></tr>
<tr><td>Course Outline</td><td colspan="7">Unit - I(Hours: 6)<br>Algebra<br>Creating and working with Arrays and Matrices- Determinants - Eigen Values and Eigen Vectors<br>Trigonometry<br>Hyperbolic Functions-Inverse Hyperbolic functions</td></tr>
<tr><td></td><td colspan="7">Unit - II(Hours: 6)<br>Differential Calculus<br>Partial Derivatives-Successive partial derivative- Maxima and Minima of functions of two variables - Envelope of family of curves</td></tr>
<tr><td></td><td colspan="7">Unit - III(Hours: 6)<br>Analytical Geometry<br>Distance between two points - Asymptotes - Tangent to a curve - Angle between two given Planes - Volume of the Tetrahedron</td></tr>
<tr><td></td><td colspan="7">Unit - IV(Hours: 6)<br>Numerical Integration<br>Single integrals - Double integrals - Triple integrals - Applications of multiple integrals</td></tr>
<tr><td></td><td colspan="7">Unit - V (Hours: 6)<br>Differential Equations<br>Solve linear and nonlinear differential equations with initial conditions</td></tr>
<tr><td>Skills acquired from the course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td>Recommended Text</td><td colspan="7">Rudra Pratap, Getting started with MATLAB</td></tr>
<tr><td>Reference Books</td><td colspan="7">Dingyu Xue and Yangquan Chen, Solutions Manual for Solving Applied Mathematical Problems with Matlab, Taylor and Francis Group, LLC, 2009.</td></tr>
</table>

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|---|---|
| **Web resources** | https://in.mathworks.com/matlabcentral/answers/270283-get-envelope-of-multiples-curve<br>https://in.mathworks.com/matlabcentral/answers/728153-finding-an-equation-of-the-tangent-line-to-a-curve-at-the-given-point-in-matlab<br>https://in.mathworks.com/matlabcentral/answers/496531-how-to-calculate-the-partial-derivatives-for-a-given-function-of-two-variable |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">LaTeX - PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SEC – VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SKILL ENHANCEMENT COURSE</td><td>Year</td><td>II</td><td rowspan="2">Credit</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMASECQ7</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>-</td><td colspan="2">--</td><td colspan="2">2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To enable the students to prepare research articles in LaTeX format.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: make different alignments in a document and an application for a job<br>CO2: generate bio-data and table structures.<br>CO3: create Mathematical statements using LaTeX.<br>CO4: prepare articles and inserting pictures.<br>CO5: prepare question paper and power point presentation in LaTeX format</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT – I (Hours : 6)<br>Creation of a document with different alignments (Left, Right, Centre, Justify) – typing a letter for appling a job.</td></tr>
<tr><td colspan="7">UNIT-II (Hours : 6)<br>Creation of own bio-data – Creating a Table Structure.</td></tr>
<tr><td colspan="7">UNIT-III (Hours : 6)<br>Typing a Mathematical Expression involving Differentiation, Integration and Trigonometry –Typing a Mathematical Expression using all expressions and Inequalities.</td></tr>
<tr><td rowspan="2"></td><td colspan="7">UNIT-IV (Hours : 6)<br>Creation of an Article using LaTeX - Inserting Picture in a LaTeX.</td></tr>
<tr><td colspan="7">UNIT-V (Hours : 6)<br>Preparing a question paper in LaTeX format - Creation of Power Point Presentation in LaTeX.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">David F Griffiths and Desmond J. Higham, Learning LaTex, SIAM (Society for Industrial and Applied Mathematics) Publishers, Phidelphia, 1996.</td></tr>
</table>

| | |
|---|---|
| **Reference Books** | 1. Nambudiripad, K.B.M., 2014. LaTeX for beginners. Narosa Publishing House private limited, New Delhi.<br>2. Martin J. Erickson and Donald Bindner, A student's Guide to the Study, Practice and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.<br>3. L. Lamport, LATEX: A Document Preparation System, User's Guide and Reference Manual,Addison-Wesley, Newyork, Second edition, 1994. |
| **Website and e-Learning Source** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ABSTRACT ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE IX</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td colspan="2">26UMACC9</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">1. To acquire knowledge of the concepts of sets, groups and Rings.<br>2. To understand the construction, characteristics and applications of the abstract algebraic structures</td></tr>
<tr><td colspan="10">Course Outcomes:<br>Students will be able to<br>CO1: learn the notions of groups, subgroups and cyclic groups and interpret their properties<br>CO2: understand the notions of normal subgroups, quotient groups, homomorphisms and automorphisms and inspect the functions for homomorphism and automorphism properties<br>CO3: analyze the attributes of permutation groups and apply Cayley ‘s theorem to problems<br>CO4: learn the concept of rings, ideals and quotient rings and examine their structure<br>CO5: discuss about the field of quotient of an integral domain and to explain in detail about Euclidean rings</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">UNIT - I (Hours: 15)<br>Definition of a group - Some examples of groups - Some preliminary lemmas - Subgroups - A counting principle.<br>Chapter 2 (Section 2.1 to 2.5)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT - II (Hours: 15)<br>Normal subgroups and Quotient groups – Homomorphisms – Automorphisms.<br>Chapter 2 (Section 2.6 to 2.8)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-III (Hours: 15)<br>Cayley’s theorem-Permutation groups.<br>Chapter 2 (Section 2.9 and 2.10)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-IV (Hours: 15)<br>Definition and examples of rings - Some special classes of rings – homomorphisms - Ideals and quotient rings- More ideals and quotient rings.<br>Chapter 3: (Section 3.1 to 3.5)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-V (Hours: 15)<br>The field of quotients of an integral domain - Euclidean rings - A particular Euclidean ring.<br>Chapter 3 (Section 3.6 to 3.8 )</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
</table>

| | |
|---|---|
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | I.N. Herstein, Topics in Algebra Wiley Eastern Ltd. Second Edition (1st January 2006) |
| Reference Books | 1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.<br>2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.<br>3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999. |
| Website and e-Learning Source | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 2 | 3 | 1 | - | 3 | 3 | 1 |
| **CO2** | 3 | 3 | 2 | 3 | 1 | - | 3 | 3 | 1 |
| **CO3** | 3 | 3 | 2 | 3 | 2 | - | 3 | 3 | 1 |
| **CO4** | 3 | 3 | 2 | 3 | 1 | - | 3 | 3 | 1 |
| **CO5** | 3 | 3 | 2 | 3 | 2 | - | 3 | 3 | 1 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">REAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>26UMACC10</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="3"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td>1</td><td colspan="2">-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To develop an understanding of the real numbers and real–valued functions.<br>2. To introduce the concepts of connectedness, compactness and completeness of metric spaces.<br>3. To study the convergence of sequences of functions through examples and counter examples.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: explain the concepts of continuous and discontinuous functions, open and closed sets and Connectedness<br>CO2: explain the concepts of bounded and totally bounded sets, completeness, compactness, continuity of inverse functions and uniform continuity<br>CO3: define the sets of measure zero, to explain about the existence and properties of Riemann integral<br>CO4: explain the concept of differentiability and to explain Rolle ‘s theorem, Law of mean, and Fundamental theorem of calculus<br>CO5: explain the point wise and uniform convergence of sequence of function and to derive the Taylor ‘s theorem</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit-I (Hours:15)<br>Continuous Functions on Metric Spaces: Open sets– closed sets– Discontinuous function on $R^1$ .<br>More about open sets-Connected sets.<br>(Chapter 5: Section-5.4 to 5.6 and Chapter6: Sections-6.1,6.2)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit-II (Hours:15)<br>Bounded sets and totally bounded sets: Complete metric spaces- compact metric spaces, continuous functions on compact metric space, continuity of inverse functions, uniform continuity.<br>(Chapter6: Sections-6.3 to 6.8)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit-III (Hours:15)<br>Calculus: Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral, properties of Riemann integral.<br>(Chapter7: Sections-7.1 to 7.4)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit-IV (Hours:15)<br>Derivatives- Rolle ‘s theorem, The Law of mean, Fundamental theorems of calculus.<br>(Chapter7: Sections-7.5 to 7.8)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit-V (Hours:15)<br>Taylor ‘s theorem-Point wise convergence of sequences of functions, uniform convergence of sequences of functions<br>(Chapter8: Sections-8.5 and Chapter9: Sections-9.1,9.2)</td></tr>
</table>

