# Annamalai University

# Faculty of Science

**Regulations, Curriculum and Syllabus**
**2019**

## M.Sc. MATHEMATICS
### Programme Code: SMAT51

# Department of Mathematics

# Annamalai University

## Faculty of Science
## DEPARTMENT OF MATHEMATICS
### M.Sc. MATHEMATICS
### Programme Code: SMAT51

These rules and regulations shall govern the Five year post graduate studies leading to the award of degree of **Master of Science in Mathematics** in the Faculty of Science. These academic Regulations shall be called "**Annamalai University, Faculty of Science Five year M.Sc. Mathematics Regulations 2019**". .They shall come into force with effect from the academic year 2019 – 2020.

1. **Definitions and Nomenclature**

1.1 **University** refers to Annamalai University.

1.2 **Department** means any of the academic departments and academic centers at the University.

1.3 **Discipline** refers to the specialization or branch of knowledge taught and researched in higher education. For example, Mathematics is a discipline in the Mathematical Science, while Economics is a discipline in Social Sciences.

1.4 **Programme** encompasses the combination of courses and/or requirements leading to a Degree. For example, M.Sc., M.A.

1.5 **Course** is an individual subject in a programme. Each course may consist of Lectures/ Laboratory /Seminar/Project work/viva-voce etc. Each course has a course title and is identified by a course code.

1.6 **Curriculum** encompasses the totality of student experiences that occur during the educational process.

1.7 **Syllabus** is an academic document that contains the complete information about an academic programme and defines responsibilities and outcomes. This includes course information, course objectives, policies, evaluation, grading, learning resources and course calendar.

1.8 **Academic Year** refers to the annual period of sessions of the University that comprises two consecutive semesters.

1.9 **Semester** is a half-year term that lasts for a minimum duration of 90 days.

1.10 **Choice Based Credit System**: A mode of learning in higher education that enables a student to have the freedom to select his/her own choice of elective courses across various disciplines for completing the Degree programme.

1.11 **Core Course** is mandatory and an essential requirement to qualify for the Degree.

1.12 **Elective Course** is a course that a student can choose from a range of alternatives.

1.13    **Value-added Courses** are optional courses that complement the students' knowledge and skills and enhance their employability.

1.14    **Credit** refers to the quantum of course work in terms of number of class hours in a semester required for a programme. The credit value reflects the content and duration of a particular course in the curriculum.

1.15    **Credit Hour** refers to the number of class hours per week required for a course in a semester. It is used to calculate the credit value of a particular course.

1.16    **Programme Outcomes** (POs) are statements that describe crucial and essential knowledge, skills and attitudes that students are expected to achieve and can reliably manifest at the end of a programme.

1.17    **Programme Specific Outcomes** (PSOs) are statements that list what the graduate of a specific programme should be able to do at the end of the programme.

1.18    **Learning Objectives** are statements that define the expected goal of a course in **Course Objectives** in terms of demonstrable skills or knowledge that will be acquired by a student.

1.19    **Course Outcomes** (COs) are statements that describe what students should be able to achieve/demonstrate at the end of a course. They allow follow-up and measurement of learning objectives.

1.20    **Grade Point Average** (GPA) is the average of the grades acquired in various courses that a student has taken in a semester. The formula for computing GPA is given in section 11.3

1.21    **Cumulative Grade Point Average**(CGPA) is a measure of overall cumulative performance of a student over all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters to the sum of the total credits of all courses in all the semesters.  is given in section11.4.

1.22    **Letter Grade** is an index of the performance of a student in a particular course. Grades are denoted by the letters S, A, B, C, D, E, RA, and W.

2.    **Programme Offered and Eligibility Criteria**:

   The Department of Mathematics offers a M.Sc. Five Year  Mathematics programme.

   A pass in H.S.E. (10+2 level) or equivalent thereto with  a minimum of 40% under academic stream in the following subjects viz. Physics, Chemistry, Mathematics or Biology.

3.    **Reservation Policy:** Admission to the various programmes will be strictly based on the reservation policy of the Government of Tamil Nadu.

4.    **Programme Duration**

4.1    The Five-Year Master's Programme consist of five academic years.

4.2     Each academic year is divided into two semesters, the first being from July to November and the second from December to April.

4.3     Each semester will have 90 working days (18 weeks).

## 5.     Programme Structure

5.1     The Five-Year Integrated Programme consists of Language Courses, Core Courses, Allied Courses, Elective Courses, Experiential Learning and Project. Students shall also participate in Extension Activities as part of their curriculum.

### 5.2     Language Courses

5.2.1     Each student shall take two languages of four courses each, one in each semester for the first two years of the programme.

5.2.2     Language – I shall be Tamil or another language such as Hindi or French.

5.2.3     Language – II shall be English.

### 5.3     Core courses

5.3.1     These are a set of compulsory courses essential for each programme.

5.3.2     The core courses include both Theory (Core Theory) and Practical (Core Practical) courses.

### 5.4     Allied Courses

5.4.1     Each student shall take courses in two disciplines allied to the main subject (Allied – I and Allied – II) of the programme in the first four semesters.

### 5.5     Elective courses

5.5.1     **Departmental Electives (DEs)** are the Electives that students can choose from a range of Electives offered within the Department.

**Interdepartmental Electives (IDEs)** are Electives that students can choose from amongst the courses offered by other departments of the same faculty as well as by the departments of other faculties.IDEs are listed in the Handbook available in the University website.

### 5.6     Soft Skills

5.6.1     Soft skills are intended to enable students to acquire attributes that enhance their performance and achieve their goals with complementing hard skills.

5.6.1     Soft skills include communication skills, **computer skills** among others.

### 5.7     Value Education

5.7.1     All students shall take a course on Value Education that includes human values, sustainable development, gender equity, ethics and human right.

5.7.1     **Value Education** is categorized as **Non-Credit Compulsory Course.**

5.8    **Experiential Learning**

5.8.1   Experiential learning provides opportunities to students to connect principles of the discipline with real-life situations.

5.8.1   In-plant training/field trips/internships/industrial visits fall under this category.

5.8.2   **Experiential learning is** categorized as **Non-Credit Compulsory Course.**

5.9    **Extension Activities**

5.9.1   It is mandatory for every student to participate in extension activities.

5.9.2   All the students shall enrol under NSS/NCC/YRC/RRC or any other Service organisation in the University.

5.9.3   Students shall put in a minimum attendance of 40 hours in a year duly certified by the Programme Coordinator.

5.9.4   Extension activities shall be conducted outside the class hours

5.9.5   Extension activity is categorized as **Non-Credit Compulsory Course**

5.10   **Project**

5.10.1  Each student shall undertake a Project and submit a dissertation as per guidelines in the final semester.

5.10.2  The Head of the Department shall assign a Research Supervisor to the student.

5.10.3  The Research Supervisor shall assign a topic for research and monitor the progress of the student periodically.

5.10.4  Students who wish to undertake project work in recognized institutions/industry shall obtain prior permission from the University. The Research Supervisor will be from the host institute.

5.11   **Value added Courses (VACs)**

5.11.1  Students may also opt to take Value added Courses beyond the minimum credits required for award of the Degree. VACs are outside the normal credit paradigm.

5.11.2  These courses impart employable and life skills. VACs are listed in the Handbook available  in the University website.

5.11.3  Each VAC carries 2 credits with 30 hours of instruction. Classes for a VAC are conducted beyond the regular class hours and preferably in the VIII and IX Semester.

5.12   **Online Courses**

5.12.1  The Heads of Departments shall facilitate enrolment of students in Massive Open Online Courses (MOOCs) platform such as SWAYAM to provide academic flexibility and enhance the academic career of students.

5.12.2  Students who successfully complete a course in the MOOCs platform shall be exempted from one elective course of the programme.

**5.13** **Credit Distribution:** The credit distribution is organized as follows:

| Semester I to VI | |
|---|---|
| Language-I (Tamil or any other Language) | 12 |
| Language-II (English) | 12 |
| Core Courses | 86 |
| Allied-I (1st Year- SEM I & II) | 10 |
| Allied-II (2nd Year- SEM III & IV) | 10 |
| Electives | **09** |
| Soft Skill | 03 |
| Environmental studies (UGC mandated) | 03 |
| Value Education | 02* |
| Experiential learning | 02* |
| Extension activities | 01* |
| **Total Credits (Semester I to VI)** | **145** |
| Semester VII to X | |
| Core Courses | 74 |
| Electives | 15 |
| Project | 06 |
| Constitution of India | 02* |
| **Total Credits (Semester VII to X)** | **95** |
| **Total Credits (Semester I to X)** | **240** |

**Note: '*' - Non -Credit Compulsory Course**

**5.14** **Credit Assignment**

Each course is assigned credits and credit hours on the following basis:

1 Credit is defined as

1 Lecture period of one-hour duration per week over a semester

1 Tutorial period of one-hour duration per week over a semester

1 Practical/Project period of two hours duration per week over a semester.

**6** **Attendance**

**6.1** Each faculty handling a course shall be responsible for the maintenance of Attendance and Assessment Record for candidates who have registered for the course.

6.2     The Record shall contain details of the students' attendance, marks obtained in the Continuous Internal Assessment (CIA) Tests, Assignments and Seminars. In addition the Record shall also contain the organization of lesson plan of the Course teacher.

6.3     The record shall be submitted to the Head of the Department and Dean once a month for monitoring the attendance and syllabus coverage.

6.4     At the end of the semester, the record shall be placed in safe custody for any future verification.

6.5     The Course teacher shall intimate to the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.

6.6     Each student shall have a minimum of 75% attendance in all the courses of the particular semester failing which he or she will not be permitted to write the End-Semester Examination. The student has to redo the semester in the next year.

6.7     Relaxation of attendance requirement up to 10% may be granted for valid reasons such as illness, representing the University in extracurricular activities and participation in NCC/NSS/YRC/RRC.

## 7    Mentor-Mentee System

7.1     To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach certain number of students to a member of the faculty who shall function as a Mentor throughout their period of study.

7.2     The Mentors will guide their mentees with the curriculum, monitor their progress, and provide intellectual and emotional support.

7.3     The Mentors shall also help their mentees to choose appropriate electives and value-added courses, apply for scholarships, undertake projects, prepare for competitive examinations such as NET/SET, GATE etc., attend campus interviews and participate in extracurricular activities.

## 8    Examinations

8.1     The examination system of the University is designed to systematically test the student's progress in class, laboratory and field work through Continuous Internal Assessment (CIA) Tests and End-Semester Examination (ESE).

8.2     There will be two CIA Tests and one ESE in each semester.

8.3     The Question Papers will be framed to test different levels of learning based on Bloom's taxonomy viz. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation/Creativity.

### 8.4 Continuous Internal Assessment Tests

8.4.1 The CIA Tests shall be a combination of a variety of tools such as class tests, assignments and seminars. This requires an element of openness.

8.4.2 The students are to be informed in advance about the assessment procedures.

8.4.3 The question paper will be set by the respective faculty using Bloom's Taxonomy.

8.4.4 CIA Test – I will cover the syllabus of the first two units while CIA Test – II will cover the last three units.

8.4.5 CIA Tests will be for one or two hours duration depending on the quantum of syllabus.

8.4.6 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason, the student is unable to attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

8.4.7 For the CIA Tests, the assessment will be done by the Course teacher.

### 8.5 End Semester Examinations (ESE)

8.5.1 The ESEs for the odd semester will be conducted in November and for the even semester in May.

8.5.2 Candidates who failed in any course will be permitted to reappear in failed course in the subsequent examinations.

8.5.3 The ESE will be of three hours duration and will cover the entire syllabus of the course.

### 9 Evaluation

### 9.1 Marks Distribution

9.1.1 For each course, the Theory, Practical and project shall be evaluated for a maximum of 100 marks.

9.1.2 For the theory courses and project, CIA Tests will carry 25% and the ESE 75% of the marks.

9.1.3 For the Practical courses, the CIA Tests will carry 40% and the ESE 60% of the marks.

### 9.2 Assessment of CIA Tests

9.2.1 For the CIA Tests, the assessment will be done by the Course Teacher

9.2.2 For the Theory Courses, the break-up of marks shall be as follows:

| CIA for Theory Courses | Marks |
| --- | --- |
| Test-I & Test-II | 15 |
| Seminar | 5 |
| Assignment | 5 |
| Total | 25 |

9.2.3 For the Practical Courses (wherever applicable), the break-up of marks shall be as follows:

| CIA for Practical | Marks |
|---|---|
| Test-I | 15 |
| Test-II | 15 |
| Viva-voce and Record | 10 |
| Total | 40 |

### 9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by Internal examiner.

### 9.4 Assessment of Project/Dissertation

9.4.1 The Project Report/Dissertation shall be submitted as per the guidelines.

9.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.

9.4.3 CIA for Project will consist of a Review of literature survey, experimentation/field work, attendance etc.

9.4.4 The Project Report evaluation and viva-voce will be conducted by a committee constituted by the Head of the Department.

9.4.5 The Project Evaluation Committee will comprise the Head of the Department, Project Supervisor, and a senior faculty.

### 9.4.6 The marks shall be distributed as follows:

| Continuous Internal Assessment (25 Marks) | | End Semester Examination (75 Marks) | |
|---|---|---|---|
| Review - I | Review - II | Project / Dissertation Evaluation | Viva-Voce |
| 10 | 15 | 50 | 25 |

### 9.5 Assessment of Value-added Courses

9.5.1 Assessment of VACs shall be internal. Two CIA Tests shall be conducted by the Department(s) offering VAC.

9.5.2 The grades obtained in VACs will not be included for calculating the GPA/CGPA.

### 9.6 Passing Minimum

9.6.1 A student is declared to have passed in each course if he/she secures not less than 50% marks in the ESE and not less than 50% marks in aggregate taking CIA and ESE marks together.

9.6.2 A candidate who has not secured a minimum of 50% of marks in a course (CIA + ESE) shall reappear for the course in the next semester/year.

### 10. Conferment of the Master's Degree

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned the minimum required credits shall be considered to have passed the Master's Programme.

### 11. Marks and Grading

11.1 The performance of students in each course is evaluated in terms Grade Point (GP).

11.2 The sum total performance in each semester is rated by Grade Point Average (GPA) while Cumulative Grade Point Average (CGPA) indicates the Average Grade Point obtained for all the courses completed.

11.3 **The GPA** is calculated by the formula

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$$

where, $C_i$ is the Credit earned for the Course $i$ in any semester;

$G_i$ is the Grade Point obtained by the student for the Course $i$

$n$ is the number of Courses passed in that semester.

11.4 **CGPA** is the Weighted Average Grade Point of all the Courses passed starting from the first semester to the current semester.

$$CGPA = \frac{\sum_{i=1}^{m} \sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{m} \sum_{i=1}^{n} C_i}$$

Where, $C_i$ is the Credit earned for the Course $i$ in any semester;

$G_i$ is the Grade Point obtained by the student for the Course $i$

$n$ is the number of Courses passed in that semester.

$m$ is the number of semester.

11.5 **Evaluation :**

11.5.1 **Performance of the student for each course will be rated as shown in the Table.**

| Range of Marks | Grade Points | Letter Grade |
|---|---|---|
| **90 and above** | **10** | S |
| **80-89** | **9** | A |
| **70-79** | **8** | B |
| **60-69** | **7** | C |
| **55-59** | **6** | D |
| **50-54** | **5** | E |
| **Less than 50** | **0** | RA |
| **Withdrawn from the examination** | **0** | W |

11.5.2 A ten-point rating scale is used for evaluation of the performance of the student to provide overall grade for the Master's Programme.

| CGPA | Classification of Final Result |
|---|---|
| **8.25 and above** | **First Class with Distinction** |
| **6.5 and above but below 8.25** | **First Class** |
| **5.0 and above but below 6.5** | **Second Class** |
| **0.0 and above but below 5.0** | **Re-appear** |

11.6 **Classification of Results**. The successful candidates are classified as follows:

11.6.1 **First Class with Distinction:** Candidates who have passed all the courses prescribed in the Programme in the first attempt with a CGPA of 8.25and above within the programme duration. Candidates who have withdrawn from the End Semester Examinations are still eligible for First Class with Distinction (See Section 12 for details).

11.6.2 **First Class:** Candidates who have passed all the courses with a CGPA of 6.5and above.

11.6.3 **Second Class:** Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5.

11.6.4 Candidates who obtain overall highest CGPA in all examinations in the first appearance itself are eligible for **University Rank.**

11.7 **Course-Wise Letter Grades**

11.7.1 The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

11.7.2 A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA.

11.7.3 A course successfully completed cannot be repeated for the purpose of improving the Grade Point

11.7.4 A letter grade RA indicates that the candidate shall reappear for that course. The RA Grade once awarded stays in the grade sheet of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

11.7.5 If a student secures RA grade in the Project Work/Field Work/Practical Work/Dissertation, he/she shall improve it and resubmit if it involves only rewriting/ incorporating the clarifications suggested by the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

**12.    Provision for Withdrawal from the End Semester Examination**

12.1    The letter grade W indicates that a candidate has withdrawn from the examination.

12.2    A candidate is permitted to withdraw from appearing in the ESE for one course or courses in ANY ONE of the semesters ONLY for exigencies deemed valid by the University authorities.

12.3    Permission for withdrawal from the examination shall be granted only once during the entire duration of the programme.

12.4    Application for withdrawal shall be considered only if the student has registered for the course(s), and fulfilled the requirements for attendance and CIA tests.

12.5    The application for withdrawal shall be made ten days prior to the commencement of the examination and duly approved by the Controller of Examinations. Notwithstanding the mandatory prerequisite of ten days' notice, due consideration will be given under extraordinary circumstances.

12.6 Withdrawal will not be granted for arrear examinations of courses in previous semesters and for the final semester examinations.

12.7 Candidates who have been granted permission to withdraw from the examination shall reappear for the course(s) when the course(s) are offered next.

12.8 Withdrawal shall not be taken into account as an appearance for the examination when considering the eligibility of the candidate to qualify for First Class with Distinction.

13. **Academic misconduct:** Any action that results in an unfair academic advantage/interference with the functioning of the academic community constitutes academic misconduct. This includes but is not limited to cheating, plagiarism, altering academic documents, fabrication/falsification of data, submitting the work of another student, interfering with other students' work, removing/defacing library or computer resources, stealing other students' notes/assignments, and electronically interfering with other students'/University's intellectual property. Since many of these acts may be committed unintentionally due to lack of awareness, students shall be sensitized on issues of academic integrity and ethics.

14. **Transitory Regulations:** Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted for two consecutive years after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendation of the Head of the Department concerned.

15. Not with standing anything contained in the above pages as Rules and Regulations governing the Five-Year Master's Programmes at Annamalai University, the Syndicate is vested with the powers to revise them from time to time on the recommendations of the Academic Council.

## M.Sc. Mathematics (Five Year) ProgrammeSMAT51
### CURRICULA AND SCHEME OF EXAMINATIONS (2019)

| Course Code | Course Title | Hours/ Week | | | C | Marks | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | L | T | P | | CIA | ESE | Total |
| *FIRST SEMESTER* | | | | | | | | |
| 19ITAMC11 | Language-I: Course 1 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IENGC12 | Language-II: Course 1 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IENSC13 | Environmental Studies | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IMATC14 | Core 1: Classical Algebra | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IPHYA01 | Allied – Physics - I | 4 | 0 | | 4 | 25 | 75 | 100 |
| 19IMATE15 | Elective: Matrices | 3 | 0 | | 3 | 25 | 75 | 100 |
| | **Total credits-Semester I** | | | | **21** | | | |
| *SECOND SEMESTER* | | | | | | | | |
| 19ITAMC21 | Language-I: Course 2 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IENGC22 | Language-II: Course 2 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19ICISC23 | Computer Applications – I | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IMATC24 | Core 2: Trigonometry | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC25 | Core 3: Differential Calculus | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IPHYA02 | Allied - Physics – II | 4 | 0 | | 4 | 25 | 75 | 100 |
| 19IPHYP01 | Allied – Physics Practical | | | 6 | 2 | 40 | 60 | 100 |
| | **Total credits-Semester II** | | | | **25** | | | |
| *THIRD SEMESTER* | | | | | | | | |
| 19ITAMC31 | Language-I: Course 3 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IENGC32 | Language-II: Course 3 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IMATC33 | Core 4: Analytical Geometry 2D | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC34 | Core 5: Vector Analysis | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19ISTAA01 | Allied– Mathematical Statistics -I | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATE35 | Elective: Integral Calculus | 3 | 0 | | 3 | 25 | 75 | 100 |
| | **Total credits-Semester III** | | | | **24** | | | |
| *FOURTH SEMESTER* | | | | | | | | |
| 19ITAMC41 | Language-I: Course 4 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IENGC42 | Language-II: Course 4 | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IMATC43 | Core 6: Statics | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC44 | Core 7: Fourier Series and Fourier Transforms | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19ISTAA02 | Allied– Mathematical Statistics –II | 5 | 0 | | 5 | 25 | 75 | 100 |

| | | L | T | P | C | CA | SE | Total |
|---|---|---|---|---|---|---|---|---|
| 19IMATF40 | Extension Activities* | 0 | 0 | 2 | 1* | 40 | 60 | 100 |
| | **Total credits-Semester IV** | | | | **21** | | | |
| | *FIFTH SEMESTER* | | | | | | | |
| 19IMATC51 | Core 8: Real Analysis – I | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC52 | Core 9: Differential Equations and Applications | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC53 | Core 10: Dynamics | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC54 | Core 11: Astronomy | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC55 | Core 12: Numerical Methods | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATE57 | Elective: Analytical Geometry 3D | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IMATV50 | Value Education* | 2 | 0 | 0 | 2* | 25 | 75 | 100 |
| | **Total credits-Semester V** | | | | **28** | | | |
| | *SIXTH SEMESTER* | | | | | | | |
| 19IMATC61 | Core 14: Real Analysis – II | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC62 | Core 15: Complex Analysis | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC63 | Core 16: Algebra | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC64 | Core 17: Discrete Mathematics | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC65 | Core 18: Optimization Techniques | 6 | 0 | | 6 | 25 | 75 | 100 |
| 19IMATF60 | Experiential Learning* | 0 | 0 | 4 | 2* | 40 | 60 | 100 |
| | **Total credits-Semester VI** | | | | **26** | | | |
| | *SEVENTH SEMESTER* | | | | | | | |
| 19IMATC71 | Core 20: Advanced Abstract Algebra I | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC72 | Core 21: Advanced Real Analysis | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC73 | Core 22: Advanced Differential Equations | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC74 | Core 23: Differential Geometry | 5 | 0 | | 5 | 25 | 75 | 100 |
| | Elective 1: Interdepartmental Elective | 3 | 0 | | 3 | 25 | 75 | 100 |
| | **Total credits-Semester VII** | | | | **23** | | | |
| | *EIGHTH SEMESTER* | | | | | | | |
| 19IMATC81 | Core 24: Advanced Abstract Algebra II | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC82 | Core 25: Measure Theory and Integration | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC83 | Core 26: Advanced Complex Analysis | 5 | 0 | | 5 | 25 | 75 | 100 |
| 19IMAPC84 | Core 27: C++ Computer Practical | | 0 | 4 | 2 | 40 | 60 | 100 |
| 19IMATEXX | Elective 3: Department Elective: Programming Language C++ | 3 | 0 | | 3 | 25 | 75 | 100 |
| | Elective 2: Interdepartmental Elective | 3 | 0 | | 3 | 25 | 75 | 100 |
| | **Total credits-Semester VIII** | | | | **23** | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***NINTH SEMESTER*** |
| 19IMATC91 | Core 28: Topology | 3 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC92 | Core 29: Linear Algebra | 4 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC93 | Core 30: Probability Theory | 4 | 0 | | 5 | 25 | 75 | 100 |
| 19IMATC94 | Core 31: Numerical Methods Practical | | 0 | 4 | 2 | 40 | 60 | 100 |
| | Elective 4: Interdepartmental Elective | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IMATEXX | Elective 5: Department Elective | 3 | 0 | | 3 | 25 | 75 | 100 |
| 19IPSC090* | Constitution of India | 2 | 0 | | 2* | 25 | 75 | 100 |
| | **Total credits-Semester IX** | **23** | | | |
| ***TENTH SEMESTER*** |
| 19IMATCX1 | Core 32: Functional Analysis | 4 | 0 | | 4 | 25 | 75 | 100 |
| 19IMATCX2 | Core 33: Stochastic Processes | 4 | 0 | | 4 | 25 | 75 | 100 |
| 19IMATCX3 | Core 34: Fluid Dynamics | 4 | 0 | | 4 | 25 | 75 | 100 |
| 19IMATCX4 | Core 35: Graph Theory | 4 | 0 | | 4 | 25 | 75 | 100 |
| 19IMATCX5 | Core 36: Calculus of Variations & Integral Equations | 4 | 0 | | 4 | 25 | 75 | 100 |
| 19IMATDX6 | Project | 6 | 0 | | 6 | 25 | 75 | 100 |
| | **Total credits-Semester X** | **26** | | | |
| | **Semesters I-X Total Credits** | **240** | | | |
| *Value added Courses* |
| *On-line courses (SWAYAM or MOOC)* |

**NOTE:  *  ➡  Non-Credit Compulsory Course**

**L**- Lectures; **T**- Tutorial; **P**- Practical; **C**- Credits; **CIA**- Continuous Internal Assessment;
**ESE**- End-Semester Examination

Note:

1. Students shall take both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available. The details of interdepartmental electives are given in the "**Handbook of Interdepartmental Electives- PG Programmes**" and listed in the University website.
2. Students may opt for any Value Added Courses listed in the University website. The details of Value Added Courses are given in the "**Handbook of Value Added Courses**" and listed in the University website.
3. Guidance/Discussion with students on course specific **experiential learning** through the application of theory and academic content to real-world experiences, either within the classroom, within the community, or within the work place, which advances program or course -based learning outcome that are specifically focused on employability skills.

## DEPARTMENT ELECTIVE COURSES (DE)

| S. No. | Course Code | Course Title | Hours/ week | | | C | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CIA | ESE | Total |
| 1. | 19IMATE15 | Elective: Matrices | 3 | 0 | | 3 | 25 | 75 | 100 |
| 2. | 19IMATE35 | Elective: Integral Calculus | 3 | 0 | | 3 | 25 | 75 | 100 |
| 3. | 19IMATE57 | Elective: Analytical Geometry 3D | 3 | 0 | | 3 | 25 | 75 | 100 |
| 4. | 19IMATE85 | Programming Language C++ | 3 | 0 | | 3 | 25 | 75 | 100 |
| 5. | 19IMATE95 | Number Theory | 3 | 0 | | 3 | 25 | 75 | 100 |
| 6. | 19IMATE96 | Fuzzy Sets and their Applications | 3 | 0 | | 3 | 25 | 75 | 100 |

## DEPARTMENT ALLIED CORSES OFFERED TO OTHER DEPARTMENTS

| S. No. | Course Code | Course Title | Hours/ week | | | C | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CIA | ESE | Total |
| 1. | 19IMATA01 | Mathematics – I | 5 | 0 | 0 | 5 | 25 | 75 | 100 |
| 2. | 19IMATA02 | Mathematics – II | 5 | 0 | 0 | 5 | 25 | 75 | 100 |
| 3. | 19IMATA03 | Discrete Mathematics | 5 | 0 | 0 | 5 | 25 | 75 | 100 |
| 4. | 19IMATA04 | Resource Management Techniques | 5 | 0 | 0 | 5 | 25 | 75 | 100 |

**ANNAMALAI UNIVERSITY**

**Department of Mathematics**

**[Question Paper Pattern - INTERNAL TESTS I & II (CIA)]**

**(Based on Revised Bloom's Taxonomy)**

**Programme: M.Sc :  Five Year Integrated**                                      **Semester:  All**

**Time: 2 Hrs**                                                                                **Max.Marks:50**

### Part-A (Level-K1)                                              Marks: (6x2=12)

*(Answer ALL of the questions)*

1. Define /Choose/ Relate……
2. What / Why / How?
3. Multiple Choices        a.        b.        c.        d.
4. Multiple Choices        a.        b.        c.        d.
5. Match the following     i - a   ii – b   iii - c   iv - d   v - …..
6. Match the following     i - a   ii – b   iii - c   iv - d   v - …..

### Part-B (Level-K2)                                              Marks: (3x5=15)

*(Answer any THREE of the questions)*

7. Explain…..
8. Describe…..
9. Select……
10. Compare

### Part-C (Level-K3/ Level-K4)                              Marks: (2x7=14)

*(Answer any TWO of the questions)*

11. Apply….
12. Calculate….
13. Categorize…

### Part-D (Level-K5/ Level-K6)                              Marks: (1x9=9)

*(Answer any ONE of the questions)*

14. Discuss….
15. Summarize….

**Department of Mathematics**
**Pattern of question paper for END semester examinations**
**(Based on Revised Bloom's Taxonomy)**

**Year: I/II**                                                    **Semester:**
**Programme: M.Sc. Five Year Integrated  PG**
**Course Code:**                          **Course Name:**
**Time: 3 Hrs**                                          **Max.Marks:100**

### Part-A (Level-K1) Marks: (15x2=30)
*(Answer ALL of the questions)*

1. Define……
2. What …….?
3. Choose/ Relate…………
4. How ……?
5. Why ……?
6. Find……
7. Spell out……
8. Multiple Choices          a.        b.        c.        d.
9. Multiple Choices          a.        b.        c.        d.
10. Multiple Choices        a.        b.        c.        d.
11. Multiple Choices        a.        b.        c.        d.
12. Match the following      i - a      ii - b    iii - c   iv - d   v - …..
13. Match the following      i - a      ii - b    iii - c   iv - d   v - …..
14. Match the following      i - a      ii - b    iii - c   iv - d   v - …..
15. Match the following      i - a      ii - b    iii - c   iv - d   v - …..

### Part-B (Level-K2) Marks: (5x5=25)
*(Answer any FIVE of the questions)*

16. Explain…..
17. Describe…..
18. Select……
19. Classify….
20. Compare….
21. Interpret…

### Part-C (Level-K3/ Level-K4) Marks: (5x7=35)
*(Answer any FIVE of the questions)*

22. Apply….
23. Show…..
24. Solve….
25. Calculate….
26. Categorize…
27. Distinguish….
28. Test for…..

*(Answer any ONE of the questions)*

29. Discuss….
30. Summarize….

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# ANNAMALAI UNIVERSITY
## Department of Mathematics
### Pattern of question paper for END semester examinations
### (Based on Revised Bloom's Taxonomy)

Year: III                                                   Semester:

Programme: M.Sc. Five Year Integrated  PG

Course Code:                                Course Name:

Time: 3 Hrs                                                Max.Marks:100

### Part-A (Level-K1)Marks: (10x2=20)
#### *(Answer ALL of the questions)*

1. Define……
2. What …….?
3. Multiple Choices       a.       b.       c.       d.
4. Multiple Choices       a.       b.       c.       d.
5. Multiple Choices       a.       b.       c.       d.
6. Multiple Choices       a.       b.       c.       d.
7. Match the following    i - a     ii - b    iii - c   iv - d   v - …..
8. Match the following    i - a     ii - b    iii - c   iv - d   v - …..
9. Match the following    i - a     ii - b    iii - c   iv - d   v - …..
10. Match the following   i - a     ii - b    iii - c   iv - d   v - …..

### Part-B (Level-K2)Marks: (5x3=15)
#### *(Answer any FIVE of the questions)*

11. Explain…..
12. Describe…..
13. Select……
14. Classify….
15. Compare….
16. Outline ….

### Part-C (Level-K3/Level-K4)  Marks: (9x5=45)
#### *(Answer any NINE of the questions)*

17. Apply….
18. Prepare….
19. Show…..
20. Solve….
21. Illustrate…..
22. Sketch….
23. Infer….
24. Categorize…
25. Analyze…
26. Distinguish….
27. Take part in…

*(Answer any TWO of the questions)*

28. Discuss….
29. Summarize….
30. Design….

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# ANNAMALAI UNIVERSITY
## Department of Mathematics
## Pattern of question paper for END semester examinations
## (Based on Revised Bloom's Taxonomy)

Year: IV                                                    Semester:
Programme: M.Sc. Five Year Integrated  PG
Course Code:                              Course Name:
 Time: 3 Hrs                                              Max.Marks:100

### Part-A (Level-K1/ Level-K2)                    Marks: (10x2=20)
*(Answer ALL of the questions)*

1.  Define……
2.  Multiple Choices       a.       b.       c.       d.
3.  Multiple Choices       a.       b.       c.       d.
4.  Match the following    i - a     ii - b    iii - c   iv –d   v - …..
5.  Match the following    i - a     ii - b    iii - c   iv –d   v - …..
6.  Explain…….
7.  Select…..
8.  Describe……
9.  Classify….
10. Elucidate….

### Part-B (Level-K3/ Level-K4)                    Marks: (8x5=40)
*(Answer any EIGHT of the questions)*

11. Prepare…..
12. Solve…..
13. Apply……
14. Show…..
15. Categorize…
16. Analyze…
17. Distinguish….
18. Infer….
19. Compare….
20. Compute

### Part-C (Level-K5)                    Marks: (3x10=30)
*(Answer any THREE of the questions)*

21. Discuss…
22. Summarize….
23. Evaluate…..
24. Disprove….

**Part-D (Level-K6) \***  Marks: (1x10=10)

*(Answer any ONE of the questions)*

25. Design….
26. Develop…

\*\*\*\*\*

i.   .

**ANNAMALAI UNIVERSITY**

**Department of Mathematics**

<span style="color:red">**Pattern of question paper for END semester examinations**</span>

**(Based on Revised Bloom's Taxonomy)**

**Year: V**                                                                                    **Semester:**

**Programme: M.Sc. Five Year Integrated  PG**

**Course Code:**                                       **Course Name:**

**Time: 3 Hrs**                                                         **Max.Marks:100**

### Part-A (Level-K1/ Level-K2)                    Marks: (10x2=20)

*(Answer ALL of the questions)*

1.  Define……
2.  Multiple Choices          a.         b.         c.         d.
3.  Multiple Choices          a.         b.         c.         d.
4.  Match the following      i - a      ii - b     iii - c    iv –d    v - …..
5.  Match the following      i - a      ii - b     iii - c    iv –d    v - …..
6.  Explain…….
7.  Select…..
8.  Describe…..
9.  Classify….
10. Elucidate….

### Part-B (Level-K3/ Level-K4)                    Marks: (6x5=30)

*(Answer any SIX of the questions)*

11. Apply……
12. Show…..
13. Prepare
14. Make use of….
15. Categorize…
16. Analyze…
17. Distinguish….
18. Simplify…..

### Part-C (Level-K5)                    Marks: (3x10=30)

*(Answer any THREE of the questions)*

19. Discuss…
20. Recommend with
21. Evaluate…..
22. Justify….
23. Optimize…

*(Answer any TWO of the questions)*

24. Design….
25. Formulate …
26. Modify …..

\*\*\*\*\*

| M.Sc. Mathematics (FIVE YEAR) PROGRAMME | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **[End Semester Examinations]** <br> **Bloom's Taxonomy - Questions Conforming to Levels K1 to K6** | | | | | | | | | | | | | |
| I Year(Five Year PG) | | | | | II Year (Five Year PG) | | | | | III Year(Five Year PG) | | | |
| Level | Part | Questions & Marks | Total Marks | | Level | Part | Questions & Marks | Total Marks | | Level | Part | Questions & Marks | Total Marks |
| K1 | A | 15 x 2 | 30 | | K1 | A | 15 x 2 | 30 | | K1 | A | 10 x 2 | 20 |
| K2 | B | 5 x 5 | 25 | | K2 | B | 5 x 5 | 25 | | K2 | B | 5 x 3 | 15 |
| K3 | C | 3 x 7 | 21 | | K3 | C | 3 x 7 | 21 | | K3 | C | 5 x 5 | 25 |
| K4 | | 2 x 7 | 14 | | K4 | | 2 x 7 | 14 | | K4 | | 4 x 5 | 20 |
| K5 | D | 1 x 10 | 10 | | K5 | D | 1 x 10 | 10 | | K5 | D | 1 x 10 | 10 |
| | | | 100 | | | | | 100 | | K6 | | 1 x 10 | 10 |
| | | | | | | | | | | | | | 100 |

| IV Year (Five Year PG) <br> I Year (Two/Three year PG)/ | | | | | V Year (Five Year PG) <br> II/III Year (Two/Three Year PG) / | | | |
|---|---|---|---|---|---|---|---|---|
| Level | Part | Questions & Marks | Total Marks | | Level | Part | Questions & Marks | Total Marks |
| K1 | A | 5 x 2 | 10 | | K1 | A | 5 x 2 | 10 |
| K2 | | 5 x 2 | 10 | | K2 | | 5 x 2 | 10 |
| K3 | B | 4 x5 | 20 | | K3 | B | 2 x 5 | 10 |
| K4 | | 4 x5 | 20 | | K4 | | 4 x 5 | 20 |
| K5 | C | 3 x 10 | 30 | | K5 | C | 3 x10 | 30 |
| K6 | D | 1 x 10 | 10 | | K6 | D | 2x 10 | 20 |
| | | | 100 | | | | | 100 |

**PROGRAMME OUTCOMES (POs)**

After the successful completion of the M.Sc. Mathematics (5 year) Degree Programme, the graduates will be able to:

| | |
|---|---|
| **PO1:** | Domain knowledge: Demonstrate knowledge of basic concepts, principles and applications of the specific science discipline. |
| **PO2:** | Resource Utilisation. Cultivate the skills to acquire and use appropriate learning resources including library, e-learning resources, ICT tools to enhance knowledge-base and stay abreast of recent developments. |
| **PO3:** | Analytical and Technical Skills: Ability to handle/use appropriate tools/techniques/equipment with an understanding of the standard operating procedures, safety aspects/limitations. |
| **PO4:** | Critical thinking and Problem solving: Identify and critically analyse pertinent problems in the relevant discipline using appropriate tools and techniques as well as approaches to arrive at viable conclusions/solutions. |
| **PO5:** | Project Management: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyse and interpret data and provide solutions. Exhibit organisational skills and the ability to manage time and resources. |
| **PO6:** | Individual and team work: Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO7:** | Effective Communication: Communicate effectively in spoken and written form as well as through electronic media with the scientific community as well as with society at large. Demonstrate the ability to write dissertations, reports, make effective presentations and documentation. |
| **PO8:** | Environment and Society: Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development. |
| **PO9:** | Ethics: Commitment to professional ethics and responsibilities. |
| **PO10:** | Life-long learning: Ability to engage in life-long learning in the context of the rapid developments in the discipline. |

**PROGRAMME SPECIFIC OUTCOMES (PSOs)**

At the end of the programme, the student will be able to

| PSO1 | Improve the problems solving skills. |
|------|--------------------------------------|
| PSO2 | Collaborate with the other related areas of science. |
| PSO3 | Improve the theoretical knowledge of Mathematical concepts. |
| PSO4 | Creatively applying the knowledge of Mathematics in selected real life situations / Ability to acquire knowledge for studying higher level abstract mathematics. |

| Semester | 19ITAMC11: Part-I Language I | L | T | P | C |
|---|---|---|---|---|---|
| I | நவீன இலட கியீ ீ நாடகீ ீ | 3 | 0 | 0 | 3 |

கீ ீர் தலீ நேரீ கீ (Learning Objective (LO))

❖ தமிழில் தோல்றிய நவண இலல்கியல்களண வளள்சியையல் ல்றல்.
❖ சில்கதை, ஸ்தினல்கல் கால்ல்ல் சல் சல் சில்கல்களைல்ல் கதை உல்திகளைல்ல் வண்ல்ல்தல்.
❖ தமிழில் நல்யாக வளள்ல்ல்ள ல்ல்கவண்தை வகைமைய எல்ல்ரைல்தல்.
❖ நவண நாடகல்களை இலல்கிய நாடகல்களோல் ஒல்யல்.
❖ ஐரோல்யல்ல் வல்கையால் தமிழில் ஏல்பல்ட மால்றல்களைல்ல் மல்மலல்சியை வண்ல்ல்தல்.

**Course Outcomes**

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

| CO1: | மொழில் பாடல் வழியே தமிழில் சிறல்ல்ல்களை மாணவல்கல் அறில்ல் கொல்வல் |
|---|---|
| CO2: | உலக இலல்கியல்கல் ல்ல் தமில் இணையானல் எல்ல் ல் மனநிலையை அடைவல் |
| CO3: | மாணவல்கல் ல்ல் நாவல்கல், சில்கதை வாசில்ல்ல் திறல் மேல்பல்ல் |
| CO4: | ல்ல்கவண்தல் படைல்ல்ல் திறல் தோல்ல்ல் |
| CO5: | பாடல்ல்தில்ல்ல்ய நாடகல்களை வல்ல்ல்களண நிகல்ல்ல்ல் ஆல்வல் ஏல்பல்ல். |

**அலீ -1 சீ கதை**

1. ல்ல்மைய்ல்ல்தல் - பால்வல் ணல்பல்ளை
2. கி.ராஜநாராயணல் - கதல்
3. ல்.அழகில்சாமி - ராஜா வல்தில்ல்கிறால்
4. கல் மணல்ல்ணசேகரல் - உயண்ல்தல் ணண்
5. மேலால் மை பொல்ல் ல்சாமி - தேசிய மயண்

**அலீ –2ீ ீ ீ கவீ தை**

1. பாரதியால் - ல்ல்மைல்பெல்
2. பாரதிதாசல் - தமில்உணல்
3. உவமைல்கவண்ல்ல்ர்தா - தமிழில் பெயல்ல்ல்கல் (ல்றைல் கல்)
4. தேவதேவல் - ல்கல்டல் (அல் தல் மால்திரமே வெளல்ல்யல்டல்)
5. அறில்மதி - நல்ல்ல்காலல் (ல் தல் 20- கவண்தகல் மல்ல்ல்)
6. மில்ரா - ஹைல் எல் தோழி

(ல் தல் 20- கவண்தகல் மல்ல்ல்)

அலகு - 3 ் தினீ

1. ்.செல்வரால்                             - பொல்்கால் ்திரை

அலகு - 4 நாடகீ

1. இல்்லால்                               - ஒளவை

அலகு - 5 ்ரீ  கால இலீ  கிய வரலாீ

ஐரோ்ய்ய்ல்வல்கை - நவண் இலல்கியல்கல் அறில் கல் - ்ல்்கவண்த - சில்கதை - ்தினால்
ஆகியவ்றில் தோ்றல் ்வளள்சில்ல் - இலல்கிய ல் ்னோல்கல் - செல்தில்தால் வல்கை -
நாடகல் - தோல்றல் ்வளள்சில்ல்.

அலகு - 6
(மாணவீ கீ   அறிீ ் கெரீ வதீ ்  மீ ்்  - தேீ ்் கான பீ தி ்ரீ ல)
இலல்கியல்களைல்ல் அவை தொடஙன இலல்கிய வரலால்றைல்ல் இணைல்ல்பல்்தல்.
நவண்  இலல்கியல்கல்  சல் கல்்தல்  படல்  பஇல்ல்கால்ல்வதை  சல் கல்
கல் ணோல்டல்தோல்  அறிதல்.  நவண்  இலல்கிய  வல்வல்களண்  வளள்சி
வால்வய்ல் ்ல்ல் பயல்பல்ல் ல் றையை வண்ால்்தல்.