| | |
|---|---|
| Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Methods of Real Analysis-Richard Goldberg (John Wiley & sons, 2 nd edition) (Indian edition –Oxford and IBH Publishing Co, New Delhi, 1 st January 2020) |
| **Reference Books** | 1. Principles of Mathematical Analysis by Walter Rudin, Tata McGraw Hill Education, Third edition (1 July 2017).<br>2. Mathematical Analysis Tom M A postal, Narosa Publishing House, 2 nd edition (1974), Addison-Wesley publishing company, New Delhi. |
| **Web resources** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 1 | 3 | 1 | - | 3 | 1 | 1 |
| **CO2** | 3 | 3 | 1 | 3 | 1 | - | 3 | 1 | 1 |
| **CO3** | 3 | 3 | 1 | 3 | 1 | - | 3 | 1 | 1 |
| **CO4** | 3 | 3 | 1 | 3 | 1 | - | 3 | 1 | 1 |
| **CO5** | 3 | 3 | 1 | 3 | 1 | - | 3 | 1 | 1 |

**Strong-3; Medium -2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL MODELLING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>26UMACC11</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">-</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. Construction and Analysis of Mathematical models found in real life problems.<br>2. Modelling through differential and difference equations to solve mathematical problems.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: explain simple situations requiring Mathematical Modelling and to determine the characteristics of such models<br>CO2: interpret Mathematical models based on first-order ordinary differential equations involving linear and nonlinear growth and decay, and compartment models.<br>CO3: apply systems of first-order ordinary differential equations to construct and solve Mathematical models in population dynamics, epidemics, and medicine.<br>CO4: analyze linear difference equations by determining the complementary function, particular solution, and their role in Mathematical Modelling.<br>CO5: evaluate Mathematical models based on difference equations and their applications in economics, finance, and actuarial science to interpret real-world problems.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit –I (Hours: 12)<br>Mathematical Modelling: Simple situations requiring Mathematical Modelling, Some characteristics of Mathematical models.<br>(Chapter1: Sections - 1.1, 1.4)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - II (Hours: 12)<br>Mathematical Modelling through Ordinary differential equations of first order: Mathematical Modelling through differential equations, Linear Growth and Decay Models, Non-Linear growth and decay models, Compartment models.<br>(Chapter2: Sections - 2.1 to 2.4)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - III (Hours: 12)<br>Mathematical Modelling through systems of Ordinary differential equations of first order: Prey-predator models, Competition models, A simple epidemic model, A Susceptible-infected- susceptible (SIS) model, SIS model with constant number of carriers, simple epidence model with carriers, model with removal and immigration, Medicine: A Model for Diabetes Mellitus.<br>(Chapter 3: Sections - 3.1 : 3.1.1, 3.1.2; 3.2: 3.2.1 to 3.2.4, 3.2.6, 3.5 : 3.5.1)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - IV(Hours:12)<br>The need for Mathematical modelling through difference equations: some simple models, the linear difference equation, the complementary function, the particular solution.<br>(Chapter 5: Sections - 5.1, 5.2 : 5.2.1, 5.2.2, 5.2.3)</td></tr>
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|---|---|
| | **Unit - V(Hours:12)**<br>Mathematical Modelling through difference equations in Economics and finance: The Harrod Model, The Cobweb model, application to Actuarial Science<br>**(Chapter 5: Sections - 5.3 : 5.3.1, 5.3.2, 5.3.4)** |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC - CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | J N Kapur, Mathematical Modelling, Third Edition, New Age International Publishers (2023). |
| **Reference Books** | 1. Mathematical Modeling by Bimalk. Mishra and Dipak K. Satpathi. Ane Books Pvt. Ltd(1 Januuary 2009)<br>2. Mathematical Modelling Models, Analysis and Applications, by Sandip Banerjee, CRC Press, Taylor & Francis group, 2014<br>3. Mathematical Modelling applications with Geogebra by Jonas Hall & Thomas Ligefjard, John Wiley & Sons, 2017<br>4. Mark M. Meerschaert: Mathematical Modeling, Elsevier Publ., 2007.<br>5. Edward A. Bender: An introduction to mathematical Modeling, CRC Press,2002<br>6. Walter J.Meyer, Concepts of Mathematical Modeling, Dover Publ., 2000 |
| **Web resources** | **https://nptel.ac.in** |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| **CO2** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| **CO4** | 3 | 2 | 2 | 2 | - | 1 | 2 | 3 | 2 |
| **CO5** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">OPTIMIZATION TECHNIQUES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE XII</td></tr>
<tr><td>Category</td><td>CORE</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>26UMACC12</td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>V</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours Per week</td><td colspan="2">Lecture<br>4</td><td colspan="2">Tutorial<br>-</td><td colspan="2">Lab Practice<br>-</td><td>Total<br>4</td></tr>
<tr><td colspan="2">Pre- requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. To provide knowledge on Formulating real life problems into L P. P<br>2. To teach the techniques for converting the industrial problems as mathematical problems and solving them.</td></tr>
<tr><td colspan="9">Course Outcomes :<br>Students will be able to<br>CO 1: define linear programming problem and to solve the problems using graphical method, Simplex method and Big-M method.<br>CO 2 : solve Transportation problems and Assignment problems.<br>CO 3 : find solutions for sequencing problems.<br>CO 4 : discuss game, strategies on dominance property.<br>CO 5 : construct network and do PERT calculations.</td></tr>
<tr><td colspan="2" rowspan="2">Course Outline</td><td colspan="7">UNIT I : (Hours: 12)<br>Operations Research - An Overview: Introduction (Operations Research) - Modelling in Operations Research - Advantages and limitations of models.<br>Linear Programming Problem - Mathematical Formulation: Introduction - Linear Programming Problem (LPP) - Mathematical Formulation of the Problem – Illustration on Mathematical formulation of LPPs.<br>Linear Programming Problem - Graphical Solutions and Extension: Introduction - Graphical Solution Method - Some Exceptional Cases.<br>Linear Programming Problem - Simplex method: Introduction - The Computational Procedure - Use of Artificial Variables.<br>(Chapter1: Sections 1.1 ,1.5 & 1.6; Chapter2: Sections 2.1 to 2.4; Chapter3: Sections 3.1 to 3.3; Chapter4: Sections 4.1, 4.3, 4.4)</td></tr>
<tr><td colspan="7">UNIT II : (Hours: 12)<br>Transportation Problem: Introduction – LP Formulation of the Transportation Problem – Finding an Initial Basic Feasible Solution - Degeneracy in Transportation Problem - Transportation algorithm (MODI Method) - Some Exceptional Cases.<br>Assignment Problem: Introduction - Mathematical Formulation of the Problem – Solution Methods of Assignment Problem - Special cases in Assignment Problem – The Travelling Salesman Problem.<br>(Chapter10:Sections 10.1, 10.2, 10.9, 10.12,10.13, 10.15 Chapter11: Sections 11.1 to 11.3 &11.4, 11.7)</td></tr>
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|---|---|
| | **UNIT III : (Hours: 12)**<br>**Sequencing problem:** Introduction - Problem of Sequencing- Basic Terms Used in Sequencing - Processing n jobs through Two Machines - Processing n jobs through k Machines - Processing 2 jobs through k Machines.<br>**( Chapter12: Sections 12.1 to 12.6)** |
| | **UNIT IV : (Hours: 12)**<br>**Games and Strategies:** Introduction - Two-Person Zero-Sum Games Some basic terms - The Maximin-minimax Principle - Games without Saddle points - Mixed Strategies – Graphic Solution of 2 x n and m x 2 Games - Dominance Property.<br>**(Chapter17:Sections 17.1 to 17.7)** |
| | **UNIT V : (Hours: 12)**<br>**Network Scheduling by PERT/CPM:** Introduction – Network: Basic Components - Logical Sequencing - Rules of Network Construction - Concurrent Activities - Critical Path Analysis - Probability Consideration in PERT - Distinction between PERT and CPM.<br>**(Chapter25: Sections 25.1 to 25.8)** |
| **Skills acquired from this course** | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill. |
| **Recommended Text** | Kantiswarup., Gupta, P.K. and Man Mohan. Operations Research.[Seventeenth Edition]. Sultan Chand and Sons, New Delhi.2020. |
| **Reference Books** | 1. Gupta, P.K. and Hira, D.S. Operations Research. [Eighth Edition]. Sulthan .Chand and Co., NewDelhi.2020.<br>2. Gupta, P.K. and Man Mohan. Problems in Operations Research.[Ninth Edition]. Sultan Chand and Sons, New Delhi.2014.<br>3. Kalavathy.S. Operations Research [Fourth Edition],Vikas Publishing House,Chennai.2012. |

## Course Learning Outcome (for Mapping with POs and PSOs)

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 1 |
| **CO2** | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 |
| **CO4** | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 1 |
| **CO5** | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 |

**Strong-3; Medium-2; Low-1**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **PROJECT & VIVA VOCE** | | | | | |
| **Paper Number** | | **ELECTIVE – III (DISCIPLINE SPECIFIC)** | | | | | |
| **Category** | ELECTIVE | **Year** | **III** | **Credits** | 4 | **Course Code** | **26UMAPVV** |
| | | **Semester** | **V** | | | | |
| **Instructional Hours** | | **Lecture** | **Tutorial** | | **Lab Practice** | | **Total** |
| **Per week** | | 5 | - | | - | | 5 |
| **Pre- requisite** | | $12^{th}$ Standard Mathematics | | | | | |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">BIOMATHEMATICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE – IV (DISCIPLINE SPECIFIC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSEC3A</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">3</td><td>--</td><td colspan="2">--</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To understand the concept of modeling using MATLAB/ Scilab.<br>2. To develop the ability of solving the homogenous and non-homogenous system of difference</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: identify discrete dynamical modeling, difference equations, MATLAB and the Nernst equation to analyze mathematical models and evaluate computational results.<br>CO2: explain first-order homogeneous and non-homogeneous difference equations to apply diffusion equations and assess mathematical models.<br>CO3: describe matrix modeling and the Gauss - Jordan elimination method to examine linear systems and validate computational solutions.<br>CO4: interpret determinants, eigenvalues, eigenvectors, and Einstein's relation to investigate matrix computations using MATLAB and justify mathematical results.<br>CO5: classify nonlinear systems of difference equations and interacting species models to integrate modeling techniques and evaluate real-world applications.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT - I (Hours: 10)<br>Overview of Discrete Dynamical Modeling and MATLAB /Scilab: Introduction to Modeling and Difference Equations - The Modeling Process - Getting Started with MATLAB/Scilab.<br>Chapter 1<br>Nernst equation<br>Chapter 9</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT - II (Hours: 9)<br>Modeling with first – order Difference Equations: Modeling with First - Order Linear Homogenous Difference with Constant Coefficients - Modeling with Non-homogenous First - Order Linear Difference Equations<br>Chapter 2<br>Diffusion – I : Diffusion equation<br>Chapter 9</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III (Hours: 07)<br>Modeling with Matrices: Systems of Linear Equations Having Unique Solutions - The Gauss-Jordan Elimination Method With Models - Introduction to Matrices<br>Chapter 3: 3.3.10 – 3.3.17<br>Diffusion – II: Mean – square displacement<br>Chapter 9</td></tr>
</table>

| | |
|---|---|
| | **UNIT-IV (Hours: 09)**<br>**Modeling with Matrices:** Determinants and System of Linear Equations<br>**Chapter 3: 3.4.1 & 3.4.2**<br>Computing Eigenvalues and Eigenvectors with MATLAB/Scilab<br>**Chapter 3: 3.5.3 – 3.5.6**<br>Diffusion – III: Einstein's relation<br>**Chapter 9** |
| | **UNIT-V (Hours: 12)**<br>**Modeling with Nonlinear Systems of Difference Equations**<br>Modeling of Interacting Species<br>**Chapter 5: 5.1.1 & 5.1.2** |
| Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Mazen Shahin, Explorations of Mathematical Models in Biology with MATLAB, Wiley Publishers. (for Unit I to Unit V)<br>2. Introduction to Mathematics for Life Scientists, E. Batschelet, Springer Verlag, 3rd edition (2003). (for Unit I to IV) |
| Reference Books | 1. R Phillips, J Kondev, J. Theriot, Physical Biology of the Cell, Garland Science, 2009<br>2. H. C.Berg, Random Walks in Biology, Princeton university press, 1993 |
| Website and e-Learning Source | http://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">BIOMATHEMATICS – PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE – IV (DISCIPLINE SPECIFIC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSECQ2A</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">-</td><td>--</td><td>2</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To use MATLAB/Scilab for solving problems on difference equations<br>2. To compute and solve problems on matrices using MATLAB/Scilab</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: recall the basics of MATLAB/Scilab<br>CO2: express the difference equations as matrices and solve them using MATLAB/Scilab<br>CO3: apply MATLAB/Scilab to analyse the society connected problems<br>CO4: perceive the idea of recurrences in difference equations and compute the Eigen values and Eigenvectors using MATLAB/Scilab<br>CO5: estimate the solution for problems occurring in real life by using MATLAB/Scilab</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT - I (Hours: 6)<br>Getting Started with MATLAB/Scilab - Operations on Vectors and Matrices</td></tr>
<tr><td colspan="6">UNIT - II (Hours: 6)<br>Problems on Modeling with First - Order Linear Homogenous and Non- Homogenous Difference equations with Constant Coefficients for computing amount of drug present in blood after a few hours, Owl’s population, in the process of Radioactive Decay and Carbon Dating and Forensic Application.</td></tr>
<tr><td colspan="6">UNIT-III (Hours: 6)<br>Problems solving using Gauss-Jordan Elimination Method for Biologists mixer problem, Nutrition Problems, Existence of bacteria, Balancing Chemical Equations</td></tr>
<tr><td colspan="6">UNIT-IV (Hours: 6)<br>Computing Eigenvalues and Eigenvectors with MATLAB/Scilab for Population movement problems</td></tr>
<tr><td colspan="6">UNIT-V (Hours: 6)<br>Problems on non-linear systems viz Predator-Prey Model using MATLAB/Scilab tools.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