பாட் ்

1.       ்்மைல்ய்ண்தல்                    - பால்வல் ணல்பண்ளை
                                        நில் செல்சல் ்ல் ஹல்ல் , செல்னை
                                        ஐ்தால் பதில்ல் - 2015

2.       கி.ராஜநாராயணல்                    - கதல்
                                        அல்னல் வெளஇல்,
                                        தல்சால் ல் ஏழால் பதில்ல் - 2015

3.       ்.அழகில்சாமி                      - ராஜா வல்தில்ல்கிறால்
                                        காலல்்வல் பதில்ய்கல், நாகல்கோயண்
                                        ல் தல்பதில்ல் -2012

4.       கல் மணல்ணசேகரல்                   - உயண்்தல் ணண்
                                        தாமரைல்செல்வல்தில்ய்கல்
                                        செல்னை, ல் தல்பதில்ல் 1997

5. மேலால் மை பொல்ல் ஸ்ராமி - தேசிய மயண்
வானதி பதிய்கல், செல்னை
ல் தல்பதில்ல் - 1997

6. பாரதியால் - பாரதியால்கவண்தகல்
நில் செல்சல்ல்ஸ்ஹல்ல் , செல்னை
ல் தல்பதில்ல் - 2014
இரல் டால் பதில்ல் செல்டல்பல் 2017

7. பாரதிதாசல் - பாரதிதாசல் கவண்தகல்
மணவ்ஸாசகல்பதிய்கல், செல்னை
ஏழால் பதில்ல் -2016

8. உவமைல்கவஞ்கல்ல்ரதா - ல்றைல் கல்
ல்வாதி பதிய்கல்,
அல்பல்ல் ல் செல்னை, ல் தல்பதில்ல் 2010

9. தேவதேவல் - அல் தல் மால்திரமே வெளண்யல்டல்
நில் செல்சல்ல்ஸ்ஹல்ல் , செல்னை
ல் தல்பதில்ல் - 2016

10. அறில்மதி - நல்ல்ல்காலல்
கவண்ஜா பதிய்கல், செல்னை
எல்டால் பதில்ல்2005

11. மில்ரா - மில்ரா கவண்தகல்
ஸாரல் வெளண்யல், செல்னை
ல் தல்பதில்ல் 1990

12. ல்.செல்வரால் - பொல்ல்கால் ல்திரை
நில் செல்சல்ல்ஸ்ஹல்ல் , செல்னை
ல் தல்பதில்ல் - 2014

13. இல்ல்லால் - ஒளவை
அகரல் பதிய்கல், தல்சால் ல்
ஐல்தால் பதில்ல் - 2015

14. ச.வே.ல்ஸ்பன்மணண்யல் - தமில் இலல்கிய வரலால்

மணிவாசகர்பதிப்பகம்
சென்னை, ஏழால் பதிப்பு 2015

15.　சோ.நா. கந்தசாமி　　　　　-தமிழ் இலக்கிய வரலாறு
　　　　　　　　　　　மணிவாசகர்பதிப்பகம்
　　　　　　　　　　　சென்னை, ல் தப்பதிப்பு 2004


**ghu;it E}y;fs; :**

1. வல்லிகல் ணால்　　　　-　　ஸ்ல்கவந்தையண் தோற்றல் ல் வளஞ்சில்ல்
　　　　　　　　　　　　பால்நிலையல், சென்னை-108
　　　　　　　　　　　　ல் தப்பதிப்பு 2008

2. க. கைலாசபதி　　　　-　　தமிழ் நாவல் இலக்கியல்
　　　　　　　　　　　　ல்மரல் பதிப்பகல்
　　　　　　　　　　　　வடபழனிசென்னை
　　　　　　　　　　　　ல் தப்பதிப்பு 1968, மல்பதிப்பு 2010

3. கால்ஸ்திகேல்சிவதல்பல்　-　தமிழில் சில்கதை தோற்றல் ல்
　　　　　　　　　　　　வளஞ்சில்ல், நில்செல்சல் ஸ்தகநிலையல்,
　　　　　　　　　　　　சென்னை- 98, ல் தப்பதிப்பு 2013

4. ஆல். அழகல்ல்　　　-　　தமிழ் நாடகல் தோற்றல் ல் வளஞ்சில்ல்
　　　　　　　　　　　　பால் நிலையல், சென்னை, ல் .ப. 2011

5. ல் சக்திவேல்　　　　-　　இல்பதால் ல் ற்றால் ல்ல் தமிழ் உரைநடை
　　　　　　　　　　　　மணிவாசகர்பதிப்பகம், சிதல்பரல்

**Outcome Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | 2 | 2 | | | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO2 | 3 | 3 | | | | 2 | | | 3 | | | 2 | 2 | | |
| CO3 | | 2 | 3 | | 3 | 2 | | | | | 3 | | | 2 | 3 |
| CO4 | 3 | | 3 | | | 2 | | | | 2 | 2 | 2 | 2 | | |
| CO5 | 3 | 2 | | | 2 | | | | 2 | 2 | 2 | | | 3 | 2 |

| Semester | 19IENGC12: Part – II  Language II | L | T | P | C |
|----------|-----------------------------------|---|---|---|---|
| I | English Through Literature I: Prose | 3 | 0 | 0 | 3 |

**LEARNING OBJECTIVE (LO):**

By introducing the course, it is intended to:

LO1: Develop the Language ability of the students

LO2: Enable students to understand the passage, to read fluently, to enrich their vocabulary, and to enjoy reading and writing

LO3: Make the students proficient in the four language skills

LO4: Make the students read with correct pronunciation, stress, intonation, pause, and articulation of voice.

LO5: Develop their inquiry skills.

**COURSE OUTCOMES (CO)**

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

CO1: Obtain competency in communication, both in written and oral skills

CO2: Acquire fluency in English language

CO3: Become knowledgeable about construction of sentence structures

CO4: Develop English vocabulary to use the English language effectively

CO5: Exhibit profic19IENCy in the four communication skills

**Unit I**

Stephen Leacock                "With the Photographer"

Winston S. Churchill           "Examinations"

 Grammar:                        Parts of Speech:  Nouns, Verbs, Adjectives, and Adverbs

**Unit II**

G.B. Shaw                       "Spoken English and Broken English"

M.K. Gandhi                     "Voluntary Poverty"

Grammar:                         Articles

**Unit III**

Robert Lynd                     "On Forgetting"

Virginia Woolf                  "Professions for Woman"

Grammar:                          Pronouns

## Unit IV

A. G. Gardiner                    "On Umbrella Morals"

R.K. Narayan                   "A Snake in the Grass"

Grammar:                           Prepositions

## Unit V

Martin Luther King (Jr.)        "I Have a Dream"

George Orwell                  "The Sporting Spirit"

Grammar:                           Conjunctions & Interjections

## Text Book:

1. Ayyappa Raja, S T. Deivasigamani. N. Saravana Prabhakar, B .Karthikeyan. *English through Literature: Prose, Chidambharam, Manibharathi Publishers, 2010.*

2. David Green: *Contemporary English Grammar: Structures and Composition*, Macmillan, 2012.

## OUTCOME MAPPING

| CO/PO | PO | | | | | | | | | | | | PSO | | | | |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO1 | | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO2 | | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO3 | 3 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 3 |
| CO4 | 3 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO5 | 2 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 2 |

*1-LOW    *2-MEDIUM   *3-STRONG

| Semester | 19IHIC11.2: Part-I Language  Basic Hindi-I | L | T | P | C |
|---|---|---|---|---|---|
| I | | 4 | 1 | 0 | 5 |

**Learning Objectives:**

- ❖ To know the Hindi terms for various professions.
- ❖ To gain knowledge of poem and prose
- ❖ To help the student to learn the importance of  the moral, spiritual and human values
- ❖ To study short stories and imbibe morals
- ❖ To know about national leaders

**Unit - I: Introduction**
Mathruvandana(poem) ,peshwar,chalo bazaar chalo, ahimsa kivijay

**Unit - II:Poem ,Prose**
Balwanbano, ,Gandhiji keasheram me chor,

**Unit - III:**vani ka theer ,Bharth, daku se mahatma.

**Unit - IV:**chandhini,samaykipabandhi, vitamin.

**Unit - V:**Rajiv Gandhi, titiali( poem),Bangalore.

**Current Streams of Thought:**The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations. Understanding on Hindi drama basis and concepts and nibandh.

**Text Books**
1.   Adharshahindi reader I-DBHPsabha-Chennai.17.
2.   ParichyaDBHPS ,Trichi 17.

**Supplementary Reading**
1.   Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.
2.   Hindi prachar vahini.1,DHBS,sabha Chennai 17.

**Course Outcomes**
           At the end of the course, the student will be able to:
**CO1:**      Understand the basic structure of poems.
**CO2:**      Knowledge on various common hindi words.
**CO3:**      Describe the basic concepts of moral stories.
**CO4:**      Apply the concepts of in life.
**CO5:**      Analyze thedifference between prose and poem.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| CO2 | 3 | - | 2 | - | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - |
| CO3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 2 | - | - | 2 | - |
| CO5 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 |

| Semester | 19IFREC11: Part-I Language  French-I | | L | T | P | C |
|----------|--------------------------------------|---|---|---|---|---|
| I | | | 3 | 0 | 0 | 3 |

**Learning Objective (LO):**

| LO1 | Greet People |
|-----|--------------|
| LO2 | Introduce oneself (Basic 1) |
| LO3 | Identify the things and the persons; spell a word |
| LO4 | Ask about the day, the time and the date |
| LO5 | Asking excuse |

**Course Outcomes (CO):**

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

| CO1 | **Greet people appropriately, ask how they are, tell them how I am and ask how others are** |
|-----|---------------------------------------------------------------------------------------------|
| CO2 | Obtain another different culture, the sound of the French language, certain words in    French, some famous French symbols/landmarks. |
| CO3 | Understand basic classroom instructions |
| CO4 | Can use different forms of address to speak to friends, teachers and people I do not know, using formal and informal modes of address and language. |
| CO5 | Understand when the teacher is speaking to one or more persons in |

class and understand simple commands (mostly passive, receptive language with some active, productive language) and polite language. I can recognise 'tu' and 'vous' forms and help phrases such as ***'Pardon', 's'il vous plaît', 'excusez-moi', 'merci'.***

### Unit I

Aborder quelqu'un; Dire son nom
Identifier une langue, la nationalité et le nombre.
Identifier les choses et les personnes

### Unit II

Remplir une fiche de renseignements.
Découvrir la carte postale, un message sur internet  et le blog très simples.
Les pays francophones ;  Les lieux de la ville
Dire si on comprend ; Saluer ; Prendre congé
Dire s'excuser ; Affirmer et nier ; Epeler son nom

### Unit III

L'espace francophone ; Découvrir la France et les pays francophones
Exprimer ses gouts ; Identifier les professions
Demander quelque chose à quelqu'un

### Unit IV

Comprendre un article de presse sur un portrait d'une personne.
Première approche de la société française (noms, âges, origines, lieux d'habitation)
Parler des loisirs ; Faire un projet

### Unit V

Proposer-accepter ou refuser une proposition
Demander une explication
Ecrire les cartes et messages d'invitation, d'acceptation ou de refus.
Découvrir la carte de France et les connaissances.

### Text Book:

1. J. Girardet et J. Pecheur, (2012), ***Echo A1*** - méthode de français***,*** Langers, Paris

**Supplementary Readings:**

1. Marie-Noelle Cocton et Emilie Pommier, (2015), *Saison A1* - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et Manuel Tost, (2001), *FORUM* – Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), *Le Cours de langue et de la civilisation française*, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), *Grammmaire Prograssive du Français avec 400 exerices*, CLE International, Paris.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| CO2 | 3 | - | 2 | - | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - |
| CO3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 2 | - | - | 2 | - |
| CO5 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 |

| Semester | 19IENSC13: Environmental Studies | L | T | P | C |
|----------|----------------------------------|---|---|---|---|
| I | | 3 | 0 | 0 | 3 |

**LEARNING OBJECTIVES:**

LO1.To make the student aware of World Environmental System

LO2.To make the student aware of the fundamental Concepts and Principles of Eco-system and energy-flow.

**COURSE OUTCOMES**

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

CO1.To evaluate the present condition of environmental pollution

CO2.To understand the nature of the atmosphere

CO3.To be aware of causes of pollution and precautionary measure

## UNIT: I ENVIRONMENTAL SYSTEM

(1.1)The Services provided by the Environmental System

(1.2)Ecosystems: Food Chains, Food Webs, Ecological Pyramids

(1.3)Biochemical Cycles: Hydrological Cycle, Carbon Cycle

## UNIT: II ENVIRONMENTAL DAMAGE –POLLUTION

Sources and impact of

(2.1) Air Pollution

(2.2) Water Pollution

(2.3) Land Pollution

(2.4) Municipal Solid Waste

(2.5) Noise Pollution

## UNIT: III RESOURCE DEPLETION

(3.1) Importance of Forests: Causes and Consequences of Deforestations

(3.2) Bio Diversity: Meaning and Importance – Reasons and Consequences of Biodiversity Decline

(3.3) Consequences of overdrawing Water Resources.

## UNIT: IV GLOBAL CLIMATE CHANGE

(4.1) The Science of Climate Change The Green House Effect (4.2) Sources and Impact of Climate Change (4.3) Coping with Climate Change

## UNIT:V SUSTAINABLE DEVELOPMENT

(5.1) Concept and Definition of Sustainable Development (Brundtland Commission Definition)

(5.2) Poverty, Population Growth and Environmental Damage

(5.3) Policies for Sustainable Development

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❖    **CURRENT STREAM OF THOUGHTS**

**For Knowledge Purpose and not for Examinations**

Current issues in environmental eco system Effects,
Climate Change and Global Warming.

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## TEXT BOOKS

1. Erach Bharucha, *Environmental Studies*, New Delhi: UGC, 2004
2. Richard Wright and Dorothy F. Boorse, *Environmental Science: Toward a Sustainable Future,* New Delhi: Prentice-Hall India, 2010

## SUPPLEMENTARY READINGS

1. Kumarasamy, K., A. Alagappa Moses and M. Vasanthy, *Environmental Studies*, Trichy: Bharathidasan University Publications,2004

2. Rajamannar, *Environmental Studies*, Trichy: EVR College Publications, 2004,

3. Kalavathy, S. (Ed), *Environmental Studies,* Trichy: Bishop Heber College Publication, 2004

## OUTCOME MAPPING

*1-LOW    *2-MEDIUM    *3-STRONG

| CO/PO | PO | | | | | | | | | | | | PSO | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO1 | | 3 | | | | | 3 | 2 | 2 | 3 | | | | | 3 | 2 | 3 |
| CO2 | | 3 | | | | | 2 | 2 | 2 | 3 | | | | | 3 | 2 | 3 |
| CO3 | | 3 | | | | | 2 | 2 | 2 | 3 | | | | | 3 | 2 | 3 |

| Semester | 19IMATC14:  Core – 1 | L | T | P | C |
|---|---|---|---|---|---|
| I | **Classical Algebra** | 5 | 0 | 0 | 5 |

### Learning Objective (LO):

| LO1 | In this course students are exposed to topics like Theory of Equations, Summation of Series, Matrices and Elementary Number Theory. |
|---|---|
| LO2 | The stress is on the development of problem solving skills. |

### Course Outcomes (CO)

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

| CO1 | Apply the fundamental concept of theory of equations and to find solutions. |
|---|---|
| CO2 | Apply Descarte's rule, Horner's method, Newton Raphson methods for finding approximate solutions. |
| CO3 | Apply summation of series using Binomial, Exponential and Logarithmic series for finding approximations. |
| CO4 | Apply the elementary number theory for highest power of prime number. |
| CO5 | Apply the elementary number theory for Fermat's and Wilson's  theorem. |

**Unit-1: Theory of Equations**

Polynomial Equations - Symmetric Functions of roots in terms of Coefficients - Sum of r-th powers of roots - Reciprocal Equations - Transformation of Equations.

**Unit-2: Theory of Equations (Contd...)**

Descartes Rule of Signs - Approximate Solutions of Polynomials by Horner's method - Newton - Raphson method of Solution of a Cubic Polynomial.

**Unit-3: Summation of Series**

Summation of series using Binomial - Exponential and Logarithmic series (Theorems without proofs) - Approximation using Binomial & Exponential series.

**Unit-4: Elementary Number Theory**

Prime Number - Composite Number - Decomposition of a Composite Number as a Product of Primes uniquely (without proof) - Divisors of a Positive Integer - simple problems.

**Unit-5: Elementary Number Theory (Contd.)**

Congruence Modulo n - Euler Function (without Proof) - Highest Power of a Prime Number p contained in n! - Fermat's and Wilson's Theorems (statements only).

**Text Books:**

1. Kandasamy P., Thilagavathy K., (2004), *Mathematics for B.Sc.,* Vol-I, II, III & IV,
   S.Chand & Company Ltd., New Delhi-55.

2. Narayanan S., Hanumantha Rao R., Manicavachagom Pillay T.K. and Kandasamy P.
   (2009), *Ancillary Mathematics*, Volume-I, S. Viswanathan (Printers & Publishers) Pvt. Ltd.,.

**Supplementary Reading:**

1. Manicavachagom Pillay T.K.,.Natarajan T and Ganapathy K.S., (2004), *Algebra*,
   Volume I & II, S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

2. Arumugam S., (2003), *Algebra*, New Gamma Publishing House, Palayamkottai.

3. Singaravelu A., (2003), *Algebra and Trigonometry*, Vol.- I & II, Meenakshi Agency, Chennai.

4. Sudha S., (1998), *Algebra, Analytical Geometry of Two Dimensions and Trigonometry*,
   Emerald Publishers, Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IPHYA01- Allied | L | T | P | C |
|----------|-------------------|---|---|---|---|
| I | PHYSICS-I | 3 | 0 | 0 | 3 |

**Learning Objective (LO):**

| LO1 | To make the interdisciplinary students to understand the elementary concepts of various topics of physics. |
|-----|-----------------------------------------------------------------------------------------------------------|
| LO2 | To understand the centre of gravity, behaviour of fluids and laser physics. |
| LO3 | To understand the fundamental principles and ideas of nuclear physics and basic electronics. |

**Course Outcomes (CO)**

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

| CO1 | Understand the behaviour of fluids and practical applications of the same in real life. |
|-----|-----------------------------------------------------------------------------------------|
| CO2 | Understand relativity and its consequences. |
| CO3 | Acquire in depth knowledge of various lasers and diodes used for different applications. |
| CO4 | Knowledge about the different types of nuclear models and detectors. |
| CO5 | Apply the elementary number theory for Fermat's and Wilson's theorem. |

### Unit - I: Mechanics

Centre of gravity – Definition - Determination of centre of gravity of a hollow hemisphere, solid hemisphere and solid cone.

Streamline and Turbulent flow - Equation of continuity of flow – Energy of a liquid in flow- Bernouli's theorem – Velocity of efflux of a liquid - Torricelli's theorem – Venturimeter.

### Unit - 2: Relativity

Introduction - Definition of Relativity - Special theory and general theory of relativity - Postulates- Newtonian relativity - Frame of reference - Galilean transformation equations - The Michelson - Morley experiment - Lorentz transformation equations - Derivation - Length contraction -Time dilation - Addition of velocity - Variation of mass with velocity - Mass - Energy equivalence.

### Unit-3: Laser Physics

Introduction - absorption – spontaneous emission – Stimulated emission – Einstein's A and B coefficients – Population inversion – Meta stable state – Pumping– Methods of pumping – Components of laser – Ruby laser – Helium – Neon laser – Applications.

### Unit- 4: Nuclear Physics

Properties of nucleus (size, mass, binding energy, spin and parity) – Particle detectors - G.M.Counter – Wilson cloud chamber - Bubble chamber- Nuclear models – Liquid drop model - Shell model– Nuclear Energy – Nuclear fission - Fusion - Self sustained chain reaction - Nuclear fusion in stars – Carbon - Nitrogen cycle - Proton - Proton cycle - Thermonuclear reaction - Nuclear reactor.

### Unit- 5: Basic Electronics

Junction diode- Zener diode- Photodiode- Transistor -CE and CB characteristics- LED and LCD – Applications.

### Text Books:

1. R. Murugesan, (2005), *Allied Physics,* S.Chand & Co, Ltd.
2. Murugasen and Kiruthiga Sivaprasath, (2016), *Modern Physics*, S.Chand & Co Ltd.
3. Pandya M.L. and Yadav P.R.S., (1993), *Elements of Nuclear Physics*, Kedarnath Ramnath.
4. Metha V.K. and Rohit Mehta, (1980), *Principles of Electronics*, S.Chand & Co Ltd.

### Supplementary Reading:

1. .Mathur DS and Hemne P.S., (2006), *Mechanics,* S. Chand & Co Ltd.
2. Beiser A., (1997), *Concepts of Modern Physics*, Tata McGraw Hill Publication.
3. Avadhanulu M.N. and Hemne P.S., (2011), *An introduction to Lasers theory and applications*, S. Chand & Co. Ltd.

## Outcome Mapping:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|
| CO1 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | | 2 | | | 3 | | 2 | 3 | 3 |
| CO2 | 3 | 2 | | | | | 3 | | | | 2 | | | 3 | | 2 | | |
| CO3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | | 2 | 3 | 2 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | | 2 | | | 3 | | 2 | 3 | 3 |

| Semester | 19IMATE15- Elective | L | T | P | C |
|----------|---------------------|---|---|---|---|
| I | **Matrices** | 3 | 0 | 0 | 3 |

## Learning Objective (LO):

| LO1 | In this course students are trained to develop skills in finding rank, inverse, Eigen values, Eigen vectors and quadratic forms. |
|-----|---|

## Course Outcomes (CO)

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

| CO1 | Find the rank and inverse of a matrix. |
|-----|---|
| CO2 | Find Eigen Values and Eigen Vectors. |
| CO3 | Diagonalize the matrix using similarity transformation. |
| CO4 | Find the nature of Quadratic forms. |

**Unit-1:**

Rank of the Matrix – Inverse of the Matrix.

**Unit-2:**

Symmetric – Skew Symmetric – Hermitian – Skew Hermitian – Orthogonal and Unitary matrices.

**Unit-3:**

Eigen values – Eigen vectors – Cayley Hamilton theorem.

**Unit-4:**

Diagonalisation by similarity transformation.

**Unit-5:**

Quadratic Forms – Nature of Quadratic Forms.

**Text Book:**

1. Narayanan S., Hanumantha Rao R and Manicavachagom Pillay T.K.,
   (2009), *Ancillary Mathematics*, Volume-I, S. Viswanathan (Printers & Publishers) Pvt. Ltd.

**Supplementary Reading:**

1. Vairamanickam K., Nirmala P. Ratchagar and Tamilselvan S., (2009), *Engineering Mathematics*, Scitech Publications (India) Pvt. Ltd., Chennai.
2. Richard Bellman, (1974), *Introduction to Matrix Analysis*, Second Edition, T.M.G. Publishing Company Ltd., New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19ITAMC21: Part-I Language I | L | T | P | C |
|----------|------------------------------|---|---|---|---|
| II | பக்தி இலக்கியக் க் சிக்றிலக்கியக் க் | 3 | 0 | 0 | 3 |

கீ பீ தலீ நேரீ கீ **(**Learning Objective (LO))

❖ பஷ்தி மல்ல்ல் சிற்றிலஸ்கிய வரையறைகளைல்ல் வகைகளைல்ல் அறில் கல் செல்தல்.

❖ தமிழில் தனஸ்ல்வமான பஷ்தி இலல்கிய வகைமையை ஒஷ்யஸ்ல்ஸ்கால்டல்.

❖ சைவ வைணவ இலல்கியல்களஸ் தனஸ்ல்வஸ்தை எல்ல்ஸ்ரைஸ்தல்.

❖ கிறில்ஸ்வ, இல்லாமிய இலல்கியல்களைல்ல் பால் பொல்ல்களைல்ல் வஸ்ரால்ஸ்தல்.

❖ சிஷ்றிலல்கியல் தோஸ்ற பஸ்ணணஸ்களஸ் வழி அல்வஸ்ல்கியல்களை அறிய வைஸ்தல்.

**Course Outcomes**

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

| CO1: | பக்தி இலக்கியல் சிற்றிலக்கியல் வகைமைகளைல்ல் உக்திகளைல்ல் அறில்ல் திறல். |
|---|---|
| CO2: | தில்ஞானசல்பத்தல்ல் பக்தில் திறல்த்தை உணக்தல். |
| CO3: | ஆல் டாளண் பக்தி மால்கதைல்ல் பாவை நோல்பைல்ல் ல்றில்ல்ல் தெளக்தல். |
| CO4: | வல்லாலால் உயண்நேயல் கோல்பால்டை அவசியல் அறிவல் |
| CO5: | இல்தியல் தல்வ ஞான வரலால்ல்டல் ல் இதிகாசல்கல் டல் தொடல் ஏல்பல்ல்ல்ல்ல். |

**அலீ - 1 பீ தி இலீ கியீ**

1. தில்ஞானசல்பத்தல் - தில்நல்ளால் - பல்சைல்பதிகல்
   (ல் தல் 5 பாடல்கல்)

2. தில்ல் லல் - தில்மல்திரல் (உடல்பண்ணை ல் ல்னை,
   யாவல்ல்ல்மால், ஒல்றே ல்லல் ல்,
   உல்ளல்பெல்ல்கோயண்,
   ஆல்ல்ல்ல் எனல்தொடல்ல்ல் பாடல்கல்)

3. சிவவால்கியல் - அறில்நிலை (5 பாடல்கல்)

**அலீ – 2 பீ தி இலீ கியீ**

1. ஆல் டால் - தில்ல்யாவை (ல் தல் 5 பாடல்கல்)

2. வல்ளலால் - தில்வல்ல்பா - பண்ளைல்சில் வண் ணைல்யல்

**அலீ – 3 பீ தி இலீ கியீ**

1. தேல்பாவணல் - ல்ழவல்ல் வதைல்படலல்

2. சீறால்ல்ராணல் - மால் ல்ல்ல்பண்ண நில்ற படலல்

**அலீ – 4 சீ றில் கியீ**

1. ல்ல்றாலல்ல்ல்றவல்சி - மலை வளல் (வானரல்கல்... பாடல் ல் தல்)

2. ல்ல் டல்பல்ல் - நால்ல் வளல்

**அலீ - 5 இலீ கிய வரலரீ**

பக்தி சிற்றிலக்கிய வரலால் - இடைல்காலல் தமிழகல்ல்ல்ழல் - சைவ வைண சமயல்களண் செல்வால்ல் - சமண பௌல்த சமய இலக்கியல்கல் - கிறில்ல்வ இல்லால் இலல்கியல்கல் - நாயல்கல் காலல்சிற்றிலக்கியல்கல் தோல்ற பண் ணணல்சிற்றிலக்கிய வகை.

அலகு – 6

(மாணவிகள் அறிந்து கொள்ள வேண்டும் - தேர்வுக்கான பாடப்பகுதி அல்ல)

இலக்கியங்களைப் அவை தொடர்பான இலக்கிய வரலாற்றில் இணைத்துப் பார்த்தல். பக்தி இலக்கிய வளர்ச்சியும் தமிழில் பல வடிவங்களும் ஏற்பட்ட வளர்ச்சியை உள்ளுணர்தல். மனம் மனதை புரிந்து புரிதல், சமூக அமைதியை நிலைநாட்டல், உலக நல்லிணக்கம் காணல் பக்தி இலக்கிய பயன்பாட்டினை உணர்தல்.

பாடநூல் :

1. ச.வே.சுப்ரமணியன்(ப.ஆ) - பன்னிரு திருமுறை
   மணிவாசகர்பதிப்பகம், சென்னை
   முதல் பதிப்பு - 2010

2. ச.வே.சுப்ரமணியன் (ப.ஆ) - நாலாயிரதிவ்ய பிரபந்தம்
   உலகநிலையம்
   சென்னை-17
   முதல்பதிப்பு - 2000, இரண்டாம் பதிப்பு 1996

3. சி.எஸ். சண்முகேசன் (ப.ஆ) - சித்தர்பாடல்கள்
   மணிவாசகர்பதிப்பகம், சென்னை
   இரண்டாம் பதிப்பு - 1996

4. வள்ளலார் - திருவருட்பா,
   அண்ணாமலை பல்கலைக்கழக பதிப்பு
   அண்ணாமலைநகர்

5. வரதராசன் என்ஜி - தேம்பாவணி
   பாரி நிலையம்,
   சென்னை - 8
   முதல்பதிப்பு - 2010

6. உமறுப்புலவர் - சீறாப்புராணம்
   நேரிசை பதிப்பகம்
   சென்னை
   முதல்பதிப்பு - 2004

7. திருத்தராசப்பக்கவிராயர் - முத்துஸ்ரவல் சி
   பாவை பதிப்பகம்
   சென்னை

இரல் டால் பதில்ல் - 2014

8. ல் னைவல்கதில்ல் ல்க(ப.ஆ) -   ல் ல்ல் டல்பல்ல்
பால் நிலையல்
செல்னை -108 , மல்பதில்ல் - 2015

**பரீ வை ீ ீ கீ**

1. ந.வ.செயராமல்  -   சிற்றிலல்கியல்செல்வல்
மணக்வாசகல்பதில்கல், செல்னை.
ல் தல்பதில்ல் 1968.

2. ந.வ.செயராமல்  -   பல்ல் இலல்கியல்
மணக்வாசகல்பதில்கல், செல்னை.
ல் தல்பதில்ல் 1980.

3. கோ.கேசவல்  -   பல்ல் இலல்கியல் ஒல் சல் கவல்ல் பால்வை
அல்னல்வெளல்ல், தல் சால் ல் 1981.
ல் தல்பதில்ல் - 1981

4. ச.வே.ல்ல்யல்மணல்ல்  -   தமில்இலல்கிய வரலால்
மணக்வாசகல்பதில்கல், செல்னை.
ஏழால் பதில்ல் - 2010

5. சோ.நா.கல்தசாமி  -   தமில்இலல்கிய வரலால்
மணக்வாசகல்பதில்கல், செல்னை.
ல் தல்பதில்ல் - 2004

**Outcome Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 |   |   |   | 2 | 2 |   |   | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO2 | 3 | 3 |   |   |   | 2 |   |   | 3 |   |   | 2 | 2 |   |   |
| CO3 |   | 2 | 3 |   | 3 | 2 |   |   |   |   | 3 |   |   | 2 | 3 |
| CO4 | 3 |   | 3 |   |   | 2 |   |   |   | 2 | 2 | 2 | 2 |   |   |
| CO5 | 3 | 2 |   |   | 2 |   |   |   | 2 | 2 | 2 |   |   | 3 | 2 |

| Semester | 19IENGC22: Part – II  Language II | L | T | P | C |
|---|---|---|---|---|---|
| II | English Through Literature II: Poetry | 3 | 0 | 0 | 3 |

## LEARNING OBJECTIVE (LO)

By introducing the course, it is intended to:

LO1: Develop the ability of the learner to comprehend and appreciate poems in English
LO2: Enhance the competence of the learner in using the English language
LO3: Improve the interest of the learner in human values and perceptions
LO4: Enable students to study and analyze the use of language in poetry
LO5: Provide learners with the theoretical and practical understanding of grammar

## COURSE OUTCOMES

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

CO1: Become competent in communication, both in written and oral skills

CO2: Gain fluency in English language

CO3: Attain knowledge about construction of sentence structures

CO4: Acquire the vocabulary to use the English language effectively

CO5: Acquire the aesthetic sense for appreciating poetry

### Unit I

| William Shakespeare | "Sonnet 116" |
|---|---|
| William Blake | "Lamb" |
| Robert Burns | "A Red, Red Rose" |
| Grammar | Finite & Non-finite verbs |

### Unit II

| PB Shelley | "To Wordsworth" |
|---|---|
| John Keats | "Sonnet to Sleep" |
| Thomas Hardy | "Neutral Tones" |
| Grammar | Strong and Weak Verbs, Auxiliaries and Modals |

### Unit III

| | |
|---|---|
| Robert Frost | "Stopping By Woods on a Snowy Evening" |
| Wilfred Owen | "Anthem for Doomed Youth" |
| Emily Dickinson | "A Narrow Fellow in the Grass" |
| Grammar | Transitive, Intransitive Verbs, Active and Passive Voice |

### Unit IV

| | |
|---|---|
| Sri Aurobindo | "The Tiger and the Deer" |
| AK Ramanujan | "Obituary" |
| Sarojini Naidu | "Queen's Rival" |
| Grammar | Concord |

### Unit V

| | |
|---|---|
| Roger Mc Gough | "My Bus Conductor" |
| Maya Angelou | "Still I Rise" |
| Langston Hughes | "The Negro Speaks of Rivers" |
| Grammar | Tenses and their forms |

### TEXT BOOKS

1. Jack.Hydes, *Touched With Fire.* London: Cambridge UP, 1985.

2. C. D Narasimhaiah, *An Anthology of Common Wealth Literature*.  New Delhi: Macmillan, 2006.

### SUPPLEMENTARY READING

1. Thomas, C.T. *Twentieth Century Verse: An Anglo-American Anthology*.  New Delhi: Macmillan, 2006.

2. Henry Louis, and Y. Nellie  McKay.*The Norton Anthology of African American Literature.* New York: W.W. Norton & Co, 2004.

3. Ramachandran, C.N. and Radha Achar. *Five Centuries of Poetry.* New Delhi: Laxmi, 1998.

## OUTCOME MAPPING

| CO/PO | PO | | | | | | | | | | | | PSO | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO1 | 3 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO2 | 2 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO3 | 3 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 2 |
| CO4 | 3 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO5 | 2 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 2 |

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

| Semester | 19IHIC21.2: Part-I Language  Basic Hindi-II | L | T | P | C |
|---|---|---|---|---|---|
| II | | 4 | 1 | 0 | 5 |

**Learning Objectives:**

- ❖ To know the life of National leaders.
- ❖ To introduce the Gandhijji's thought.
- ❖ To understand the concepts of teaching and learning  from Dr.Sarvapalli Radhakrishnan's life.

**Unit - I: Introduction**

man ki shakti dena ,prathighnapalan, hamaraRajchinga,adhbhudmaya..

**Unit - II:Poem ,Prose**

sarvapalliradhakrishnan,amedkar, mahaveer, sadakkeniyam,sanghi ka phal(poem),

**Unit - III:Stories.**

Tyog ka such,bhavansabkaekhai,chirjivan ka jharna, , lob ka parinam.

**Unit - IV:**dadhakimoorkatha, kuthekipoonchandebarabardhana.

**Unit - V:**bakri do ghav kha gayi, ,Dhankimagima,

**Current Streams of Thought:**The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

**Text Books**

1.Naveen Hindi Patamala: Part - II   D.B.H.P. Sabha, Chennai - 600 017.

2. Manohar Kahaniyam ,   Part – II  D.B.H.P. Sabha, Chennai - 600 017.

**Supplementary Reading**

   1.Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.

   2.Hindipracharbodhini-DHBS, Chennai 17

**Course Outcomes**

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

**CO1:**   Understand the basic structure of  poem and prose.

**CO2:**   Classify and compare various poems.

**CO3:**   Describe the basic concepts of moral stories.

**CO4:**   Apply the teachings of various national leaders.

**CO5:**   Understand the spirit of spirituality.

**Outcome Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | -   | 3   | 3   | 2   | 2   | 3   | 2   | 3   | 3   | 3    | 3    | 3    | -    | -    | -    |
| CO2 | 3   | -   | 3   | -   | 3   | -   | 2   | 2   | -   | 3    | -    | -    | -    | -    | -    |
| CO3 | 3   | 3   | -   | -   | 2   | 3   | -   | 2   | 3   | -    | -    | -    | 2    | -    | -    |
| CO4 | 3   | 3   | 3   | 3   | 3   | -   | 3   | -   | 2   | 2    | 2    | -    | -    | 2    | -    |
| CO5 | -   | -   | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 2    | 2    | -    | -    | -    | 3    |

| Semester | 19IFREC21: Language- I: Course -2 | L | T | P | C |
|----------|-----------------------------------|---|---|---|---|
| II       | **French-II**                     | 3 | 0 | 0 | 3 |

**Learning Objective (LO):**

| LO1 | By introducing the course, it is intended to: |
|-----|-----------------------------------------------|
| LO2 | Talk about their family members               |
| LO3 | Engage a simple conversation about family members. |
| LO4 | Talk about your likes and dislikes            |
| LO5 | Fill in a simple form                         |

## Course Outcomes (CO):

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

| CO1 | **Understand simple texts providing personal details of others.** |
|-----|--------------------------------------------------------------------|
| CO2 | State how many people are in my family and who they are, using vocabulary including family members, possessive adjectives and negatives such as 'je n'ai pas de frères/sœurs'. |
| CO3 | Write a short text to inform others of my likes and dislikes and provide reasons. Ask others about their likes and dislikes, showing that I appreciate diverse viewpoints and personalities e.g. 'Quel est ton … favori/préféré?' |
| CO4 | Understand in filling up a simple form. |
| CO5 | Write a short introduction about myself, providing personal details and use simple connectors, such as *'et' , 'mais' and 'aussi'.* |

**Unit I**

Demander /donner des précisions sur le temps
Demander / indiquer l'heure et la date
Demander / dire ce qu'on a fait
Féliciter

**Unit II**

Comprendre et écrire un journal personnel en français.
Comprendre l'agenda de quelqu'un
Les rythmes de vie en France
Evaluez-vous

**Unit III**

Evasion en français par l'Internet, la télévision, la radio et la presse.
Découvrir la France dans votre pays

**Unit IV**

Les voyages et les transports
Comparer les choses ; Montrer ; Indiquer une appartenance
Demander / donner une explication

**Unit V**

Voyager en France ; Situations pratiques relatives au voyage.
Parler d'un repas.
Situations pratiques à l'hôtel et au restaurant
Les habitudes des Français sur un repas.

**Text Book:**

1. J. Girardet et J. Pecheur, (2012), *Echo A1* - méthode de français*,* Langers, Paris

**Supplementary Readings:**

1. Marie-Noelle Cocton et Emilie Pommier, (2015), *Saison A1* - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et Manuel Tost, (2001), *FORUM* – Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), *Le Cours de langue et de la civilisation française*, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), *Grammmaire Prograssive du Français avec 400 exerices*, CLE International, Paris.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| CO2 | 3 | - | 2 | - | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - |
| CO3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 2 | - | - | 2 | - |
| CO5 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 |

| Semester | 19ICISC23:  Computer Applications - I | L | T | P | C |
|----------|--------------------------------------|---|---|---|---|
| II       |                                      | 3 | 0 | 0 | 3 |

**Learning Objective (LO):**

| LO1 | To Study the Fundamentals Concepts of Computers and Operating Systems. |
|-----|-----------------------------------------------------------------------|
| LO2 | To get familiar with basics of the Internet Programming. |
| LO3 | To acquire knowledge and skills for creation of web site considering both client and server side programming. |
| LO4 | To explore different web extensions and web services standards and ability to develop responsive web applications. |

**Course Outcomes (CO)**

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

| CO1 | Describe the usage of computers and why computers are essential components in business and society. |
|-----|----------------------------------------------------------------------------------------------------|
| CO2 | Solve common business problems using appropriate Information Technology applications and systems. |
| CO3 | Identify categories of programs, system software and applications. Organize and work with files and folders and utilize the Internet Web resources and evaluate on-line e-business system. |
| CO4 | Design a responsive web site using HTML5 and demonstrate Rich Internet Application. |

**Unit – 1**:  Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers. Input, output devices, data storage devices, software, the definition, the role of software, House  keeping.

**Unit – 2:** The computer internals, typical PC configuration, booting, virus, antivirus, vaccine, versions of software. Operating system, definition, classification, basics of MSDOS, introduction to windows operating system, features of windows OS, desktop and desktop icons, starting programs, browsing and managing windows explorer, setting, Taskbars and creating shortcuts.

**Unit – 3:** Introduction to internet, client sever basics, E-mail, Telnet and Archie, FTR – Gopher, Jug head and Veronica, WAIS and world wide web, fundamentals of HTML, TCP / IP and E – Commerce.

**Unit – 4:** Issues involved in web site management, addressing, designing web sites with front page.

**Unit – 5:** Multimedia, concept, requirements, applications and future, hardware and software requirements for Multimedia development and delivery platforms, multimedia methodologies fundamental and use of hypertext, hypermedia, sound, images, animation, video. Using multimedia, multimedia interface, planning and development of multimedia projects.

**Text Books:**

1. Sanjay Saxena, (2015), *"A first course in computers"*, Vikas Publishing House, New Delhi.
2. Alexies Leon and Mathews Leon *"Internet in a nutshell"* Leon Press, Chennai and Vikas Publishing House, New Delhi.
3. Tay Vaughan (1999), "*Multimedia Making it work"*, Osborne, Tata McGraw Hill.

**Reference Books:**

1. Ron Mansfield, (1997), "*Windows 95 for Busy People"*, Obsorne,  McGraw Hill.
2. *Krishnan, "Computer fundamentals and Windows with Internet Technology"*, Scitech Publications Pvt Ltd, Chennai, India.
3. *Krishnan, "Windows and MS-Office 2000 with database concepts"*, Scitech Publications Pvt Ltd, Chennai, India.

**Outcome Mapping:**

| PO / CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|
| CO1 | 3 | | 1 | 3 | 2 | | 2 | | 2 | 3 | | | 3 | 1 | | 3 | | 2 |
| CO2 | 3 | 2 | 3 | | | | | 3 | | 2 | | | | | | 3 | 1 | |
| CO3 | | | 3 | | 3 | | 1 | | | | | | 2 | 3 | | | | 1 |
| CO4 | 3 | 2 | | 3 | 2 | 1 | | 3 | | | | | 3 | | | 3 | 3 | |

| Semester | 19IMATC24:  Core – 2 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| II | **Trigonometry** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This course is a fundamental one for many courses of this Degree Programme. |
|-----|---------------------------------------------------------------------------|
| LO2 | This covers topics on the expansions of trigonometric functions, hyperbolic functions, inverse circular, inverse hyperbolic functions and it aims to develop computational skills. |

## Course Outcomes (CO)

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

| | |
|---|---|
| **CO1** | Apply for finding expansions of cos$n\theta$, sin$n\theta$ and tan$n\theta$ and formation of equations. |
| **CO2** | Apply for finding cos$\theta$, sin$\theta$ in a series of ascending powers of $\theta$ and their approximation. |
| **CO3** | Apply for finding Hyperbolic and inverse Hyperbolic functions. |
| **CO4** | Apply for resolution into factors and study De-Moivre's property. |
| **CO5** | Apply to evaluate the summation of trigonometric series and their differences, Gregory series and Euler series. |

**Unit-1:**

Expansions of cos $n\theta$, sin $n\theta$ – Expansion of tan $n\theta$ in terms of tan $\theta$ – Expansion of tan(A+B+C+… ) – Formation of Equations.

**Unit-2:**

Powers of sines and cosines of $\theta$ in terms of functions of multiples of $\theta$ – expansions of sin $\theta$ and cos $\theta$ in a series of ascending powers of $\theta$ – Approximations.

**Unit-3:**

Definition – Relation between Hyperbolic Functions – Inverse Hyperbolic Functions.

**Unit-4:**

Resolution into Factors – simple problems only – DeMoivre's property on the Circle and Cote's Property on the Circle. Logarithm of complex quantities.

**Unit-5:**

Summation of Trigonometric Series: When the angles are in A.P, C+iS method of summation – Method of Differences – Gregory Series – Euler Series.

**Text Book:**

Narayanan S. and Manicavachagom Pillay T.K., *Trigonometry*, (2009), S.Viswanathan Printers & Publishers Pvt. Ltd., Chennai.

Unit– I          Chapter III sections 1 to 3
Unit– II         Chapter III sections 4 and 5
Unit– III        Chapter IV
Unit– IV        Chapter V
Unit– V         Chapter VI sections 1 to 3

**Supplementary Reading:**

1. Kandasamy P., Thilagavathy K., (2004), *Mathematics for B.Sc.*, Vol.-I, II, III & IV,
   S. Chand & Company Ltd., New Delhi-55.

2. Duraipandian S. and Laxmi Duraipandian, (1984), *Trigonometry*, Emerald  Publishers, Chennai.
3. Grewal B.S, (2002), *Higher Engineering Mathematics*, Khanna Publishers. New Delhi.
4..Loney S.L, (1982), *Plane Trigonometry*, Part II, Cambridge University Press, London.
5. Singaravelu A., (2003), *Algebra and Trigonometry*, Vol.-I, Meenakshi  Agency, Chennai.
6. Vittal P.R, (2004), *Trigonometry*, Margham Publications, Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 |  |  |  |  |  | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 |  |  |  |  |  | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IMATC25:  Core – 3 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| II | **Differential Calculus** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This course develops problem solving skills in differential calculus and applications of differential calculus. |
|-----|----------------------------------------------------------------------------------------------------------------|

**Course Outcomes (CO)**

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

| CO1 | Apply Leibnitz theorem for $n^{th}$ derivative, total differentials in terms of partial derivatives and Jacobians. |
|-----|--------------------------------------------------------------------------------------------------------------------|
| CO2 | Apply maxima and minima functions for two and three independent variables. |
| CO3 | Apply for finding, angle between vectors, pedal equations and finding solutions. |
| CO4 | Apply for finding radius of curvature and centre of curvature. |
| CO5 | Apply for finding envelope and Asymptotes. |

**Unit-1:**

The nth derivative, Leibnitz theorem and its applications, Total differential, $\dfrac{d^2y}{dx^2}$ and $\dfrac{dy}{dx}$ in terms of partial derivatives of f when f(x,y)=0, Jacobians.