| | |
|---|---|
| Recommended Text | Mazen Shahin, Explorations of Mathematical Models in Biology with MATLAB, Wiley Publishers. |
| Reference Books | 1 R Phillips, J Kondev, J. Theriot, Physical Biology of the Cell, Garland Science, 2009<br>2 H. C.Berg, Random Walks in Biology, Princeton university press, 1993 |
| Website and e-Learning Source | https://www.mathworks.com/solutions/mathematical-modeling.html |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">DISCRETE MATHEMATICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE – IV (DISCIPLINE SPECIFIC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSEC3B</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">3</td><td colspan="2">--</td><td>--</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">1. To gain knowledge about the concept of Mathematical logic and algebraic structures.<br>2. To know about Boolean algebra and its application to Sequential Machines.<br>3. To make them to use in practical applications related to computer science.</td></tr>
<tr><td colspan="10">Course Outcomes:<br>Students will be able to<br>CO1: recognize connectives, normal forms, statement and predicate calculus to compare inference methods and evaluate logical validity<br>CO2: explain relations, functions, binary operations and natural numbers to implement mathematical properties and justify discrete structures.<br>CO3: describe algebraic systems, semigroups, monoids, Polish expressions and group codes to analyze communication models and validate computational solutions.<br>CO4: classify lattices, Boolean algebra, homomorphisms and direct products to examine algebraic relationships and assess logical structures.<br>CO5: interpret grammar, formal languages and finite state machines to investigate sequential circuits and recommend computational applications.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="8">UNIT - I (Hours: 15)<br>Connectives: Negation, Conjunctions, Disjunctions, Conditional and Biconditional, WFF, Tautologies equivalence and duality.<br>Normal forms: DNF, CNF, PDNF, PCNF.<br>Theory of inference for the statement calculus: validity using truth table.<br>Predicate calculus: Predicates, Statement function, Variables and Quantifiers.<br>Inference theory of predicate calculus: Valid formulae and Equivalences.<br>Chapter 1 (sections 1.2,1 -1.2.3, 1.2.6-1.2.10, 1.3.1 - 1.3.4, 1.4.1, 1.5.1, 1.5.2, 1.6.1)</td></tr>
<tr><td colspan="8">UNIT - II (Hours: 15)<br>Relations and ordering: Relations, Properties of binary relation in a set.<br>Functions: Definitions and introduction, composition of functions, Inverse function, Binary and n-array operations, Hashing functions.<br>Natural numbers: Peano axioms and Mathematical introduction, cardinality.<br>Chapter 2 (Sections 2.3.1, 2.3.2, 2.4.1 – 2.4.4, 2.4.6, 2.5.1, 2.5.2)</td></tr>
<tr><td colspan="8">UNIT-III (Hours: 15)<br>Algebraic systems: Definition and examples<br>Semigroups and monoids: Definition and examples - Homomorphism of semi group and monoids, Sub semigroups and sub monoids<br>Polish expression and their compilation: Polish notation, Conversion of infix expressions to polish notation.<br>Group codes: The communication model and basic notations of error correction, Generation of codes by using parity checks, Error recovery in group codes.<br>Chapter 3 (Sections 3.1.1, 3.2.1 - 3.2.3, 3.4.1, 3.4.2, 3.7.1 – 3.7.3)</td></tr>
</table>