**Unit-2:**

Maxima and minima of functions of two independent variables, Necessary and sufficient conditions, Lagrange's method, Problems on maxima and minima (second order conditions must be verified for maxima and minima).

**Unit-3:**

Polar coordinates - Angle between radius vector and tangent, Angle of intersection of two curves, Slope of the tangent, Pedal equation of a curve, Simple problems.

**Unit-4:**

Curvature: Radius of curvature – Cartesian formula for radius of curvature – Parametric formula for radius of curvature – Radius of curvature in polar co-ordinates – Centre of curvature in Polar co-ordinates.

**Unit-5:**

Envelope of one parameter family of curves - Envelope of two parameter family – Asymptotes – Definition – Methods of finding Asymptotes to plane algebraic curves.

**Text Book:**

Narayanan S. and Manicavachagom Pillay T.K., (1995), *Calculus*, Volume – I (Differential Calculus), S.Viswanathan Printers & Publishers Pvt. Ltd., Chennai.

**Supplementary Reading:**

1. Venkataraman M.K., *Engineering Mathematics*, The National Publishing Company, Chennai.
2. Kandasamy P., Thilagavathy K. and Gunavathy K., (2006), *Engineering Mathematics*, S. Chand and Company, Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IPHYA02 - ALLIED PHYSICS – II | L | T | P | C |
|----------|--------------------------------|---|---|---|---|
|          |                                | 4 | 0 | 0 | 4 |

**Learning Objectives (LO):**

| LO1 | To indoctrinate and stimulate the interdisciplinary students to understand the fundamental concepts of various topics of physics. |
|-----|---------------------------------------------------------------------------------------------------------------------------------|
| LO2 | To understand about an atom model and production of X-rays |
| LO3 | To learn photo electric effect and also the particles and wave nature of the quantum particles.. |
| LO4 | To know more about the nuclear detectors and particle accelerators. |

**Course Outcomes (CO)**

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

| CO1 | understand the atomic models, production of X-rays andphotoelectric effect with its applications |
|-----|------------------------------------------------------------------------------------------------|
| CO2 | understand the various nuclear detectors and particle accelerators. |
| CO3 | understand the phenomenon of polarization. |
| CO4 | acquire basic knowledge about number systems and logic gates. |

**UNIT - I: ATOMIC PHYSICS**

**Atom model**: Bohr, Sommerfeld's and vector atom models -The Pauli's exclusion principle - Various quantum numbers.

**X-Rays:** Production and properties of X-rays - Bragg's law - Bragg's X-ray spectrometer - Moseley's law - Compton Scattering.

**UNIT – II: MODERN PHYSICS**

**Photo electric effect** – Einstein's photo electric equation – verification of Einstein's photo electric equation by Millikan's experiment – photo electric cells – applications

**Wave mechanics:** De Broglie matter waves – characteristics and calculation of De Broglie wave length – Experimental study of De Broglie matter wave by G.P.Thomson experiment.

**UNIT – III: NUCLEAR PHYSICS**

**Nuclear detectors** – Ionization Chamber – Proportional counter –Scintillation counters.

**Particle accelerators** – Linear accelerator – Cyclotron – synchro cyclotron – Betatron.

**UNIT – IV: POLARIZATION**

**Polarization** - Brewster's Law -Huygen's explanation of double refraction in uniaxial crystals - polarizing prisms - Quarter and half wave plates - Production and detection of a plane, circularly and elliptically polarized light.

**Optical Activity** – Fresnel's explanation of rotation - Fresnel's experiment - Specific rotation - Determination of Specific  rotatory by Laurent's half  shade polarimeter.

## UNIT- V: DIGITAL ELECTRONICS:

Decimal, binary, octal and  hexadecimal number systems  -  Basic logic gates  -  OR, AND, NOT - universal gates -  Boolean algebra  -  Demorgan's theorem  -  Verification.

## CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Gamma ray microscope -Nuclear reactor -Electron microscope, Scanning electron microscope - Binary adder and subtractor.

## TEXT BOOKS :

1. Murugasen, R,  & KiruthigaSivaprasath, (2016), Modern Physics,S.Chand& Co Ltd.
2. Murugesan, R, (2005), Allied Physics, S.Chand& Co, Ltd.

3. SubramaniyamBrijlal, N, and Avadhanulu, M.N,  (2018), A Text Book of Optics ,  S. Chand  & Co Ltd.

## SUPPLEMENTARY READING:

1. Saxena, A.K, (2010),Principles of Modern Physics ,  Narosa Publishing House.
2. Rajam,  J. B , (2004),  Atomic Physics, S. Chand & Co Ltd.20th Edition.
3. Jain, R.P. (2006), Modern Digital Electronics, Tata McGraw Hill .

**COURSE OUTCOME MAPPING:**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 |

**Note : 3 - Strong,  2 - Medium,  1 – Low**

| Semester | 19IPHYP01 - ALLIED PHYSICS PRACTICAL | L | T | P | C |
|---|---|---|---|---|---|
|  |  | 3 | 0 | 0 | 3 |

**Learning Objectives (LO):**

| LO1 | To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems. |
|---|---|
| LO2 | To study the aspects related to the application side of the experiments |
| LO3 | To understand the usage of basic laws and theories to determine |

| | | various properties of the materials given. |
|---|---|---|
| **LO4** | | To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity. |

## Course Outcomes (CO)

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

| **CO1** | Apply knowledge of physics fundamentals and an instrumentation to arrive solution for various problems. |
|---|---|
| **CO2** | Understand the usage of basic laws and theories to determine various properties of the materials given. |
| **CO3** | Understand the application side of the experiments |
| **CO4** | Use of basic laws to study the spectral properties and optical properties of the given prism. |

### Any Ten Experiments

1. Sonometer – Verification of laws.
2. Spectrometer – Refractive index of a solid prism.
3. Spectrometer – Grating – Normal incidence – λ determination.
4. Potentiometer – Low range voltmeter.
5. Potentiometer – Low range Ammeter.
6. Rigidity modulus by torsional pendulum.
7. Young's modulus – Non uniform bending (pin and microscope).
8. Young's modulus – uniform bending (pin and microscope).
9. Drop weight method - Surface tension of a liquid.
10. Coefficient of viscosities- Hare's apparatus.
11. Field along the axis of a circular coil – deflection magnetometer.
12. V-I characteristics of junction diode.
13. Logic gates – Discrete components.
14. Half wave and full wave rectifier.
15. V-I Characteristics of Zener diode.

**COURSE OUTCOME MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | | 1 | 3 | 2 | | 3 | | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | | 1 | 3 | 2 | | 3 | | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 | | 3 | | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 | | 3 | | 3 | 3 | 3 |

**Note : 3 - Strong,  2 - Medium,  1 - Low**

| Semester | 19ITAMC31: Part-I Language I | L | T | P | C |
|---|---|---|---|---|---|
| III | அற இலக்கியக் க் காக்பியக் க் | 3 | 0 | 0 | 3 |

**கீ பீ தலீ நேரீ கீ** (Learning Objective (LO))

- ❖ தமில் அற இலல்கிய வரலால்றை அறில் கல் செல்ல் வன்ரால்கல்யல்ல்.
- ❖ அற இலல்கியல்களை வழில் தனல்மனன் ஒல் ல்கல் வலில்ல்ல்தலயல்ல்.
- ❖ காய்ய்ய இலல்கிய இலல்கணல்ல்டல அதல் வரலால்ல் ஙகல்டயல்ல்.
- ❖ தமிழில் தோல்றில்ல்ள காய்யல்களை தனல்ல்வல் உணல்ல்தலயல்ல்.
- ❖ தமிழில் அற இலல்கியல்களை தேவையைல்ல்ல்ய வைல்தல்.

**Course Outcomes**

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

| CO1: | தில்ல்ல்றல் வழி மனன் மால்ல்களைல்ல் ஒல் ல்கல்களைல்ல் அறில்ல் திறல். |
|---|---|
| CO2: | பெல்யவல்களை மதில்ல்ல் மனல்யால்மைல்ல் பல்ழல் ல் றாமைல்ல் வளல்ல். |
| CO3: | இல்திர வல்ழா கொல் டால்ய தமிழல்கல் பல் பால்டை உணல்ல்தில்ல்யல் |
| CO4: | நாயல்மால்கல் வரலால்றைல்ல் பல்தி நெறியைல்ல் பெல்றில்ல்யல் |
| CO5: | வாலி வதைல் படலல் வழிவல்ஙாத திறல் ஏல்பல்ல். |

**அலீ –1 அற இலீ கியீ**

1. தில்ல்ல்றல் - உழல், ஒல் ல்கல் டைமை, காலமறிதல், நல்ல் பல்ல்வால்றாமை

**அலீ –2 அற இலீ கியீ**

1. நாலல்யால் - பெல்யாரைல்பல்ழியாமை
2. பழமொழி நால் ல் - கல்வல்

**அலீ - 3 கரீ பீ யீ**

1. சிலல்பதிகாரல் - இல்திர வல்ழல் ஊரெல்ல்த காதை
2. மணிமேகலை - ஆல்ல்திரல் திறல் அறிவல்ல்த காதை

அலீ - 4    கரீ பீ யீ

1.    பெய்ய ஞ்ராணல்    -    அல்ஸ்தி அல்கல் ஞ்ராணல்
2.    கல்பராமாயணல்    -    வாலி வதைஷ்டலல்


அலீ - 5    இலீ கிய வரலரீ

சங்க மல்வய்கால அற இலல்கியல்கல் - தில்ல்ற்றளஞ் பெல்மை - அற இலல்கியல்களஞ் வளஞ்சி - காய்வய்ய இலல்கணல் - பல்ல்கல் - காலஞ்தோறல் தோல்றிய காய்யய்ல்கல் - வரலால்.

அலீ – 6    (மாணவீ கீ அறிீ ீ கெரீ வதீ ீ மீ ீ ீ - தேீ ீ ீ கான பீ தி அீ ல)

அறஇலல்கியல்கல் மனதை நெறிஷ்ல்ல்ஷ்வதோல் சல்க நடல்தைகளைல்ல் கல்ல்ஷ்தல்கில்றன. அற இலல்கியல்களஞ் தொடஷ்யால் மாணவஞ்கல் நல்லல்கல்ல்ல்களைல் கல்ல்கொல்வதோல் வால்வஞ்ல் கடைபஞ்ல்க எல்ல் தல் நல்ல சல் கல் உல்வால்ல. சல் கல்தில்ல் அறநெறிகளஞ் தேவையானவை எல்ல்ல்ரைல்தல்.

பாட்  ீ  கீ

1.    பதிஞ்யாசிஷ்யல்ச. மெல்யஷ்யல் -    தில்ல்ற்றல்
மணஞ்வாசகஷ்திஷ்ஙகல், செல்னை - 08.
இரல் டால் பதில்ஞ் - 2017

2.    ச.வே.ல்ஷ்யஷ்மணஷ்யல்    -    நாலல்யால்ஷ்பழமொழி நால் ல்
மணஞ்வாசகஷ்திஷ்ஙகல், செல்னை - 08.
இரல் டால் பதில்ஞ் - 2012

3.    இளல்கோவல்கல்    -    சிலஷ்பதிகாரல்
டால்டல்உ.வே.சா. பதில்ஞ்
2, அல்ல் மடல் கடல்கலை சாலை
பெசல்ல் நகல்ஷ் செல்னை
பதினொல்றால் பதில்ஞ் - 2008

4.    சீஷ்தலைல்சாஷ்தனால்    -    மணஞேகலை
டால்டல்உ.வே.சா. பதில்ஞ்
2, அல்ல் மடல் கடல்கலை சாலை
பெசல்ல் நகல்ஷ் செல்னை
எல்டால் பதில்ஞ் - 2008

5. சேக்கிழார் - பெரியபுராணம்
   ல் ல்லை நிலையம், சென்னை
   ல் தல்பதில்ல் -2010

6. கல்பல் - கல்பராமாயணம்
   அல் ணாமலை பல்கலைக்கழகம்
   வெளயில்,

7. ச.வே.ல்ப்ய்மணய்ல் - தமில் இலல்கிய வரலால்
   மணல்வாசகல்பதில்ய்கல், சென்னை.
   ல் தல்பதில்ல் 1999

பால்வை ல்ல்கல்

1. சோ.ந.கல்தசாமி - தமில் இலல்கிய வரலால்
   மணல்வாசகல்பதில்ய்கல், சென்னை.
   ல் தல்பதில்ல் - 2004

2. க.ப. அறவாணல் - அறஇலல்கியல்களல் சியல்
   தமில்ல்கோல்டல்
   சென்னை, ல் தல்பதில்ல் - 2000

## Outcome Mapping

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 |  |  |  | 2 | 2 |  |  | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO2 | 3 | 3 |  |  |  | 2 |  |  | 3 |  |  | 2 | 2 |  |  |
| CO3 |  | 2 | 3 |  | 3 | 2 |  |  |  |  | 3 |  |  | 2 | 3 |
| CO4 | 3 |  | 3 |  |  | 2 |  |  |  | 2 | 2 | 2 | 2 |  |  |
| CO5 | 3 | 2 |  |  | 2 |  |  |  | 2 | 2 | 2 |  |  | 3 | 2 |

| Semester | 19IENGC32: Part – II  Language II | L | T | P | C |
|---|---|---|---|---|---|
| III | **English Through Literature III: Drama** | 3 | 0 | 0 | 3 |

**LEARNING OBJECTIVE (LO):**

By introducing the course, it is intended to:

LO1:  Enhance the conversational competence of the learners by introducing drama in English.

LO2:  Make the students the understand characteristics of the Elizabethan Age.

LO3:  Make them appreciate Shakespearean drama.

LO4:  Make them learn the key elements of sentence structures

LO5:  Make the students master the mechanics of writing

**COURSE OUTCOMES (CO):**

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

CO1:  Obtain a literary acumen to answer MCQs of NET/SET examinations and other competitive examination

CO2:  Appreciate conversational English

CO3:  Recognize the dramatic elements of Shakespearean dramas

CO4:  Use punctuations and capitals effectively in their composition

CO5:  Recognize the elements of the spoken discourses

**Unit I**

William Shakespeare                    *The Tempest* (Act I)

Grammar                                   "Phrases and Clauses"

**Unit II**

William Shakespeare                    *The Tempest* (Act II)

Grammar                                   "Simple, Compound, and Complex Sentences"

**Unit III**

William Shakespeare                    *The Tempest* (Act III)

Grammar                                   "Transformation of Sentences"

## Unit IV

| William Shakespeare | *The Tempest* (Act IV) |
| Grammar | "Sequence of Tenses and Reported Speech" |

## Unit V

| William Shakespeare | *The Tempest* (Act V) |
| Grammar | "Punctuation and Capitals" |

## Text Books:

1. Shakespeare, William. *The Tempest*, New Delhi: S. Chand & Co., 2008.
2. Green, David. *Contemporary English Grammar, Structures, and Composition.* Chennai: MacMillan, 2010.

## Supplementary Reading:

1. Cahn. L Victor. *Shakespeare the Playwright: A Companion to the Complete Tragedies Histories, Comedies, and Romances.* London: Praeger, 1996.
2. Crystal, David. *Shakespeare's Words: A Glossary and Language Companion.* London: Penguin, 2009.
3. Greenbaum , Sidney. *Oxford English Grammar.* London: Oxford UP, 2005.
4. McCarthy. *Cambridge Grammar of English.* London: Cambridge UP, 2018.
5. Quirk, Randolph. *A Comprehensive Grammar of the English Language.* London: Pearson, 2010.

## OUTCOME MAPPING

| CO/PO | PO | | | | | | | | | | | | PSO | | | | |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|---|---|---|---|---|
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO1 | 3 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO2 | 2 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO3 | 3 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 2 |
| CO4 | 3 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO5 | 2 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 2 |

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

| Semester | 19IHIC31.2: Part-I Language  Basic Hindi-III | L | T | P | C |
|----------|-----------------------------------------------|---|---|---|---|
| III | | 4 | 1 | 0 | 5 |

**Learning Objectives:**
- ❖ To study various  comedy stories.
- ❖ To introduce Indian epics.
- ❖ To understand the concepts of drama

**Unit - I: Introduction,ekanki.**
. Andher Nagari - Bharathendhoo Harishchandra

**Unit - II:**Mahabharath Ki EkSanj  -  Bharath BhoosahnAgrwal [Full]

**Unit - III:**Drama.
3.Ladai - SarveswarDayalSaxeena [Full]

**Unit - IV:**stories,Tatava-vyanghya

**Unit - V:**Upstick Ki Muskhan - Vishnu Prabakar [Full]

**Current Streams of Thought:**The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

**Text Books**

1Andher Nagari - Bharathendhoo Harishchandra, VinodhPustak Mandir, Agra-2
2. PrathinidhiEkanaki - Dr. Dashrath Oojaa, Jawahar Pustakalya, Mathura
3. EkanakiManach - Dr.V.P. Abhithap, Jawahar Pustakalya, Mathura
4. Ladai - SarveswarDayalSaxeena, RajkamalPrakashan, New Delhi

**Supplementary Reading**

1.Hindi natakuthbhavaurvikas-dashrath ojha-rajpal and saons, new Delhi.7.
2.hindi natakaurrangmanch-pahachanaurparak-Dr. Indranathmadan, newdelhi.7.

**Course Outcomes**
At the end of the course, the student will be able to:
**CO1:** Understand the basic structure of short stories.
**CO2:** Knowledge on Mahabharath.
**CO3:** Describe the basic concepts of human feelings.
**CO4:** Apply the concepts of comedy in stories.
**CO5:** Describe the effects of western culture.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| CO2 | 3 | - | 3 | - | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - |
| CO3 | 3 | 3 | - | - | 2 | 3 | - | 2 | 3 | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 2 | - | - | 2 | - |
| CO5 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 |
| | | | | | | | | | | | | | | | |

| Semester | 19IFREC31: Language- I: Course -3 | L | T | P | C |
|----------|-----------------------------------|---|---|---|---|
| **III** | **French-III** | 3 | 0 | 0 | 3 |

## Learning Objective (LO):

| LO1 | Buy some products in a shop |
|-----|------------------------------|
| LO2 | Ask the news of someone |
| LO3 | Talk about the climate |
| LO4 | Introduce their family |
| LO5 | Talk about their accommodation. |

## Course Outcomes (CO):

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

| CO1 | **Ask the price of the product, pay the product.** |
|-----|----------------------------------------------------|
| CO2 | Ask about their daily activities |
| CO3 | To give and ask information about the climate |
| CO4 | Describe their family |
| CO5 | Describe their accommodation where they live. |

**Unit I**

Demander des nouvelles de quelqu'un(les activités de la journée)
Choisir, acheter, payer un objet

**Unit II**

S'informer sur la présence ou l'existence d'une personne ou d'un objet (Parler d'un logement ; s'orienter, Décrire un trajet, Exprimer un besoin)

S'informer sur l'état physique de quelqu'un

Le temps en France et parler du temps

**Unit III**

Evaluez-vous

Evasion dans la Poésie

**Unit IV**

Souvenez-vous (Les moments de la vie)

Demander /donner des informations sur la biographie d'une personne (enchainer les idées)

**Unit V**

Demander /donner des informations sur ses relations amicales ou familiales.

Présenter sa famille.

**Text Book:**

1. J. Girardet et J. Pecheur, (2012), *Echo A1* - méthode de français*,* Langers, Paris

**Supplementary Readings:**

1. Marie-Noelle Cocton et Emilie Pommier, (2015), *Saison A1* - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et Manuel Tost, (2001), *FORUM* – Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), *Le Cours de langue et de la civilisation française*, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), *Grammmaire Prograssive du Français avec 400 exerices*, CLE International, Paris.

**Outcome Mapping:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| CO2 | 3 | - | 2 | - | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - |
| CO3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 2 | - | - | 2 | - |
| CO5 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 |

| Semester | 19IMATC33:  Core – 4 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| III | **Analytical Geometry 2D** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | Students are exposed to fundamental aspects of Two Dimensional Analytical Geometry and it develops logical and systematic computational skills. |
|-----|----|

**Course Outcomes (CO)**

On  a successful completion of the course, the students will able to

| CO1 | Explain the fundamental concepts of analytical geometry in 2D about parabola, Equation of a Parabola, the pole of line with Parabola, Ellipse, equation of an Ellipse, tangent and normal drawn from Ellipse. |
|-----|----|
| CO2 | Hyperbola, Equation of Hyperbola, Co-ordinates of a point on the Hyperbola in terms of a single parameter tangent and normal drawn from Hyperbola, Rectangular Hyperbola. |
| CO3 | Transformation of polar co-ordinates into Cartesian co-ordinates and vice versa, parallel straight lines, the polar equation of a conic, general equation of the second degree tracing of conics. |

**Unit-1: Parabola**

Equation of a Parabola, Different forms, The Pole of line with Parabola.

**Unit-2: Ellipse**

Equation of an Ellipse, Tangents and Normals drawn from ellipse.

**Unit-3: Hyperbola**

Equation of Hyperbola, with other properties of hyperbola.

**Unit-4: Polar Equations**

Transformation of polar co-ordinates into Cartesian co-ordinates and vice versa with other properties.

**Unit-5:** General Equation of the Second degree tracing of conics.

**Text Book:**

Manickavachagom Pillay T.K.  and Natarajan T., (2009), *Analytical Geometry*, *(Part-I – Two Dimensions)*, S.Viswanathan Printers & Publishers Pvt. Ltd., Chennai.

Unit – I:          Chapter VI (Fully)

Unit-II:          Chapter VII (Fully)

Unit- III:          Chapter VII (Fully)

Unit- IV:          Chapter IX (Fully)

Unit- V:          Chapter X (Fully)

**Supplementary Reading:**

1. Duraipandian P. and Laxmi Duraipandian, (1965), *Analytical Geometry-2D*, Asia Publishing Company, Bombay.
2. Thomas G.B. and .Finney R.L, (1998), *Calculus and Analytic Geometry*, 9th Edition, Addison Wesley, Mass. (Indian Print).
3. Vittal P.R., (2003), *Coordinate Geometry*, Margham Publishers, Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC34: Core – 5 | L | T | P | C |
|---|---|---|---|---|---|
| III | **Vector Analysis** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | The objective of the module is to introduce and develop the methods of vector analysis. |
|---|---|
| LO2 | These methods provide a natural aid to the understanding of geometry and some physical concepts. |
| LO3 | They are also a fundamental tool in many theories of Applied Mathematics. |

**Course Outcomes (CO)**

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

| CO1 | explain the fundamental concepts of vectors, direction cosines, direction ratios and workout scalar and vector products of two and three vector. |
|---|---|
| CO2 | differentiate vector functions of a single variable, find the gradient, divergence and curl and prove identities involving them. |
| CO3 | integrate vectors, compute line, surface and volume integrals in a vector field and verify Gauss, Stoke's and Green's theorem. |

**Unit-1: Vector Algebra**

Vectors, Operations with vectors, Space coordinates, Resolution of vectors, Direction cosines and Direction ratios, Section formulae, Products of two vector, Scalars or dot product,

**Unit-2: Vector Algebra contd.**

Vector or cross product, Physical application, Product of three or more vectors, Scalar product of three vectors, Vector product of three vectors.

**Unit-3: Differential Vector Calculus**

Differentiation of a Vector - Geometrical Interpretation of the Derivative - Differentiation Formulae - Differentiation of dot and Cross Products - Partial Derivatives of Vectors - Differentials of Vectors.

**Unit-4: Gradient, Divergence and Curl**

Vector Differential Operator Del - Gradient of a Scalar Function - Directional Derivative - Geometric Interpretation - Gradient of the sum of Functions; of the product of functions and of a function of function - Operations involving Del - Divergence of a Vector and its Physical Interpretation - Curl of a Vector and its Physical Interpretation - Expansion Formulae for Operators involving Del - Solenoidal and Irrotational.

## Unit-5: Vector Integration

The Line Integral - Surface Integral and its Physical Meaning - Surface Integral and the Concept of Divergence of a Vector - Equivalence of two Definitions of Divergence - Statements of Gauss Divergence Theorem and Green's Theorem (only) and Problems - Line Integral - The Concept of the Curl of a Vector - Statement of Stoke's Theorem (only) and Problems.

**Text Book:**

Grewal B.S., (2014), *Chapter 3 and 8 as in the book Higher Engineering Mathematics,* Khanna Publishers, New Delhi, (Edition 43$^{rd}$ ).

**Supplementary Reading:**

1. Thomas G.B. and Finney R.L., *Calculus and Analytic Geometry*, (1998) Addison Wesley (9$^{th}$ Edn), Mass. (Indian Print).
2. Venkataraman M.K., (1992), *Engineering Mathematics-Part B*, National Publishing Company, Chennai.
3. Vittal P.R., (2004), *Vector Calculus, Fourier series and Fourier Transform*, Margham Publications, Chennai.
4. Vairamanickam K., Nirmala P. Ratchagar and Tamilselvan S., (2011), *Engineering Mathematics – II*, Scitech Publications (India) Pvt. Ltd., Chennai.
5. Vairamanickam K., Nirmala P. Ratchagar and Tamilselvan S., (2012), *Transforms and Partial Differential Equations*, Scitech Publications (India) Pvt. Ltd., Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19ISTAA01: Allied | L | T | P | C |
|---|---|---|---|---|---|
| III | **Mathematical Statistics – I** | 4 | 0 | 0 | 4 |

**Learning Objective (LO):**

| LO1 | The objective is to train students in some concepts in mathematical statistics. |
|---|---|
| LO2 | The notion of random variables, distribution function and characteristic functions are introduced. |
| LO3 | Some examples of discrete and continuous random variables are introduced and their properties are studied. |

**Course Outcomes (CO)**

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

| CO1 | Gains working knowledge related to the problems of theoretical statistics. |
|---|---|
| CO2 | Apply the fundamental concept of statistical methods to solve some real life problems. |
| CO3 | Gains a basic knowledge for study advanced courses in this area. |

**Unit-1: Random Variables**

The concept of a random variable, The distribution function, Random variables of the discrete type and the continuous type, functions of random variables, Multi dimensional random variables, Marginal distributions, Conditional distributions, Independent random variables, Functions of multi dimensional random variables.

**Unit-2: Parameters of the distribution of a random variable**

Expected values, Moments, The Chebyshev inequality, Absolute moments, Order parameters, Moments of random vectors, Regression of first type, Regression of the second type.

**Unit-3: Characteristic Functions**

Properties of characteristic functions, The characteristic functions and moments, Emi invariants, The characteristic function of the sum of independent random variables, Determination of the distribution function by the characteristic function, The characteristic function of multidimensional random vectors, Probability generating functions.

**Unit-4: Some Probability Distributions**

One point and two point distributions, The Bernoulli scheme, The binomial distribution, The Poisson scheme, The generalized binomial distribution, The Polya and hypergeometric distributions, The Poisson distribution.

**Unit-5: Some Probability Distributions (Continued)**

The uniform distribution, The normal distribution, The gamma distribution, The beta distribution, The Cauchy and Laplace distributions, The multidimensional normal distribution, The multinomial distribution.

**Text Book:**

Marek Fisz, (1963), *Probability Theory and Mathematical Statistics*, John Wiley, Third Edition, New York.

Unit – I          Chapter 2: Sections 2.1 to 2.9.
Unit – II        Chapter 3: Sections 3.1 to 3.8.
Unit – III       Chapter 4: Sections 4.1 to 4.7.
Unit – IV       Chapter 5: Sections 5.1 to 5.5.
Unit – V        Chapter 5: Sections 5.6 to 5.12.

**Supplementary Reading:**

1. Cramer H., (1970), *Random variables and probability distributions*, University Press, Cambridge.
2. Cramer H., (1999), *Mathematical methods in Statistics*, Princeton University Press, Princeton.
3. Samuel S. Wilks, (2018), *Mathematical Statistics*, John Wiley & Sons, Read Books Ltd.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |
| CO2 | 2 | 3 | 2 | 2 | | | | | | 2 | 3 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 2 | 2 | | | | | | 2 | 2 | 3 | 2 | 2 |

| Semester | 19IMATE35: Elective | L | T | P | C |
|----------|---------------------|---|---|---|---|
| **III** | **Integral Calculus** | **3** | **0** | **0** | **3** |

**Learning Objective (LO):**

| LO1 | In this paper the student is exposed to the idea of integration and different methods of integration. |
|-----|-------------------------------------------------------------------------------------------------------|
| LO2 | The application of integration to the evaluation of areas and volumes is also introduced. |

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

| | |
|---|---|
| **CO1** | Solve problems using the different methods of integration. |
| **CO2** | Solve problems in double and triple integrals. |
| **CO3** | Apply double and triple integrals in finding area and volume. |

**Unit-1:**
Introduction, Definite integral, Methods of integration, Integrals of the form

$$\int \frac{f'(x)}{f(x)}dx$$

$$\int F\{f(x)\}f'(x)\,dx$$

$$\int \frac{dx}{ax^2+bx+c}dx$$

$$\int \frac{lx+m}{ax^2+bx+c}dx$$

**Unit-2:**
Integration by parts, Bernoulli's formula, Reduction formula for the following types

$$I_n = \int x^n e^{ax} \qquad \text{S } n \rightarrow \text{+ve integer}$$

$$I_n = \int \cos^n x\,dx \quad \text{n, positive integer}$$

$$I_n = \int \sin^n x\,dx$$

$$I_{m,n} = \int \sin^m x \cos^n x\,dx$$

**Unit-3:**
Change of order of integration – Properties of definite integrals.
**Unit–4:**
Double integrals – Double integrals in Polar coordinates – Triple integrals.
**Unit–5:**
Application of double and triple integrals – area, volume.

**Text Book:**

Narayanan S. and Manicavachogam Pillay T.K., (2003), *Calculus (Major),* Vol. II, S.Viswanathan Printers & Publishers Pvt. Ltd., Chennai.

**Supplementary Reading:**

Thomas G.B. and Finney R.L., (1998), *Calculus and Analytic Geometry*, 9th Edition, Addison Wesley, Mass Indian Print.

Venkataraman M.K., (1992), *Engineering Mathematics-Part B*, National Publishing Company, Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19ITAMC41: Part-I Language I | L | T | P | C |
|----------|------------------------------|---|---|---|---|
| IV | சங்க இலக்கியக் க செந்மொழி வரலாக் க | 3 | 0 | 0 | 3 |

கீ ரீ தலீ நேரீ கீ **(**Learning Objective (LO))

- ❖ தமிழ்ல் செல்மொழி இலங்கியங்கள் ற்றிள் அறில் கல் செல்தல்..
- ❖ செல்மொழி வரலாங்ல்தல் அதல் தல்திபால்கல் ங்கான வரையறைகள் ல்ங்டல்ய்ல்ல.
- ❖ சங்க அக, ்ற இலங்கியங்கள்ங் தனண்தல்மைகளை உணல்தல்.
- ❖ பல்ல்ய்பால்ல் இலங்கியங்கள்ங் நெல்நல்வாடை வழில் பல் பால்டைல் ல்ல்ல் காங்டல்.
- ❖ தமிழில் பயல்பால்ல் தேவைல்ல் எல்ல்ல்ங்கால்ங்கல் டல் வண்ல்ல்தல்.

**Course Outcomes**

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

| CO1: | சங்க அக இலங்கியங்கள்ல் திணை அல்ங்டையங் ஆராஙல்ஸ் கல்ல்ல திறல். |
|------|---|
| CO2: | ்ற இலங்கியங்கள்ங் பெல் பால் ல்வங்கள்ங் ல்மையை அறில்ல் ஆல்றல் |
| CO3: | நெல்நல்வாடை வழி இலங்கியங்கள்ங் இயல்கைல் பெல்மிடல்ஞதல் ல்ல்ல்வல் |
| CO4: | சங்க இலங்கியங்கள்ங் வகைமை, வல்வல், உல்லடல்கல் ்ற்றிந்த அறிவைல் பெல்றில்ல்யல் |
| CO5: | தொல்காய்ல்ல் எல்ல் ல் தனண்ல்வமான இலல்கணல்தை வங்ல்ல்ல் திறல் |

அலீ – 1 அக இலீ கியீ கீ

| | | | | |
|---|---|---|---|---|
| 1. | ல்ல்ஷிதொகை | - | 125, 128, 177, 303, 397 | (நெல்தல்) |
| 2. | நற்றிணை | - | 206, 217, 304, 334, 383 | (ல்றில் சி) |
| 3. | ஐல்ல்ல் ல் | - | 17, 18, 71, 75, 96, | (மல்தல்) |
| 4. | அகநால் ல் | - | 147, 303, 371 | (பாலை) |
| 5. | கலில்ஷிதொகை | - | 104, 105 | (ல் ல்லை) |

அலல் - 2 ற்ற இலல்கியல்கல்

| | | | |
|---|---|---|---|
| 1. | ற்றநால் ல் | - | பெல் பால்ல்லவங்கல் |

66, 83, 112, 140, 187,
226, 269,271, 278,290

அலீ - 3 பீ ° ° பரீ °

1. நெல்நெல்வாடை

அலீ - 4 சீ க இலீ கிய வரலரீ

தொல்காய்யில் - சல்க காலல் - ல் ல்சல்கல்கல் - பால்ல்ல் தொகைல்ல் - தொல்ல்ல்ல் றை - தனஷ்தல்மைகல்.

அலீ - 5 பயீ பரீ ° ° தமீ ° செீ மொழி வரலரீ °

மொழி வண்ல்கல் - மொழில்ல்ல்ல்யல்கல் - உலகல் செல்மொழிகல் - இல்ஷியல் செல்மொழிகல் - செல்மொழில் தல்திகல் - வரையறைகல் - வால் ல் செல்மொழில் தமில் - தமிழில் தொல்மை - தமிழில் சிறல்ல்ல்கல் - தமில்ல்செல்மொழி ல் ல்கல் - தமில் செல்மொழி அறில்ஷேல்ல் - பல்திமால்கலைஞல் ல் தல் தல்கால அறிஞுல்கல் வரை (அறிஞுல்கல் - அமைல்ல்கல் - நில்வனல்கல் - இயல்கல்கல் தொடல் யல்சிகல் - அறல்பேரால்டல்கல் - உலகல் தமில்ல்செல்மொழி மாநால், கோவை-2010)

அலீ – 6

(மாணவீ கீ அறிீ ° கெரீ வதீ ° மீ ° ° - ஷேீ ° ° கான பீ தி அீ ல)

பல் டைய தமில் மரல்களைல்ல் சல் க அமைல்ல்களைல்ல் வண்ல்ஷ்தல், தமில் மொழியஷ் தனஷ்ல்வஷ்தைல்ல் செல்மொழி இயல்ல்களைல்ல் சல்க இலல்கியல்களஷ் ல்ஷைல்கொல் ல் வண்ல்ஷ்தல். சல்கல் பல் வல்களஷ் பொல்மைஷ்தல்மையைல்ல் அவல்றில் சிறல்ய்யல்ல்களைல்ல் வண்ல்ஷ்தல்.

பாட்ீ ° :

| | | | |
|---|---|---|---|
| 1. | ச.வே.ல்ய்ஷ்மணஷ்ல் (ப.ஆ) | - | ல்ல்ல்ஷிதொகை, நற்றிணை, ஐல்ல்ல் ல், " அகநால் ல், கலில்ஷிதொகை, மணஷ்ாசகல்திஷ்யகல்,செல்னை இரல் டால் பதில்ல் -2011 |

2. **ச.வே.ஸ்ப்மணவ்யல்** (ப.ஆ) - ஸ்றநால் ல்,
மணவ்ாசகல்திஸ்கல், செல்னை
இரல் டால் பதில்ல் -2011

3. **ச.வே.ஸ்ப்மணவ்யல்** (ப.ஆ) - பல்ல்ஸ்யால்ல் (நெல்நல்வாடை)
மணவ்ாசகல்திஸ்கல், செல்னை
இரல் டால் பதில்ல் -2011

4. தெ.பொ.மணால்சி ஸ்தரல் - சல்க மொழி வரலால்
நில்செல்சல் ஸ்தக நிலையல்
ல் தல்பதில்ல் -2018

5. மணவை ல் ல் தபா - செல்மொழி உல்ல் ல் ஸ்றல் ல்
சீதை பதில்ங்கல், செல்னை
ல் தல்பதில்ல் -2010

6. **ச.வே.ஸ்ப்மணவ்யல்** - சல்க இலல்கியல்
மணவ்ாசகல்திஸ்கல், செல்னை
இரல் டால் பதில்ல் -2011

7. ல் .வரதராசல் - தமில்இலல்கிய வரலால்,
சாகில்திய அகாதெமி வெளஸ்யல், ஸ்ல்தில்லி
ல் ல்றால் பதில்ல் 2015

### Outcome Mapping

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 |  |  |  | 3 | 3 |  |  | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO2 | 3 | 3 |  |  |  | 3 |  |  | 3 |  |  | 3 | 2 |  |  |
| CO3 |  | 2 | 3 |  | 3 | 3 |  |  |  |  | 3 |  |  | 3 | 3 |
| CO4 | 3 |  | 3 |  |  | 2 |  |  |  | 3 | 2 | 2 | 3 |  |  |
| CO5 | 3 | 2 |  |  | 2 |  |  |  | 2 | 3 | 2 |  |  | 3 | 2 |

| Semester | 19IENGC42: Part – II Language II | L | T | P | C |
|---|---|---|---|---|---|
| IV | English Through Literature IV: Short Story | 3 | 0 | 0 | 3 |

## LEARNING OBJECTIVE

By introducing the course, it is intended to:

LO1: Develop the communicative competence of learners in the English Language through training them in the skills of listening, speaking, reading, and writing

LO2: Enable the students to know about the origin and development of short story

LO3: Write objectively, avoiding vagueness, prejudice, and exaggeration

LO4: Enable the learner to function through the written mode of English language in all situations including classroom, library, laboratory etc

LO5: Discover an author's purpose, and draw conclusions about certain events, evaluating cause and effect, and understanding point of view

## COURSE OUTCOMES

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

CO1: Use more vocabularies while writing

CO2: Ensure about the history and development

CO3: Develop a flow in writing

CO4: Come up with new ideas while reading stories from different perspectives

CO5: Write in a style appropriate for communicative purposes

### Unit I

1. O' Henry                        "The Gift of The Magi"
2. Ken Liu                         "The Paper Menagerie"
   Grammar                        Synonyms and Antonyms

### Unit II

1. Flora Annie Steel               "Valiant Vicky"
2. Oscar Wilde                     "Happy Prince"
   Grammar                        Words often confused

### Unit III

1. R. K. Narayan                   "The Martyr's Corner"
2. Mahasweta Devi                  "Draupati"
   Grammar                        Paragraph-Writing

## Unit IV

1. Leo Tolstoy           "How much Land Does a Man Need?"
2. Somerset Maugham       "The Verger"

    Grammar              Letter-Writing

## Unit V

1. Langston Hughes        "On the Road"
2. Premchand            "Bakthi Marg"

    Grammar              Precis-Writing

## TEXT BOOKS

1. Srinivasa Iyengar, K.R.. *Indian Writing in English*. New Delhi: Sterling Pub., 1996.
2. Michael Swan, *Practical English Usage*, New Delhi: Oxford University Press, 2016.

## SUPPLEMENTARY READING:

1. Frank Robert Palmer,. *Grammar: (by) Frank Palmer*. New Delhi: Penguin Books, 1975.
2. Browns, Julie, ed., *Ethnicity and the American Short Story*, New York: Garland, 1997.
3. Patea, Viorica. *Short Story Theories: A Twenty-First-Century Perspective*. Amsterdam [etc.]: Rodopi, 2012.

## OUTCOME MAPPING

| CO/PO | PO | | | | | | | | | | | | PSO | | | | |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|---|---|---|---|---|
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO1 | 3 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO2 | 2 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO3 | 3 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 2 |
| CO4 | 3 | | | 3 | | | 3 | 3 | | 3 | | | 3 | 3 | | | 3 |
| CO5 | 2 | | | 2 | | | 2 | 2 | | 2 | | | 2 | 2 | | | 2 |

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

| Semester | 19IHIC41.2: Part-I Language  Basic Hindi-IV | L | T | P | C |
|---|---|---|---|---|---|
| IV | | 4 | 1 | 0 | 5 |

**Learning Objectives:**

- ❖ To learn the important poems of famous Hindi poets.
- ❖ To imbibe the knowledge of writing in Premchand stories.
- ❖ To understand the relation between poems and stories.
- ❖ To gain knowledge on stories of BeeshmaSahini

**Unit - I: Introduction, Poem**

.Kabeer  -  1 To  10 DohasTulasi   -  1 To  10 Dohas.

**Unit - II:**Rahim   -  1 To   10 Dohas

**Unit – III:** Edgaah -   Premchand. Madhuva  -Jayashankar Prasad.

**Unit - IV:**stories,

Chief Ki Daavat - BeeshmaSahinI

**Unit - V:**7. HANUMAN JI ADHALATH ME - HARISHAKNA PARSAYE

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**Current Streams of Thought:**The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

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**Text Books**

1PADHYA MANJARI - DR. T.NIRMALA & DR.S.MOHANRajkamalPrakashan, New Delhi
2.premchand kipradhinikahaniya,rajkamalprakshan,new Delhi.7.
3.kahani:nayikahani: namvirsingh,RajkamalPrakashan, New Delhi.
4.bihari-ompraksh.vaniprakshan,newdelhi 110002.

**Supplementary Reading**

1.    Nayikahani:prakrutiaurpaat:surendrachowdari.
2.Naveen ekanki , D.B.H.P. SABHA, madras17.
3.Bihari ki kavya sruti:jayapraksh.

**Course Outcomes**

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

**CO1:**     Understand the concepts of Hindi poems.

**CO2:**     Knowledge on stories of Premchand.

**CO3:**     Describe the basic concepts of hindi stories.

**CO4:**  Apply the concepts of writings of Jai sankar Prasad.

**CO5:**  Understand the writing style of BeeshmaSahini.

### Outcome Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| CO2 | 3 | - | 3 | - | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - |
| CO3 | 3 | 3 | - | - | 2 | 3 | - | 2 | 3 | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 2 | - | - | 2 | - |
| CO5 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 |

### TEXT BOOK

1.  PadhyaManjari - Dr. T.Nirmala&Dr.S.Mohan,RajkamalPrakashan, New Delhi.

| Semester | 19IFREC41: Language- I: Course -2 | L | T | P | C |
|----------|-----------------------------------|---|---|---|---|
| IV | **French-IV** | 3 | 0 | 0 | 3 |

### Learning Objective (LO):

| LO1 | Draw a France map and name its regions and cites. |
|-----|---------------------------------------------------|
| LO2 | Fix an appointment |
| LO3 | Draw a person physically and name its parts. |
| LO4 | Talk about the qualities and defects of the person |
| LO5 | Talk about their health problems |

### Course Outcomes (CO):

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

| CO1 | **Describe a country** |
|-----|------------------------|
| CO2 | Take an appointment with a doctor or with friends, etc. |
| CO3 | Express in which part of the body they have pain. |
| CO4 | Describe a person physically and mentally |
| CO5 | Ask others about how they are feeling using expressions such as 'Qu'est-ce que tu as? Où est-ce que tu as mal?' |

**Unit I**

Faire un bilan du sondage
Aborder quelqu'un (Parler de moyens de communication)

**Unit II**

Faire valoir son droit
Exprimer une opinion sur la vérité d'un fait.
Savoir-vivre en France

**Unit III**

Donner un conseil
Téléphoner /Prendre rendez-vous

**Unit IV**

Exposer un problème/ réagir
Parler du corps et des problèmes de santé

**Unit V**

Parler des qualités et des défauts des personnes
Demander / donner une explication
décrire une personne
Evaluez-vous

## Text Book:

1. J. Girardet et J. Pecheur, (2012), *Echo A1* - méthode de français*,* Langers, Paris

## Supplementary Readings:

1. Marie-Noelle Cocton et Emilie Pommier, (2015), *Saison A1* - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et  Manuel Tost, (2001), *FORUM* – Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), *Le Cours de langue et de la civilisation française*, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997),  *Grammmaire Prograssive du Français avec 400 exerices*, CLE International, Paris.