| | |
|---|---|
| | **UNIT-IV (Hours: 15)**<br>**Lattices as partially ordered set**: Definition and examples, Some properties of lattices, Sub lattices, Direct product and homomorphism.<br>**Boolean algebra**: Definition and examples, Sub algebra, Direct product and homomorphism.<br>**Chapter 4 (Sections 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2)** |
| | **UNIT-V (Hours: 15)**<br>**Grammar and Language**: Discussion of grammar, Formal definition of a language<br>**Finite state machines**: Introductory sequential circuit, Equivalence of finite state machines.<br>**Chapter 3 (Sections 3.3.1, 3.3.2) and 4 (Sections 4.6.1, 4.6.2)** |
| Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | J.P.Trembley and R.Manohar, Discrete Mathematical Structures with Applications to Computer Science Year of publication 2001, Tata McGraw-Hill, New Delhi. |
| Reference Books | 1. M. Chandrasekaran, M. Umaparvathi Discrete Mathematics, PHI Learning Private Ltd. 2010.<br>2. T. Veerarajan, Discrete Mathematics, Mcgraw- Hill Company Ltd, 2007 |
| Website and e-Learning Source | http://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DISCRETE MATHEMATICS - PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE - IV (DISCIPLINE SPECIFIC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSECQ2B</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td colspan="2">-</td><td>2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To enable students to implement discrete mathematical concepts using Python for solving computational and real-world problems.<br>2. To develop logical thinking, algorithmic skills, and hands-on programming ability through practical exploration of discrete structures.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: construct truth tables and verify logical propositions using Python.<br>CO2: implement relations, functions, and operation tables programmatically.<br>CO3: model algebraic structures like groups and semigroups through Python code.<br>CO4: simplify Boolean expressions and implement logic circuits computationally.<br>CO5: design and simulate Finite Automata and Grammars using Python.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT - I (Hours: 6)<br>Logic and Predicate Calculus<br>Program to generate truth tables - Checking tautology and contradiction - Normal form conversion (PDNF & PCNF) - Argument validation using inference rules.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT - II (Hours: 6)<br>Relations and Functions<br>Program for relation matrix - Check reflexive, symmetric, transitive properties - Function domain and range - Inverse function implementation - Binary operation table generation.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III (Hours: 6)<br>Algebraic Systems and Group Codes<br>Semigroup and group validation program - Check identity and inverse - Infix to postfix/prefix conversion - Parity check and group code generation.</td></tr>
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| | **UNIT-IV (Hours: 6)**<br>**Lattices and Boolean Algebra**<br>Hasse diagram generation (text or graph output) - Boolean expression simplification program - Truth table from Boolean expression - Sub-lattice identification. |
| | **UNIT-V (Hours: 6)**<br>**Finite Automata and Formal Languages**<br>DFA simulation program - Check accepted/rejected strings - Grammar generation - Transition table and diagram implementation. |
| Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. J.P.Trembley and R.Manohar, Discrete Mathematical Structures with Applications to Computer Science Year of publication 2001, Tata McGraw-Hill, New Delhi<br>2. Amit Saha, Doing with Python, William Pollock, 2015. |
| Reference Books | 1. M. Chandrasekaran, M. Umaparvathi Discrete Mathematics, PHI Learning Private Ltd. 2010.<br>2. T. Veerarajan, Discrete Mathematics, Mcgraw- Hill Company Ltd, 2007 |
| Website and e-Learning Source | http://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">LINEAR ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE – XIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">26UMACC13</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">Hours per week</td><td>5</td><td colspan="2">1</td><td colspan="2">-</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. Vector Spaces, linear dependence and independence of vectors, dual spaces, inner products and norms, orthogonalization process.<br>2. Linear transformations, various operators on vector spaces.</td></tr>
<tr><td colspan="8">Course Outcomes: Students will be able to<br>CO 1: understand and apply the notions of vector spaces, subspaces and matrix operations.<br>CO 2: explain the concepts of linear dependence, linear independence, bases and dimension of basis.<br>CO 3: analyze the attributes of linear transformations, their matrix representation and the notion of dual spaces.<br>CO 4 : find the Eigen values and Eigen vectors and to apply the concepts for diagonalization.<br>CO 5: examine the concepts of inner products and norms and apply the Gram-Schmidt orthogonalization process to problems on inner product spaces.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit - I (Hours: 15)<br>Vector spaces – Subspaces – Linear combinations and systems of linear equations – Homogenous linear differential equations with constant coefficients – Elementary matrix operations and elementary matrices<br>Chapter 1 (Sections 1.2 - 1.4), Chapter 2 (Section 2.7) & Chapter 3 (Section 3.1)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - II (Hours: 15)<br>Linear dependence and linear independence – Bases and dimension<br>Chapter 1 (Sections 1.5 & 1.6)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - III (Hours: 15)<br>Linear transformations, null spaces and ranges – The matrix representation of a linear transformation – Invertibility and isomorphisms – Dual spaces<br>Chapter 2 (Sections 2.1, 2.2, 2.4 & 2.6)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - IV(Hours:15)<br>Eigen values and eigen vectors - Diagonalizability – Invariant subspaces and the Cayley - Hamilton theorem<br>Chapter 5: (Sections 5.1, 5.2 & 5.4)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - V(Hours:15)<br>Inner products and norms – The Gram Schmidt orthogonalization process and Orthogonal complements<br>Chapter 6 (Section 6.1 & 6.2)</td></tr>
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|---|---|
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC - CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Linear Algebra - Stephen H Friedberg, Arnold J Insel and Lawrence E Spence, Pearson, 5th edition (2018). |
| **Reference Books** | 1. N. Herstein, Topics in Algebra, Wiley Eastern Ltd. Second Edition, 2006.<br>2. N. S. Gopalakrishnan, University Algebra, New Age International Publications, Wiley Eastern Ltd.<br>3. John B. Fraleigh, First course in Algebra, Addison Wesley.<br>4. Santiago M.L, Modern Algebra, Tata Mc graw - Hill Publishing Company Ltd., New Delhi.<br>5. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2004.<br>6. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.<br>7. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.<br>8. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007. |
| **Web resources** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 2 | 1 | 2 | 1 | - | 3 | 2 | 1 |
| **CO2** | 3 | 2 | 2 | 3 | 2 | - | 3 | 3 | 1 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | - | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">COMPLEX ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE XIV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">26UMACC14</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>5</td><td colspan="2">1</td><td colspan="2">-</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To understand the concepts of analyticity, mappings, and transformations, and to apply Cauchy’s integral theorems, zeros, singularities, and residues of analytic functions in evaluating definite and improper integrals.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: explain the concepts of analytic functions, their differentiation and continuity, and to verify Harmonic functions using analyticity conditions.<br>CO2: apply the principles of Conformal mappings and illustrate mappings by linear and linear fractional transformations.<br>CO3: analyze the integration of complex functions over simply and multiply connected domains and to derive Cauchy’s Integral Formula, Liouville’s Theorem, Fundamental Theorem of Algebra, and Maximum Modulus Principle.<br>CO 4: examine the convergence of sequences and series of complex functions and to construct Taylor’s and Laurent’s series expansions.<br>CO5: evaluate the nature of singularities, compute residues of complex functions, and interpret zeros and poles to determine real improper integrals using the Residue Theorem.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit - I (Hours: 18)<br>Analytic functions: Functions of a Complex variable - Limits - Theorem on limits - Continuity - Derivatives - Differentiation formulas - Cauchy Riemann equation - conditions for differentiability - Polar coordinates - Analytic functions - Harmonic functions.<br>Chapter2 : Sections-11,14,15,17,18,19,20,21,22,23 & 25</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - II (Hours: 18)<br>Conformal mapping : Mappings - Mapping by exponential function - Linear transformation- The transformation w= 1 z / Mappings by 1 z Linear fractional transformations (bilinear)<br>Chapter2: Sections-12 & 13; Chapter8:Sections-83 to 86</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - III (Hours: 18)<br>Complex Integration: Contour integrals - Some examples – Simply and Multiply connected domains - Cauchy integral formula - Formula for derivatives - Liouville‘s theorem - Fundamental theorem of Algebra - Maximum modulus principle.<br>Chapter4: Sections - 39,40 & 46 to 50</td></tr>
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| | **Unit - IV(Hours:18)**<br>**Sequences and Series:** Convergence of sequences - Convergence of series - Taylor's series – Laurent series– Absolute and uniform convergence of power Series - Continuity of sums of power series– Integration & differentiation of power series.<br>**Chapter 5**: Sections- 51,52,53,55,57,58 & 59 |
| | **Unit - V(Hours:18)**<br>**Residues and Poles:** Isolated singular points - Residues - Cauchy Residue theorem -Residue at infinity - The three types of isolated singular points - Residues at poles - Zeros of analytical functions - Zeros and poles - Evaluation of real improper integrals (excluding poles on the real axis).<br>**Chapter6:** Sections - 62,63,65,66,68 & 69: **Chapter7:** Section-71 |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC - CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Complex variables and application, Seventh Edition by James Ward Brown and Ruel V.Churchill, Mc-GrawHill BookCo., International Edition, 2009. |
| **Reference Books** | 1. Theodore W. Gamelan, Complex Analysis, SpringerVerlag, 2008<br>2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.<br>3. Richard A. Silverman, Introductory Complex Analysis. Dover Publications, 1972.<br>4. S.Ponnusamy and H.Silverman, Complex variables with applications, Birkhauser, 2006.(1980); also published by Hindustan Publishing Company, New Delhi. |
| **Web resources** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 2 | 3 | 2 | 1 | - | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 | - | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 |

**Strong-3; Medium-2; Low-1**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **MECHANICS** | | | | | |
| **Paper Number** | | **CORE XV** | | | | | |
| **Category** | **Core** | **Year** | **III** | **Credits** | 4 | **Course Code** | **26UMACC15** |
| | | **Semester** | VI | | | | |

| **Instructional Hours per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** |
|---|---|---|---|---|
| | 5 | 1 | - | 6 |

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|---|---|
| **Pre-requisite** | 12th Standard Mathematics |
| **Objectives of the Course** | 1.Equilibrium of a particle under the action of given forces<br>2. Simple Harmonic Motion<br>3. Projectiles |

**Course Outcomes:**

Students will be able to

**CO1**: understand the fundamental definitions and principles of forces, resultant, equilibrium of a particle, coplanar forces and limiting equilibrium on inclined planes.