**Outcome Mapping:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| CO2 | 3 | - | 2 | - | 3 | - | 2 | 2 | - | 3 | - | - | - | - | - |
| CO3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 2 | 2 | - | - | 2 | - |
| CO5 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 |

| Semester | 19IMATC43: Core – 6 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| IV | **Statics** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This course aims to provide basic skills and problem solving techniques in forces acting at a point, coplanar forces, moment of a set of concurrent forces, couples, reduction of coplanar system of forces, friction and equilibrium of strings and chains. |
|-----|---|

**Course Outcomes (CO)**

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

| CO1 | Apply the fundamental concept of statics to<br><br>a.   demonstrate the application of vectors for the analysis of static equilibrium ;<br>b.   analyze static equilibrium to particles and rigid bodies and apply the principles of equilibrium for analyzing beams. |
|-----|---|
| CO2 | Solve equations involving frictional, statistical, dynamical and limiting frictions. |
| CO3 | Illustrate the mathematical aspects that provide the skills and problem solving in forces acting at a point, coplanar forces and equilibrium of strings and chains. |

**Unit-1:**

Forces acting at a point, Resultant and components, Parallelogram of forces, Analytical expression for the resultant of two forces acting at a point, Triangle of forces, The polygon of forces, Lami's theorem, An extended form of the Parallelogram law of forces, Resolution of a force, Components of a force, Resultant of any number of forces acting at a point, Conditions of equilibrium of any number of forces acting upon a particle.

**Unit-2:**

Parallel forces and Moments, The resultant of two like and unlike parallel forces acting on a rigid body, Resultant of a number of parallel forces acting on a rigid body, Conditions of equilibrium of three coplanar parallel forces, Centre of two parallel forces, Moment of a force, Varignon's theorem of moments, Generalized theorem of moments.

Couples, Definition, Equilibrium of two couples, Equivalence of two couples, Couples in parallel planes, Representation of a couple by a vector, Resultant of a coplanar couples, Resultant of a couple and a force.

**Unit-3:**

Equilibrium of three forces acting on a rigid body, Rigid body subjected to any three forces, Three coplanar forces, Conditions of equilibrium, Procedure to be followed in solving any statical problem, Two trigonometrical theorems, Some artifices, Problems on parallel forces.

**Unit-4:**

Coplanar forces, Reduction of coplanar forces in general, Reduction of any number of coplanar forces, Conditions and alternative conditions for a system of forces to reduce to a single force or to a couple, Change of the base-point, Equation to the line of action of the resultant, Equation to the line of action of the resultant, General conditions of equilibrium.

**Unit-5:**

Friction, Statical, Dynamical and Limiting frictions, Laws of friction, Coefficient of friction, Angle of friction, Cone of friction, Numerical values, Equilibrium of a particle on a rough inclined plane, Equilibrium of a body on a rough inclined plane.


**Text Book:**

Venkataraman M.K., (1986), *A Text Book of STATICS*, Agasthiar Book Depot, Trichy.

| | | |
|---|---|---|
| Unit I | - | Chapters 2 all sections. |
| Unit II | - | Chapter 3 Sections 1to13 and |
| | | Chapter 4 all sections. |
| Unit III | - | Chapter 5 Sections 1 to 7. |
| Unit IV | - | Chapter 6 Sections 1 to 13. |
| Unit V | - | Chapter 7 Sections 1 to 13. |


**Supplementary Reading:**

1. Varma R.S., *Text book on STATICS*, Pothishala Pvt. Ltd., Allahabad.
2. Dharmapadam A.V., (1973), *STATICS*, S.Viswanathan Printers & Publishers Pvt. Ltd., Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC44: Core – 7 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| IV | **Fourier Series and Fourier Transform** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | Introduce the Fourier series and its application and the concepts of Fourier transforms. |
|-----|------------------------------------------------------------------------------------------|

**Course Outcomes (CO)**

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

| CO1 | Find the Fourier series representation of a function of one variable. |
|-----|----------------------------------------------------------------------|
| CO2 | Find the solution of the wave, diffusion and Laplace equations using the Fourier series. |
| CO3 | Demonstrate the use of Fourier Transform to connect the time domain and frequency domain. |

**Fourier Series:**

**Unit-1:**

Introduction, Dirichlet conditions, Euler's Formulae for Fourier Series, Theorem for the convergence of Fourier series, Fourier Series for functions of period $2\pi$ .Examples.

**Unit-2:**

Change of Interval -Fourier Series for functions of period 2l, Dirichlet's conditions, Examples. Fourier Series of a function with its periodic extension.

**Unit-3:**

Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Examples.

**Fourier Transform:**

**Unit-4:**

Fourier Integral Theorem, Fourier sine and cosine integrals, Complex form of Fourier Integral, Inversion formula for complex Fourier transform, Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation, Fourier Transform of Derivatives Examples.

**Unit-5:**

Theorem Fourier Cosine & Sine Transforms and their properties, Parseval's Identity for Fourier Transform, Convolution Theorem for Fourier Transform, Examples.

**Text Books:**

1. Dr. Venkataraman M. K. and Manorama Sridhar, (2001), *Calculus and Fourier Series*, The National Publishing Company, Chennai.

    Unit- I, II, III: Chapter 1

2. Dr. Vittal P. R., (2006), *Differential equations*, *Fourier and Laplace Transforms, Probability*, Margham Publications, Chennai.

    Unit- IV & V: Chapter 8

**Supplementary Reading:**

1. Narayanan S. and Manicavachagom Pillay T.K., (2008), *Calculus Volume-III*, S.Viswanathan Printers & Publishers Pvt. Ltd., Chennai.
2. Venkataraman M.K., (1992), *Engineering Mathematics-Part B*, National Publishing Company, Chennai.
3. Dr. Grewal B. S., (2014), *Higher Engineering Mathematics*, 43rd Edition, Khanna Publishers, New Delhi.
4. Vairamanickam K., Nirmala P. Ratchagar and Tamilselvan S., (2011), *Engineering Mathematics – II*, Scitech Publications (India) Pvt. Ltd., Chennai.
5. Vairamanickam K., Nirmala P. Ratchagar and Tamilselvan S., (2012), *Transforms and Partial Differential Equations*, Scitech Publications (India) Pvt. Ltd., Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19ISTAA02: Allied | L | T | P | C |
|:---:|:---:|:---:|:---:|:---:|:---:|
| IV | **Mathematical Statistics – II** | **4** | **0** | **0** | **4** |

**Learning Objective (LO):**

| LO1 | The objective is to train students in some concepts in mathematical statistics. |
|:---:|:---|
| LO2 | The theory of sample moments, significant test, sampling theory and analysis of variance are introduced. |
| LO3 | Practical problems are solved. |

**Course Outcomes (CO)**

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

| CO1 | Gains working knowledge related to the problems of theoretical statistics. |
|:---:|:---|
| CO2 | Apply the fundamental concept of statistical methods to solve some real life problems. |
| CO3 | Gains a basic knowledge for study advanced courses in this area. |

**Unit-1: Sample Moments and their Functions**

The notion of a sample- The notion of a statistic – the distribution of the arithmetic mean of independent normally distributed random variables – The x2 distribution – The distribution of the statistic (X, S) –Student's t-distribution

**Unit-2: Sample Moments and their Function (Contd...)**

Fisher's Z-Distribution – The distribution of X for some non-normal populations – The distribution of sample moments and sample correlation coefficients of a two-dimensional normal population – The distribution of regression coefficients – Limit distributions of sample moments.

**Unit-3: Significance Tests**

The concept of a statistical test – Parametric tests for small samples – Parametric tests for small samples – Parametric tests for large samples – The $x^2$ test – Independence tests by contingency tables.

**Unit-4: Theory of sampling**

Preliminary notions – Consistent estimates – Unbiased estimates – The sufficiency of an estimate – The efficiency of an estimate.

**Unit-5: Analysis of variance**

One-way classification – Multiple classification – A modified regression problem.

**Text Book:**

Marek Fisz, (1963), *Probability Theory and Mathematical Statistics*, Third Edition, John Wiley & Sons, Inc.,.

Unit – I         Chapter 9: Sections 9.1 to 9.6.

Unit - II         Chapter 9: Sections 9.7 to 9.11.

Unit - III        Chapter 12: Sections 12.1 to 12.4 & 12.7.

Unit - IV        Chapter 13: Sections 13.1 to 13.5.

Unit - V         Chapter 15: Sections 15.1 to 15.3.

**Supplementary Reading:**

1. Cramer H., (1970), *Random variables and probability distributions*, University Press, Cambridge.
2. Cramer H., (1999), *Mathematical methods in Statistics*, Princeton University Press, Princeton.
3. Samuel S. Wilks, (2018), *Mathematical Statistics*, John Wiley & Sons, Read Books Ltd.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |
| CO2 | 2 | 3 | 2 | 2 | | | | | | 2 | 3 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 2 | 2 | | | | | | 2 | 2 | 3 | 2 | 2 |

| Semester | 19IMATC51: Core – 8 | L | T | P | C |
|---|---|---|---|---|---|
| V | Real Analysis I | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | To understand various limiting behavior of sequences and series to explore the various limiting processes viz.continuity, uniform continuity, differentiability and integrability and to enhance the mathematical maturity and to work comfortably with concepts. |
|---|---|

## Course Outcomes (CO)

Students will be introduced to and have knowledge of many mathematical concepts

| CO1 | examples and counter examples |
|-----|-------------------------------|
| CO2 | proof techniques |
| CO3 | problem solving<br>      studied in real analysis such as<br>   • Real Valued Functions<br>   • Convergence Sequence<br>   • Cauchy Sequence<br>     • Series of Real Numbers |

### Unit-1: Functions & Sequences

Functions – real valued functions – equivalence – countability and real numbers – least upper bound – definition of sequence and subsequence – limit of a sequence – convergent sequence.

### Unit-2: Sequences [Contd...]

Divergent sequences – Bounded sequences – Monotone sequence – Operations on convergent sequences – Operations on divergent sequences – Limit superior and Limit inferior – Cauchy sequences

### Unit-3: Series of Real Numbers

Convergence and Divergence – Series with non negative terms – Alternating series – conditional convergence and Absolute convergence – Test for Absolute convergence.

### Unit-4: Series of Real Numbers [Contd...], Limits and Metric Spaces

Series whose terms form a non increasing sequence – The class $\ell 2$ – Limit of a function on the real line – Metric spaces – Limits in Metric spaces.

### Unit-5: Continuous Functions on Metric Spaces

Functions Continuous at a point on the real line – Reformulation – Functions Continuous on a Metric Spaces – Open Sets – Closed Sets.

### Text Book:

Goldberg R., (2000), *Methods of Real Analysis*, Oxford & IBH Publishing Co., New Delhi.

| | |
|---|---|
| Unit – I | Chapter 1 Sections 1.4 to 1.7, 2.1 to 2.3 |
| Unit – II | Chapter 2 Sections 2.4 to 2.10 |
| Unit – III | Chapter 3 Sections 3.1 to 3.4 and 3.6 |
| Unit – IV | Chapter 3 Sections 3.7, 3.10, 4.1 to 4.3 |
| Unit – V | Chapter 5 Sections 5.1 to 5.5 |

**Supplementary Reading:**

1. Tom M.Apostol, (1974), *Mathematical Analysis*, 2<sup>nd</sup> Edition, Addison-Wesley, New York.
2. Bartle. R.G. and Shebert, (1976), *Real Analysis*, John Wiley and Sons Inc., New York.
3. Malik, S.C. and Savita Arora, (1991), *Mathematical Analysis*, Wiley Eastern limited, New Delhi.
4. Sanjay Arora and Bansi Lal, (1991), *Introduction to Real Analysis*, Satya Prakashan, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC52: Core – 9 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| V | **Differential Equations and Applications** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This course aims to provide logical skills in the formation of differential equations, to expose to different techniques of finding solutions to these equations and in addition stress is laid on the application of these equations in geometrical and physical problems. |
|-----|---|
| LO2 | It also aims to provide logical skills in the formation and solutions techniques of partial differential equations. |

**Course Outcomes (CO)**

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

| CO1 | Explain the fundamental concepts of ordinary differential equations and their role in modern mathematics. |
|-----|---|
| CO2 | Use ordinary differential equations to model simple electric circuits, population growth and mass-spring systems, as well as other applications. |
| CO3 | Demonstrate accurate and efficient use of the Laplace transforms and their applications in the solution of ordinary differential equations. |

| **CO4** | Apply problem-solving using concepts and techniques from ordinary differential equations and Laplace transforms relevant to diverse situations in physics, engineering, financial mathematics and in other mathematical contexts. |
|---|---|

### Unit-1: Ordinary Differential Equations

Bernoulli Equation – Exact Differential Equations – Equations Reducible to Exact Equations – Equations of First order and Higher degree: Equations solvable for p, Equation solvable for x and Equations Solvable for y – Clairaut's Equation.

### Unit-2: Ordinary Differential Equations [Contd...]

Method of Variation of Parameters – 2nd order Differential Equations with Constant Coefficients for finding the P.I's of the form $e^{ax} V$, where V is sin(mx) or cos(mx) and $x^n$ – Equations reducible to Linear equations with constant coefficients – Cauchy's homogeneous Linear Equations – Legendre's Linear Equations – Linear Dependence of Solutions – Simultaneous Equations with Constant Coefficients.

### Unit-3: Laplace Transform

Laplace Transform, Inverse Laplace transform, Application to the first and second order linear differential equations and Simultaneous linear differential equations, Simple problems.

### Unit-4: Partial Differential Equations

Partial differential equations: Formation of P.D.E. by eliminating arbitrary constants and arbitrary functions, Complete, Singular and General integral. Solution of equations of standard types: f(p,q)=0, f(x,p,q)=0, f(y,p,q)=0, f(z,p,q)=0, f(x,p)=f(y,q), and Clairaut's form. Lagrange's equation Pp+Qq=R, Simple problems.

### Unit-5: Series Solution

Series solutions of first order equations, Second order linear equations, Ordinary points, Regular Singular Points and Legendre polynomials, Properties of Legendre polynomials and Bessel functions and their differential equations.

**Text Books:**

1. Vittal P.R., (2016), *Differential Equations*, *Fourier and Laplace Transforms, Probability*, Margham Publications, Chennai, Reprint.

   Unit I     -     Chapter 2.

   Unit II     -     Chapter 3.

   Unit III     -     Chapter 7.

   Unit IV     -     Chapter 5.

2. George F. Simmons, (2003), *Differential equations with applications and historical notes*, Second Edition, Tata McGraw Hill Pub. Co., New Delhi.

   Unit V     -     Chapter 5 Sections 26 – 29

                             Chapter 8 Sections 44, 45 and 46

                             (except Gamma function)

**Supplementary Reading:**

1. Raisinghania M.D. and Aggarwal R.S., (1983), *Ordinary and partial Differential equations*, Sultan Chand and Company Ltd.
2. Raisinghania M.D., (2006), *Ordinary and Partial Differntial Equations*, S. Chand.
3. Grewal B.S., (2002), *Higher Engineering Mathematics*, Khanna Publishers, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC53: Core – 10 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| V | Dynamics | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This course aims to provide basic skills and problem solving techniques in kinematics of point and Newton's laws of motion. |
|-----|------------------------------------------------------------------------------------------------------------------------------|
| LO2 | Projectiles and simple harmonic motions are studied in detail. Problems in moment of inertia are also considered. |
| LO3 | The course enhances the problem solving skill of the student. |

**Course Outcomes (CO)**

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

| CO1 | Apply the fundamental concept of dynamics to <br><br> a. demonstrate their understanding of the principles of kinematics and kinetics of particles and planar rigid bodies; <br> b. analyze planar rigid body kinematics and kinetics. |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO2 | Solve equations of projectiles, moment of inertia and simple harmonic motions. |
| CO3 | Illustrate the mathematical aspects that provide the skills and problem techniques in kinematics of point and Newton's laws of motion. |

**Unit-1:**

Kinematics, Speed, Displacement, Velocity, Composition of velocities; Parallelogram law , Resolution of Velocities , Components of a velocity along two given directions , Triangle of velocities, Theorem, Polygon of velocities,Theorem , Resultant of several simultaneous coplanar velocities of a particle, Relative velocity, Angular velocity, Angular velocity of a particle, Relative angular velocity, Change of velocity, Acceleration, Variable acceleration, Parallelogram law of accelerations, Relative acceleration , Motion in a straight line under uniform acceleration, Motion in a straight line with variable acceleration, Space-times graph, Velocity-time curve, Velocity-space graph , To derive graphically the equations of motion of a particle under constant acceleration, Acceleration of falling bodies, Vertical motion under gravity, Bodies freely falling downward, Motion of a particle down a smooth inclined plane, Theorem, Lines of quickest descent, Theorem.

**Unit-2:**

The laws of motion: Momentum, Newton's laws of motion, Composition of forces: Conservation of linear momentum, Force of friction, Presssure of a body resting on a moving horizontal plane, Motion of connected particles, Tension in the inextensible string, Atwood's machine, Work, Tension in an elastic string, Work done in stretching an elastic string, Power, Energy, Kinetic Energy, The Principle of work-Energy, Potential Energy, The principle of conservation of energy, Verification of the principle of energy in the case of a freely falling body, Velocity and acceleration of the centre of interia of a system of particles.

**Unit-3:**

Projectiles: Two fundamental principles, Path of a projectile, Characteristics of the motion of a projectile, The horizontal range, The velocity at time t, Range on an inclined plane.

**Unit-4:**

Simple harmonic motion: Simple harmonic motion in a straight line, General solution of the S.H.M. equation, Geometrical representation of a simple harmonic motion, Change of origin, Composition of two simple harmonic motions of the same period and in the same straight line, Composition of two simple harmonic motions of the same period in two perpendicular directions, Force necessary to produce simple harmonic motion, Motion of a particle suspended by a spiral spring, Horizontal oscillations of a particle tied to an elastic spring.

**Unit-5:**

Moment of Inertia: The definition of parallel axes, The theorem of perpendicular axes, Moments of inertia in some particular cases, Dr. Routh's rule, Equimomential systems.

**Text Book:**

Venkataraman M.K., (1985), *Dynamics*, Agasthiar Book Depot, Trichy.

| Unit I | - | Chapter 3 all sections |
|---|---|---|
| Unit II | - | Chapter 4 all sections |
| Unit III | - | Chapter 6 sections 1 to 15 |
| Unit IV | - | Chapter 10 sections 1 to 10 |
| Unit V | - | Chapter 12 all sections |

**Supplementary Reading:**

1.  Duraipandian P. and Laxmi Duraipandian, (1979), *Mechanics*, S. Chand and Co., New Delhi.
2.  Dharmapadam A.V., (1996), *Dynamics*, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.

**Outcome Mapping:**

| Semester | 19IMATC54: Core – 11 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| V | **Astronomy** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | The prime aim of this paper is to enrich the knowledge of movements of celestial objects using mathematical concepts. |
|-----|---|

**Course Outcomes (CO)**

On successful completion of the course, the student will be able to understand

| CO1 | the concepts of Celestial movements, |
|-----|---|
| CO2 | application of Spherical Trignomentry, |
| CO3 | application of three dimensional geometry. |

**Unit-1:** Spherical Trigonometry - Spherical Triangle - The fundamental formulae of Spherical Trigonometry, the sine, cosine, four parts and Napier formulae (without proof).

The Celestial Sphere: Celestial coordinators - Diurnal motion - Rising and setting of a star - Sidereal time - Circumpolar star - Morning and Evening stars - Twilight - Earth - Length of the day.

**Unit-2:** Refraction - Tangent Formula – Cassini's formula - Effects of Refraction - Geocentric Parallax - Effects of Geocentric Parallax - Heliocentric Parallax - Effects of Heliocentric Parallax - Aberration - Its Effects.

**Unit-3:** Kepler's Laws - Verification of Kepler's Laws - True anomaly, Mean Anomaly - Eccentric Anomaly, Relation between them - Time - Equation of Time - Seasons - Converson of Time.

**Unit-4:** Moon - Sidereal Month, Lunation and Relation between them - Phases of the Moon - Lunar Libration - Surface of the Moon - Metonic Cycle - Tides - Eclipses - Shadow Cone - Minimum and Maximum number of Eclipses.

**Unit-5:** Planetary Phenomena - Bodes law - Elongation - Sidereal Period, Synodic period and the relation between them - Phase - Stationary Points - Solar System - Stellar Universe - A brief history of Astronomy - Astronomical Instruments.

**Text Book:**

Kumaravelu. S and  Susheela Kumaravelu, (2005), Astronomy for degree classes, Rainbow Printers, Nagarcoil.

**Supplementary Reading:**

1. Ramachandran. G.V., A Text Book of Astronomy,(1951), St. Josephs Industrial School Press, Trichy.

 2.George.O.Abell, *Exploration of the Universe*, Brooks/Cole; 7th Revised edition Second Edition.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC55: Core – 12 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| V | **Numerical Methods** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | The roll of numerical analysis is to develop and analyze the numerical techniques. |
|-----|-----|
| LO2 | In this paper, different methods for finding the roots of algebraic and transcendental equations, solutions of simultaneous equations, solutions of differential equations are concentrated. |
| LO3 | Numerical solutions of partial differential equations such as Elliptic, Poisson and Laplace equations are discussed. Numerical differentiation and integration are also evaluated. |

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

| CO1 | explain finite difference operator, solve the first and second order linear difference equations with constant coefficients and non homogenous equations of the same kind. |
|-----|---|
| CO2 | interpolate using Newton's and Legrangian formulae, do numerical differentiation and integration, find solutions to algebraic and transcendental equation using bisection method ,approximation method, regula falsi method, Newton Raphson method and Bairstow method. |
| CO3 | solve ODE and PDE using the methods mentionable in the syllabus. |

### Unit-1: Finite Differences and Difference Equations

Finite difference operator: E-Solution of first and second order linear difference equations with constant coefficients, Non-homogeneous linear difference equations with constant coefficients.

### Unit-2: Interpolation, Numerical Differentiation and Integration

Interpolation, Gregory - Newton forward and backward interpolation formula, Newton's divided difference formula, Lagrange's interpolation formula for unequal intervals, Gauss interpolation formula, Numerical differentiation, Numerical Integration, Trapezoidal rule.

### Unit-3: Numerical solution of algebraic and transcendental equations

Numerical solution of algebraic and transcendental equations, Bolzano's bisection method, Successive approximation method, Regula falsi method, Newton-Raphson method, Bairstow method. Numerical solution of simultaneous linear algebraic equations, Gauss elimination method, Gauss-Jordan elimination method, Gauss - Seidel iteration method, Crout's method.