**CO2**: apply the concepts of moment of a force, couple and parallel forces to solve problems involving frictional forces and forces acting along a triangle.

**CO3**: analyze the concepts of work, energy and power, and evaluate different types of rectilinear motion under varying forces and simple Harmonic motion.

**CO4**: analyze and evaluate the motion of projectiles, prove the parabolic path, and apply the principles of impulse, impact, and laws of impact to smooth elastic spheres.

**CO5**: evaluate the theory of central orbits, interpret conics as central orbits and apply these concepts to solve related problems.

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| **Course Outline** | **UNIT- I (Hours :18)**<br>**Force:** Newton‘s laws of motion – Resultant of two forces on a particle.<br>**Equilibrium of a particle:** Equilibrium of a particle – Limiting equilibrium of a particle on an inclined plane.<br>**Chapter2 (Section 2.1 & 2.2)**<br>**Chapter3 (Section 3.1 & 3.2)** |
| | **UNIT - II (Hours :18)**<br>**Forces on a Rigid Body:** Moment of a force – general motion of a body – equivalent systems of forces- parallel forces – forces acting along a triangle.<br>**A specific reduction of Forces:** Reduction of coplanar forces into a force and couple – problems involving frictional forces.<br>**Chapter4 (Section 4.1 to 4.5)**<br>**Chapter 5 (Sections 5.1 & 5.2)** |

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|---|---|
| | **UNIT-III ( Hours :18)**<br>**Work, Energy and Power:** Work – conservative field of force – power .<br>**Rectilinear Motion under Varying Force:** Simple Harmonic motion - along a horizontal line – along a vertical line.<br>**Chapter 11(Section-11.1,11.2 & 11.3)**<br>**Chapter 12 (Section-12.1,12.2 & 12.3)** |
| | **UNIT – IV (Hours: 18)**<br>**Projectiles:** Forces on a projectile – Projectile projected on an inclined plane<br>**Chapter 13 (Section-13.1 & 13.2)** |
| | **UNIT-V (Hours :18)**<br>**Central Orbits:** General orbits – Central orbit – Conic as a centered orbit.<br>**Chapter16 (Section-16.1 to 16.3)** |
| Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1. Duraipandian. P.,LaxmiDuraipandian and Muthamizh Jayapragasm Mechanics. 2007. S.Chand and company. |
| **Reference Books** | 1. A. Ruina and R. Pratap, Introduction to Statics and Dynamics, , Oxford University Press, 2014.<br>2. S.L. Loney, The Elements of Statics and Dynamics, Cambridge University Press, 1904.J.L. Meriam and L. G. Kraige, Engineering Mechanics: Statics, Seventh Edition,Wiley and sons Pvt ltd., New York, 2012.<br>3. J.L. Meriam, L. G. Kraige, and J.N. Bolton, Engineering Mechanics: Dynamics, 8thedn, Wiley and sons Pvt ltd., New York, 2015.<br>4. A. K. Dhiman,P.Dhinam and D. Kulshreshtha, Engineering Mechanics (Statics and Dynamics) ,McGraw Hill Education(India) Private Limited, New Delhi, 2015. |
| **Web resources** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 2 |
| **CO4** | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 2 |
| **CO5** | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 2 |

**Strong-3; Medium -2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">NUMERICAL METHODS WITH APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td rowspan="2">26UMADSEC4A</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To solve algebraic and transcendental equations by various numerical methods.<br>2. To acquire knowledge on numerical differentiation and integration.<br>3. To know about the concepts of finite differences and interpolation</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: learn the principles of numerical methods to solve algebraic and transcendental equations.<br>CO2: understand and apply direct and iterative methods to solve systems of linear algebraic equations.<br>CO3: analyse finite difference techniques to express functions and estimate errors.<br>CO4: evaluate interpolation formulas for data with equal and unequal intervals.<br>CO5: compute numerical derivatives and integrals using various rules and evaluate the accuracy of results</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT - I (Hours: 15)<br>The Solution of Numerical Algebraic and Transcendental Equations<br>The Bisection Method (or BOLZANO'S method or Interval halving method), Iteration method (or method of successive approximations), The conditions for the convergence of the method, Order of convergence of an iterative process, RegulaFalsi method (or the method of false position), Geometrical interpretation, Newton – Raphson method (or Newton's method), Geometrical meaning of Newton's method, Criterion for the convergence in Newton – Raphson method & Order of convergence of Newton's method.<br>Chapter 3 (Sections :3.1.1, 3.2, 3.2.1, 3.2.2, 3.3, 3.3.1, 3.4, 3.4.1, 3.4.2 & 3.4.3 (Page No: 69 – 98))</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II(Hours:15)<br>Solutions of Simultaneous Linear Algebraic Equations<br>Gauss – Elimination Method, Gauss – Jordan elimination Method (Direct method), Inversion of a matrix using Gauss – Elimination method, Iterative methods, Jacobi method of iteration or Gauss – Jacobi</td></tr>
</table>

| | |
|---|---|
| | method & Gauss -Seidel method of iteration.<br>**Chapter 4(sections: 4.1,4.2, 4.2.1, 4.3, 4.7, 4.8 &4.9 ( Page No: 112 – 126, 145 – 159))** |
| | **Unit- III(Hours:15)**<br>**Finite Differences**<br>First difference, Express any value of y in term of $y_n$ and the backward differences of $y_n$ , Differences of a polynomial, Factorial polynomial, Error Propagation, Finite Integration, Summation of Series &Montmort's theorem.<br>**Chapter 5(sections: 5.1 to 5.8 ( Page No: 170 – 207))** |
| | **UNIT-IV (Hours:15)**<br>**Interpolation**<br>Gregory – Newton forward interpolation formula or Newton's forward interpolation formula (*for equal intervals*), Gregory – Newton Backward Interpolation formula (*for equal intervals*)& Equidistant terms with one or more missing values.<br>**Central Difference Interpolation Formulae** (*for equal intervals*)<br>Gauss's forward interpolation formula, Gauss's backward interpolation formula, Bessel's formula.<br>**Interpolation with unequal intervals**<br>Divided differences,Newton's interpolation formula for unequal intervals, Lagrange's interpolation formula(for unequal intervals) ,Different form of Lagrange's interpolation formula & Inverse interpolation .<br>**Chapter 6 (Sections: 6.2 , 6.3&6.7( Page No: 210 - 230)**<br>**Chapter-7 (Sections: 7.3, 7.4 & 7.6( Page No: 231 – 240, 242 ))**<br>**Chapter-8 (Sections: 8.2, 8.5,8.7& 8.8 ( Page No: 257-260,263 – 280))** |
| | **UNIT-V (Hours: 15)**<br>**Numerical Differentiation and Integration**<br>Newton's forward difference formula to get the derivative, Newton's backward difference formula to compute the derivative, Derivative using Stirling's formula &To find maxima and minima of the function given the tabular values. A general quadrature formula for equidistant ordinates(*or Newton-cote's formula*), Trapezoidal rule, Simpson's one-third rule, Simpson's three- eighths rule & Weddle's rule.<br>**Chapter-9 (Sections :9.2, 9.3, 9.4, 9.6, 9.8, 9.9, 9.13, 9.14 & 9.15 (Page No: 281 – 301, 303 – 306))** |
| Extended Professional Component (is a part of internal component only, not to be included in the | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |

| | |
|---|---|
| External Examination question paper) | |
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | P.Kandasamy, K,Thilagavathy,K.Gunavathy, Numerical Methods,First Edition, S.Chand& Company Ltd. |
| Reference Books | S.S. Sastry - Introductory methods of numerical Analysis 3rd Edition, Prentice Hall of India Private Ltd., New Delhi. |
| Website and e-Learning Source | http://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">GRAPH THEORY WITH APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>26UMADSEC4B</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To acquire the basic knowledge of various types of graphs.<br>2. To know about the problem-solving power of the graph theory.<br>3. To know about the applications of graphs to simple situations and puzzles.</td></tr>
<tr><td colspan="8">Course Outcomes:<br>Students will be able to<br>CO1: understand the definition and basics of graphs with types and examples<br>CO2: interpret the concepts of connectedness in graph<br>CO3: apply Eulerian and Hamiltonian Graphs to solve related problems<br>CO4: analyse the characterisation of trees and classification of directed graphs<br>CO5: relate the graph theory to the real world problems</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT - I (Hours: 15)<br>Graphs and Subgraphs Definition and examples, Degrees, Subgraphs, Operations on graphs</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II(Hours:15)<br>Connectedness Walks, Trails and Paths, Connectedness and Components, Blocks, Connectivity.</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit- III(Hours:15)<br>Eulerian And Hamiltonian Graphs Eulerian graphs, Hamiltonian graphs.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-IV (Hours:15)<br>Trees Characterisation of trees, Centre of a tree.</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit – V (15 Hours)<br>Directed Graphs Definition and basic properties, Paths and connections, Digraphs and Matrices.</td></tr>
</table>

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|---|---|
| Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour) |
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | S. Arumugam, S. Ramachandran - Invitation to Graph Theory,Year of Publication 2001, Scitech Publications, Chennai. |
| Reference Books | 1. Narsingh Deo -Graph Theory with applications to Engineering and Computer Science , Prentice Hall of India, 2004.<br>2. Gary Chartrand and Ping Zhang - Introduction to Graph Theory, Tata McGraw-Hill Edition, 2004 |
| Website and e-Learning Source | http://nptel.ac.in |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">INTRODUCTION TO ARTIFICIAL INTELLIGENCE</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE – VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSEC5A</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">Hours per week</td><td>2</td><td colspan="2">1</td><td colspan="2">-</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. To provide students with a deep understanding of the principles, techniques and applications of AI.<br>2. To cultivate students' analytical and problem-solving abilities by engaging them in hands-on activities, assignments and projects that require the application of AI techniques.</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: learn to design and implement knowledge-based agents using logic, including propositional logic<br>CO2: understand the definition, history, and state-of-the-art developments in AI, along with its risks and benefits<br>CO3: apply AI techniques learned across units to analyze and address real-world problems, fostering critical thinking and practical problem-solving skills.<br>CO4 : explore game theory principles and optimal decision-making strategies, such as heuristic alpha- beta tree search and Monte Carlo tree search.<br>CO5: develop proficiency in problem-solving algorithms and search strategies, including uniformed search and local search.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">Unit - I (Hours: 10)<br>Introduction: What is AI? - The foundation of Artificial Intelligence -The history of Artificial Intelligence - The state of the art, risks and benefits of AI.<br>Intelligent Agents: Agents and environments – The good behavior: The concept of rationality.<br>Chapter 1 (Sections-1.1 to 1.9)</td></tr>
<tr><td colspan="7">Unit - II (Hours: 09)<br>Solving Problems by Searching: Problem-solving agents, example problems - Search algorithms - Uniformed search strategies.<br>Chapter 2 (Sections 2.1 to 2.8)</td></tr>
<tr><td colspan="7">Unit - III (Hours: 07)<br>Search in Complex Environments: Local search and optimization problems - Local search in continuous spaces - Search with nondeterministic actions - Search in partially observable environments.<br>Chapter 3 (Sections 3.1 to 3.6)</td></tr>
<tr><td colspan="7">Unit - IV(Hours:09)<br>Adversarial Search and Games: Game Theory - optimal decisions in games - Heuristic alpha beta tree search - Monte Carlo trees search.<br>Chapter 4 (Sections 4.1 to 4.6)</td></tr>
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| | **Unit - V(Hours:10)**<br>Logical Agents: Knowledge-based agents, The wumpus world -Logic, propositional Logic: A very simple logic<br>**Chapter 5 ( Sections 5.1 to 5.6)** |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC - CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Dr. B. Amudhambigai and Dr. P. Saranya, Introduction to AI, Royal Book Publishing,2025. |
| **Reference Books** | 1. Ian Good Fellow, Yoshua Bengio & Aaron Courville, Deep Learning, MIT Press (2016).<br>2. Ethem Alpaydin, Machine Learning: The New AI, The MIT Press (2016).<br>3.Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, fourth Edition (2021). |
| **Web resources** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Strong-3; Medium-2; Low-1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">INTRODUCTION TO ARTIFICIAL INTELLIGENCE WITH PYTHON- PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE – VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credit</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td rowspan="2">26UMADSECQ3</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td>-</td><td colspan="2">-</td><td colspan="2">2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. Possess a proficient understanding of Python, tailored specifically for implementing artificial intelligence algorithms and techniques.<br>2. Be capable of designing and implementing intelligent agents, considering various environments and rational decision-making processes, using Python.<br>3. Demonstrate proficiency in solving complex problems through the application of search algorithms, logical reasoning techniques, and building AI-based games and simulations using Python libraries.</td></tr>
<tr><td colspan="9">Course Outcomes: Students will be able to<br>CO1: recall fundamental concepts of Artificial Intelligence and Python programming syntax for AI.<br>CO2: explain the principles behind AI and its applications, as well as comprehend Python code related to AI concepts.<br>CO3: apply knowledge of Python programming to design and implement intelligent agents capable of interacting with environments.<br>CO4: analyze the efficiency of problem-solving algorithms and search strategies in Python.<br>CO5: develop novel problem- solving algorithms and search strategies using Python.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">Unit - I (Hours: 06)<br>Basics of Artificial Intelligence using Python.</td></tr>
<tr><td colspan="7">Unit - II (Hours: 06)<br>Implementing intelligent agents using Python.</td></tr>
<tr><td colspan="7">Unit - III (Hours: 06)<br>Developing problem-solving algorithms and search strategies in Python.</td></tr>
<tr><td colspan="7">Unit - IV (Hours: 06)<br>Applying logical reasoning techniques in Python.</td></tr>
<tr><td colspan="7">Unit - V (Hours: 06)<br>Building AI-based games and simulations using Python libraries.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of Internal Component only,</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC - CSIR/ GATE/ TNPSC/ others to be solved.</td></tr>
</table>

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|---|---|
| not to be included in the External Examination question paper) | |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Dr. B. Amudhambigai and Dr. P. Saranya, Introduction to AI, Royal Book Publishing,2025. |
| **Reference Books** | 1. Sebastian Raschka and Vahid Mirjalili, Python for AI and Machine Learning, Packt Publishing Ltd, Second Edition, 2017.<br>2. Online resources and documentation for Python libraries such as NumPy, pandas, scikit learn, and TensorFlow.<br>3. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, fourth Edition (2021). |
| **Web resources** | https://onlinecourses.nptel.ac.in/noc22_cs56/preview |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DIFFERENCE EQUATIONS WITH APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE – VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>26UMADSEC5B</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">Hours per week</td><td>4</td><td colspan="2">1</td><td colspan="2">-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. Understand difference equations and summation methods.<br>2. Solve linear systems using z-transform and stability concepts.<br>3. Analyze system behavior using phase plane and Floquet theory.</td></tr>
<tr><td colspan="8">Course Outcomes: Students will be able to<br>CO 1: explain the concepts of difference operators and summation and relate them to first-order linear difference equations in solving discrete mathematical problems.<br>CO 2: apply generating functions and z-transform methods to solve linear difference equations and discrete-time system models<br>CO 3: analyze difference equations with variable coefficients and investigate their initial value problems and stability behavior.<br>CO 4 : evaluate the stability of linear systems using phase plane techniques and fundamental matrices (Unit V) to determine long-term system behavior.<br>CO 5: construct and compare solutions of linear systems using Floquet theory and fundamental matrices combined with approximate summation and generating functions for modeling periodic discrete systems</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit - I (Hours: 15)<br>Difference operator - Summation – Generating functions and approximate summation.<br>Chapter 2 (Sections-2.1 - 2.3)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - II (Hours: 15)<br>First order equations - General results for linear equations - Solving linear equations<br>Chapter 3 (Sections 3.1 - 3.3)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - III (Hours: 15)<br>Equations with variable coefficients – The z -transform.<br>Chapter 3 (Sections 3.5 - 3.7)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - IV(Hours:15)<br>Initial value problems for linear systems – Stability of linear systems.<br>Chapter 4 (Sections 4.1& 4.2)</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - V(Hours:15)<br>Phase plane Analysis for Linear Systems, Fundamental Matrices and Floquet Theory<br>Chapter 4 ( Sections 4.3 & 4.4)</td></tr>
</table>

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|---|---|
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC - CSIR/ GATE/ TNPSC/ others to be solved.<br>(To be discussed during the Tutorial hour) |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | W.G. Kelley and A.C. Peterson, "Difference Equations", 2nd Edition, Academic Press, New York, 2001.. |
| **Reference Books** | 1. R.P. Agarwal, "*Difference Equations and Inequalities*", 2nd Edition, Marcel Dekker, New York, 2000.<br>2. S.N. Elaydi, "*An Introduction to Difference Equations*", 3rd Edition, Springer, India, 2008.<br>3. R. E. Mickens, "*Difference Equations*", 3rd Edition, CRC Press, 2015. |
| **Web resources** | https://nptel.ac.in |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Strong-3; Medium-2; Low-1**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">COMPUTATIONAL TECHNIQUES IN MATHEMATICS WITH PYTHON-PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Professional Competency Skill</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE</td><td>Year</td><td>III</td><td>Credits</td><td>2</td><td>Course Code</td><td>26UMAPCSQ</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td colspan="2">2</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">UG level Algebra and Trigonometry, Differential and Integral Calculus, Operation Research</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. Enables students to apply Python programming for solving mathematical problems in algebra, calculus, numerical methods, and operations research.<br>2. Enhances computational skills and analytical thinking through practical implementation and visualization techniques.</td></tr>
<tr><td colspan="9">Course Outcomes:<br>Students will be able to<br>CO1: explain number systems, sets, and graphical fundamentals, and apply Python to perform related operations.<br>CO2: apply Python to solve algebraic and trigonometric problems and analyze matrix transformations.<br>CO3: apply Python tools to differentiate and integrate functions, and analyze maxima, minima, and Laplace transforms.<br>CO4: implement numerical methods using Python and evaluate the accuracy and convergence of results.<br>CO5: evaluate Python programs for Operations Research techniques and optimal solutions for decision-making.</td></tr>
<tr><td>Course Outline</td><td colspan="8">Unit –I (Hours: 6)<br>Working with Numbers, Sets and graphs<br>Different Kinds of Numbers: Working with Fractions and Complex number, Set Construction and Operations, Creating Graphs.</td></tr>
<tr><td></td><td colspan="8">Unit - II (Hours: 6 ) Algebra<br>and trigonometry<br>Solving of equation, Solving of Quadratic equation, Symmetric and Skew - Symmetric Matrix, Transpose Matrix, Hyperbolic Function.</td></tr>
<tr><td></td><td colspan="8">Unit - III (Hours: 6 )<br>Differential and Integral calculus<br>Derivatives of Function, Maxima and Minima Function of Two Variables, Integration, Laplace Transform.</td></tr>
<tr><td></td><td colspan="8">Unit – IV (Hours: 6)<br>Numerical methods<br>Euler, Runge - Kutta Method, Gauss-Seidel Method, Trapezoidal and Simpson’s Rule.</td></tr>
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| | **Unit – V (Hours: 6)**<br>**Operation Research**<br>Simplex Method, Graphical Method, Assignment Problem, PERT, CPM. |
| Extended Professional Component (is a part of Internal Component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations<br>UPSC/TRB/NET/UGC - CSIR/ GATE/ TNPSC/ others to be solved. |
| Skills acquired from the course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | 1. Amit Saha, Doing with Python, William Pollock, 2015.<br>2. Robert Johansson, Numerical Python, Springer Science+ Media, 2015. |
| **Reference Books** | 1. Jay Gopalakrishnan, Lectures on Mathematical Computing with Python, Portland State Uniersity, 2020.<br>2. Jaan Kiusalaas, Nuerical Metods, in Engineering with Python, Cambridge University Pess, 2005. |
| **Web resources** | https://www.geeksforgeeks.org/<br>https://www.reddit.com/r/Physics/comments/nzlpyx/second_year_calculus_done_entirely_in_python_no/<br>https://www.statology.org/how-to-check-if-a-matrix-is-skew-symmetric-in-python/ |

**Mapping of COs with POs and PSOs:**

| | **POs** | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |

**Strong-3; Medium-2; Low-1**