### Unit-4: Numerical solution of ordinary differential equation

Numerical solution of ordinary differential equations of first and second order simultaneous equations, Taylor series method, Euler's method, Improved Euler's method, Modified Euler's method, Runge-Kutta Method of second and fourth order, Milne's Predictor - corrector method – Picard's method.

### Unit-5: Numerical solution of partial differential equation

Numerical solution of partial differential equations, Elliptic equation, Poisson's equation, Laplace equation, Liebmann's iterative method, Relaxation Method, Hyperbolic equations.

**Text Book:**

Venkataraman M.K., (2001), *Numerical methods in Science and Engineering*, National Publishing Co., Chennai.

Unit I - Chapter V and X.

Unit II - Chapters VI and IX.

Unit III - Chapters III and IV.

Unit IV - Chapter XI.

Unit V - Chapter XII.

**Supplementary Reading:**

1. Sastry S.S., (1998), *Introductory Methods of Numerical Analysis*, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi.

2. Sankara Rao K.,(2001), *Numerical Methods for Scientists and Engineers,* Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IMATC56: Core - 13 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| V | **Extension Activities** | 0 | 0 | 2 | 1 |

Extension activities are the activities that provide a link between the University and the community such as lab-to-land, literacy, population education, and health awareness programmes. These are integrated within the curricula with a view to sensitise the students about Institutional Social Responsibility (ISR).

| Semester | 19IMATE57: Elective | L | T | P | C |
|----------|---------------------|---|---|---|---|
| V | **Analytical Geometry 3D** | 3 | 0 | 0 | 3 |

**Learning Objective (LO):**

| LO1 | This paper aims to understand the fundamental concepts of Analytical Geometry in Three Dimension. |
|-----|---------------------------------------------------------------------------------------------------|

**Course Outcomes (CO)**

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

| CO1 | explain fundamental concepts of analytical geometry in 3D, about direction cosines of a line and the plane, equation and plane. |
|-----|-------------------------------------------------------------------------------------------------------------------------------|
| CO2 | The straight line, symmetric form of equation of a line, equation of a line passing |

| | through two given points, the plane and the straight line, intersection of three planes. |
|---|---|
| **CO3** | Sphere, the length of the tangent form of point to sphere equation of a circle on a sphere, intersection of two spheres, cone, cylinder and central quadrics. |

**Unit-1:** Rectangular Cartesian Co-ordinates: Direction Cosines of a line.

**Unit-2:** The Plane.

**Unit-3:** The Straight Line.

**Unit-4:** The Sphere.

**Unit-5:** The Central Quadrics and Cone.

**Text Book:**

Manickavachagom Pillay T.K. and Natarajan T., (2009), *Analytical Geometry, (Part-II – Three Dimensions)*, S. Viswanathan Printers & Publishers Pvt. Ltd., Chennai.

Unit – I:          Chapter 1 (Fully)

Unit-II:          Chapter 2 (Fully)

Unit- III:          Chapter 3 (Fully)

Unit- IV:          Chapter 4 (Fully)

Unit- V:          Chapter 5 (Fully)

**Supplementary Reading:**

1..Duraipandian P and Laxmi Duraipandian, (1975), *Analytical Geometry-3D*, Emerald
   Publishers, Chennai.

2. Thomas G.B. and .Finney R.L, (1998), *Calculus and Analytic Geometry*, 9th Edition,
   Addison Wesley, Mass, (Indian Print).

3. Vittal P.R., (2003), *Coordinate Geometry*, Margham Publishers, Chennai.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| **CO1** | 3 | 3 | 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 |

| 19IXXXV50 | VALUE EDUCATION | L | T | P | C |
|-----------|----------------|---|---|---|---|
|           |                | 2 |   |   | 2 |

**LEARNING OBJECTIVES**

LO1.This paper focuses on Value Educations among the young minds.

LO2.To nurture the rational ethics among the students community.

LO3.To understand the importance of Human Freedom as responsibility.

LO4.To taught about Lifestyle, Equality and Fraternity.

LO5.To include the ethical values to the students and develop the ethical culture.

**COURSE OUTCOMES**

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

CO1.The students may lead a life in ethical way and also able to take ethical based rational decision in their life.

CO2.Better understanding of moral consciousness of day to day life.

**UNIT – I**

Value education – Meaning – Nature and Purpose

Importance of Value Education

**UNIT – II**

Basic Features of Rational Ethics- Moral consciousness and conscience

Love – the ultimate moral norm

**UNIT – III**

Morality and Freedom - Human Freedom and Moral Responsibility- God, Religion and Morality

Sanction for Moral Life.

**UNIT – IV**

Social Ethics: Value of life and human beings

Liberty. Equality and Fraternity

**UNIT – V**

Ethical Issues Today: Religious Ethics- Family Ethics- Political Ethics - Business Ethics- Ethics and Culture.

**TEXT BOOKS**

1. Heroled Titus, *Ethics for Today*. New Delhi: Eurasia Publishing House, 1964.

2. Madan, G.R., *Indian Social Problems*, New Delhi: Allied Publishers, 1966.

## SUPPLEMENTARY READINGS

1. Sharma, R.N., *Principles of Sociology*, Meerut: Educational Publishers, 1968
2. Willam, K., *Ethics* , Delhi: Prentice Hall of India,1999
3. Arumugam, N., *Value based Education*, Madras: Saras, 2012

### Outcome Mapping

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| CO1 | 3 | | | | 1 | | | | | | 2 | | | | 1 | | | 2 |
| CO2 | | 3 | | 1 | | 1 | | 2 | | 2 | | 2 | | 1 | | | | |
| CO3 | | 2 | | | 2 | | | | | 1 | | | | 2 | | | 2 | |
| CO4 | 1 | | 2 | | | 1 | | | | | | 1 | | | 2 | | 3 | |
| CO5 | 3 | | | 3 | | | 2 | | 1 | | 3 | | 3 | | 2 | | | 2 |

| Semester | 19IMATC61: Core – 14 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| VI | Real Analysis – II | 5 | 0 | 0 | 5 |

### Learning Objective (LO):

| LO1 | To understand Integration process of Riemann to develop the understanding of point wise and uniform convergence of sequence and series of functions. |
|-----|---|
| LO2 | To enhance the mathematical maturity and to work comfortably with concepts. |

### Course Outcomes (CO)

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

| CO1 | Describe fundamental properties of matric spaces that lead to the formal development of  matric spaces. |
|-----|---|
| CO2 | Demonstrate an understanding of a set of measure zero and how that are used in Riemann integral. |
| CO3 | Differentiate  point wise convergence and uniform convergence of a sequence of functions  and  series of  functions. |

**Unit-1: Connectedness, Completeness**

Open Sets – Connected Sets – Bounded Sets and Totally Bounded Sets – Complete Metric Spaces.

**Unit-2: Compactness**

Compact Metric Space – Continuous Functions on Compact Metric Spaces - Continuity of Inverse Functions – Uniform Continuity.

**Unit-3: Riemann Integration**

Sets of measure zero - Definition Riemann Integral – Properties of Riemann Integral – Derivatives.

**Unit-4: Riemann Integration [Contd...]**

Rolle's Theorem – The law of mean – Fundamental theorems of calculus – Taylor's theorem.

**Unit-5: Sequences and Series of Functions**

Pointwise convergence of sequences of functions – Uniform convergence of sequences of functions – consequences of uniform convergence – Convergence and uniform convergence of series of functions.

**Text Book:**

Goldberg R., (1970), *Methods of Real Analysis*, Oxford & IBH Publishing Co., New Delhi.

Unit – I          Ch. 6.1 to 6.4
Unit – II         Ch. 6.5 to 6.8
Unit – III        Ch. 7.1, 7.2 7.4, 7.5
Unit – IV        Ch. 7.6 to 7.8 and 8.5
Unit – V         Ch. 9.1 to 9.4

**Supplementary Reading:**

1.   Tom M.Apostol, (1974), *Mathematical Analysis*, 2$^{nd}$ Edition, Addison-Wesley Publishing Company Inc., New York.
2.   Bartle.R.G. and Shebert, (1976),  *Real Analysis*, John Wiley and Sons Inc., New York.
3.   Malik, S.C. and Savita Arora,  (1991), *Mathematical Analysis*, Wiley Eastern Limited, New Delhi.
4.   Sanjay Arora and Bansi Lal,  (1991), *Introduction to Real  Analysis*, Satya Prakashan, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC62: Core – 15 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| VI | Complex Analysis | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This paper is an introduction to the theory of analytic functions of one complex variable. |
|-----|---------------------------------------------------------------------------------------------|
| LO2 | Properties of analytic functions, results on linear transformations, problems on complex integration are discussed. |
| LO3 | Calculus of residues are also studied. |

**Course Outcomes (CO)**

Students will be introduced to and have knowledge of many mathematical concepts

| CO1 | examples and counter examples |
|-----|-------------------------------|
| CO2 | proof  techniques |
| CO3 | problem solving<br>studied in complex analysis such as<br>      Analytic function,<br>      Some mappings,<br>      Complex integration,<br>      Power series. |

**Unit-1:**

Analytic function:  Introduction, Laws of algebra, Functions of a complex variable, Continuous functions, Analytic functions, Cauchy-Riemann equations.

**Unit-2:**

Conformal mapping, Bilinear transformation, Special bilinear transformation, Stereo graphical projection.

**Unit-3:**

Integration in the complex plane, Complex integration, Cauchy's integral theorem, Extension of Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Morera's theorem, Cauchy's inequality, Liouville's theorem, Fundamental theorem of algebra, Maximum modulus theorem.

**Unit-4:**

Expansion of functions in power series, Taylor's theorem, Laurent's theorem, Singular points; Pole, essential singularity and removable singularity, Weirstrass theorem, Meromorphic function, Argument principle, Rouche's theorem.

**Unit-5:**

Residues-Evaluation of definite integrals, Evaluation of residue at a pole, Residue theorem, Evaluation of definite integrals, Jordan's lemma.

**Text Book:**

Narayanan S. and Manicavachagom Pillay T.K., *Complex Analysis*, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai – 31.

Unit I  -        Chapter 1 and 2 all sections
Unit II -        Chapter 3 all sections
Unit III-        Chapter 4 all sections
Unit IV-        Chapter 5 all sections
Unit V -        Chapter 6 all sections

**Supplementary Reading:**

1. Conway J.B.,  (1973), *Functions of one Complex Variable*, Springer-Verlag, New Delhi.
2. Ponnusamy S., (1995), *Foundations of Complex Analysis*, Narosa Publishing House,
   New  Delhi.
3. Ahlfors L.V., (1979), *Complex Analysis*, McGraw Hill, New Delhi.

## Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC63: Core – 16 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| VI | Algebra | 5 | 0 | 0 | 5 |

## Learning Objective (LO):

| LO1 | Modern algebra plays a major role in other branches of Mathematics. |
|-----|---------------------------------------------------------------------|
| LO2 | Properties of analytic functions, results on linear transformations, problems on complex integration are discussed. |
| LO3 | Homomorphism of groups and rings, automorphisms of groups are discussed. |
| LO4 | The properties of rings, ideals, quotient rings and Euclidean rings are discussed. |

## Course Outcomes (CO)

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

| CO1 | explain the fundamental concepts of algebra such as groups, subgroups, quotient groups, homomorphism, automorphisms and using these ideals, Cayley's theorem and permutation groups. |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO2 | demonstrate accurate and efficient use of a ring with examples, some classes of a ring, homomorphism of a ring, ideals, quotient rings and integral domain. |
| CO3 | solve problems in the above related topic. |

**Unit-1: Group Theory**

Definition and examples of groups, Some preliminary Lemmas, Subgroups.

**Unit-2: Group Theory (continued)**

A Counting principle, Normal subgroups and Quotient groups, Homomorphisms.

**Unit-3: Group Theory (continued)**

Automorphisms, Cayley's theorem, Permutation groups.

**Unit-4: Ring Theory**

Definition and examples of rings, Some special classes of rings, Homomorphisms, Ideals and quotient rings.

**Unit-5: Ring Theory (continued):**

More on ideals and quotient rings, The field of quotients of an integral domain.

**Text Book:**

I.N. Herstein, (1999), *Topics in Algebra*, John Wiley and Sons, New  York.

Unit I -        Chapter 2: Sections 1 to 4.

Unit II-        Chapter 2: Sections 5 to.7.

Unit III-       Chapter 2: Sections 8 to10.

Unit IV-       Chapter 3: Sections 1 to 4.

Unit V-        Chapter 3: Sections 5 and 6.

**Supplementary Reading:**

1. Balakrishnan R. and Ramabhadharan N., (1994), *A textbook of Modern Algebra*, Second Revised  Edition, Vikas Publishing House, New Delhi.
2. Fraleigh J.B., (1999), *A first course in Abstract Algebra*, Fifth Edition,  Addison-Wesley, New Delhi.

 **Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC64: Core – 17 | L | T | P | C |
|---|---|---|---|---|---|
| VI | Discrete Mathematics | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | Students must understand mathematical reasoning in order to read, comprehend and construct mathematical arguments. |
|---|---|
| LO2 | Mathematical logic, which serves as foundation for subsequent discussion is discussed. |
| LO3 | Discrete structures such as sets and permutations are studied. |
| LO4 | Discrete probability, recurrence relations, conquer relations and principles of inclusion and exclusion are studied. |

**Course Outcomes (CO)**

Students will be introduced to and have knowledge of many mathematical concepts

| CO1 | examples and counter examples |
|---|---|
| CO2 | Proof techniques |
| CO3 | problem solving <br>     studied in Discrete Mathematics such as <br>         Logic <br>         Relations <br>         Functions <br>         Some Algebraic structure |

**Unit-1: Logic and Counting**

Propositions and logical operations, Conditional statements, Methods of Proof, Mathematical Induction. Permutations, Combinations, Pigeonhole Principle, Elements of Probability, Recurrence Relations.

**Unit-2: Relations and Digraphs**

Product sets and partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of relations, Equivalence Relations, Computer Representation of Relations and Digraphs, Operations on Relations, Transitive Closure and Warshall's Algorithm.

**Unit-3: Functions**

Functions, Functions for Computer Science, Growth of Functions, Permutation Functions.

**Unit-4: Order Relations and Structures**

Partially Ordered Sets, Extremal Elements of Partially Ordered Sets, Lattice, Finite Boolean Algebras, Functions on Boolean Algebra, Circuit Designs.

**Unit-5:**

Languages and Finite State Machine.

**Text Book:**

Bernard Kolman, Robert C. Busby and Sharon Cutler Ross, (2002), *Discrete Mathematical Structures,* Prentice - Hall of India, Private Limited, New Delhi.

Unit I    Chapter 2 Sections 1 to 4, Chapter 3 Sections 1 to 5.

Unit II    Chapter 4 Sections 1 to 8.

Unit III   Chapter 5 Sections 1 to 4.

Unit IV   Chapter 6 Sections 1 to 6.

Unit V    Chapter 10 Sections 3 to 5.

**Supplementary Reading:**

1. Goodaire E.G. and Paramenter M.M., (1998), *Discrete Mathematics with Graph Theory*, Prentice Hall International Editions, New Jersey.
2. Matonsek J. and Nesetril J., (1998), *Invitation to Discrete Mathematics,* Clarendon Press, Oxford.
3. Tremblay J.P. and Manohar R., (1997), *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill Publication Company, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC65: Core – 18 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| VI | Optimization Techniques | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | Mathematical programming finds applications in diverse fields including Engineering, Management Sciences, Computer Science and Economics. |
|-----|----|
| LO2 | In this course, the general linear programming problem, simplex computation procedure, revised simplex method, duality problems in linear programming and some nonlinear programming problems are covered. |

**Course Outcomes (CO)**

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

| CO1 | Apply for finding solutions of general linear programming by Simplex computational procedure |
|-----|----|
| CO2 | Apply for finding feasible solutions by Artificial technique and by Perturbation technique. |
| CO3 | Apply for finding solutions using revised simplex method and duality problems. |
| CO4 | Apply for finding solutions by additional computational technique and transportation problems. |
| CO5 | Apply for finding solutions of Non-linear programming. |

**Unit-1:**

The General Linear Programming problem:, The linear programming problem, properties of solution to the linear programming problem, Generating extreme - point solutions. The Simplex Computational procedure: Development of a minimum feasible solution, computational procedure.

**Unit-2:**

The Artificial – Basis Technique: A first feasible solution using slack variables, Geometric Interpretation of the simplex procedure.

Degeneracy and anticycling procedure: Perturbation Techniques, The lowest – Index Anticycling Rules, Example of Cycling.

**Unit-3:**

The Revised Simplex method: The General form of the inverse, The Product form of the inverse, Computational considerations.

The Duality problems of linear programming: The unsymmetric Primal - Dual problems, the symmetric primal-dual problems, Economic Interpretation of the Primal, Dual problems.

**Unit-4:**

Additional computational Technique: Determining a first feasible solution, The dual simplex method, Integer programming.

The Transportation problem: The General Transportation problem, Computational procedure for solving the transportation problem, Variations of the transportation problem.

**Unit-5:**

Non-Linear Programming: The General problem of mathematical programming, Mathematical background, the convex programming problem, Quadratic programming, Separable programming.

**Text Book:**

Gass Saul I., (1994), *Linear Programming - methods and applications*, Fifth Edition, McGraw Hill, New Delhi.

Unit I    -       Chapter 3 Sections 1, 2 and 3 and Chapter 4
                      Sections 1 and 2
Unit II   -       Chapter 4 Sections 3, 4 and 5 and  Chapter 7
                      Sections 1, 2 and 3
Unit III  -       Chapter 5 Sections 1, 2 and 3 and Chapter 6
                      Sections 1,2 and 3
Unit IV  -       Chapter 9 Sections 1, 2 and 3 and Chapter 10
                      Sections 1, 2 and 3
Unit V   -       Chapter 12 Sections 1 to 5

**Supplementary Reading:**

1.   Taha H.A., (1998), *Operations Research - An Introduction*, Macmillan publishing Co.,
       New York.
2.   Hadley G., (1962), *Linear Programming*, Oxford and IBH Pub. Co., New Delhi.
3.   Kambo N.S., (1991), *Mathematical Programming*, Affliated East-West Press, New Delhi.
4.   Sharma J.K., *Operations Research*, Trinity (Laxmi Publications), New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IMATC66: Core – 19 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| VI | **Experiential Learning** | 0 | 0 | 4 | 2 |

Experiential learning provides opportunities to students to connect principles of the discipline with real-life situations.

In-plant training/field trips/internships/industrial visits fall under this category.

Experiential Learning is a process of learning through experience. It is specifically defined as "learning through reflection on doing".

| Semester | 19IMATC71: Core – 20 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| VII | **Advanced Abstract Algebra – I** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics. |
|-----|---|
| LO2 | The focus of the course will be the study of certain structures called groups and some related structures. |
| LO3 | Some advanced concept of groups, Dihedral groups are introduced. Homomorphsims and Isomorphisms, cyclic groups, permutation groups, Sylow's theorem, direct and semi-direct products are studied. |

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

| | |
|---|---|
| *CO1* | give examples and counter examples |
| *CO2* | understand  techniques |
| *CO3* | solve problems |

of various concepts in:

- Groups,
- Quotient Groups,
- Homomorphism of Groups,
- Group Actions,
- Direct products of Groups.

**Unit-1: Introduction to groups**:

Dihedral groups - Symmetric groups - Matrix groups - Homomorphisms and Isomorphisms - Group actions.

Subgroups: Definition and Examples - Centralizers and Normalizers, Stabilizers and Kernels.

**Unit-2: Subgroups (Continued):**

Cyclic groups and Cyclic subgroups of a group.

Quotient Groups and Homomorphisms: Definitions and Examples - More on cosets and Lagrange's Theorem - The isomorphism theorems - Transpositions and the Alternating group.

**Unit-3: Group Actions:**

Group actions and permutation representations - Groups acting on themselves by left multiplication - Cayley's theorem - Groups acting on themselves by conjugation - The class equation - Automorphisms.

**Unit-4: Group Actions (Continued):**

The Sylow theorems - The simplicity of An.

Further topics in group theory:   p-groups, Nilpotent groups and Solvable groups.

**Unit-5: Direct and semi-direct products and abelian groups:**

Direct Products - The fundamental theorem of finitely generated abelian groups - Table of groups of small order - semi direct products.

**Text Book:**

1. David S. Dummit and Richard M. Foote, (2004),*Abstract Algebra,* Third Edition, Wiley Student Edition, ISBN 0-471-4334-9.

   Unit I:   Chapter 1: (Sections 1.2, 1.3. 1.4, 1.6, 1.7) and

   Chapter 2: (Sections 2.1, 2.2)

   Unit II:  Chapter 2: (Section 2.3) and

   Chapter 3: (Sections 3.1, 3.2, 3.3, 3.5)

   Unit III: Chapter 4: (Sections 4.1, 4.2, 4.3, 4.4)

   Unit IV: Chapter 4: (Sections 4.5, 4.6) and

   Chapter 6: (Section 6.1)

   Unit V:  Chapter 5: (Sections 5.1, 5.2, 5.3, 5.5)

**Supplementary Reading:**

1. Herstein I.N., (2007), *Topics in Algebra,* Second Edition, John Wiley & Sons, New Delhi, Third Reprint.
2. Jacobson N. and Van D., (1951), *Lectures in Abstract Algebra*, Nostrand Co., Vol. I, New York.
3. Anderson M. and Feil T., (2005), *A First Course in Abstract Algebra – Rings, Groups, and Fields*, Chapman & Hall/CRC.
4. Artin M., (2015), *Algebra*, Prentice Hall of India, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC72: Core – 21 | L | T | P | C |
|---|---|---|---|---|---|
| VII | **Advanced Real Analysis** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | The concept of derivatives of real valued functions and their properties are studied. |
|---|---|
| LO2 | Properties of monotonic functions, functions of bounded variations are also introduced. |
| LO3 | The concept of Riemann-Stieltjes integral and its properties are studied. |
| LO4 | The notion of convergence and uniform convergence of real valued functions and infinite series of functions are also studied. |

**Course Outcomes (CO)**

At the end of the course, the student will be able to introduced to and have knowledge of many mathematical concepts

| CO1 | of proof techniques |
|---|---|
| CO2 | of problem solving |
| CO3 | studied in real analysis such as <br><br> • Functions of bounded variations, <br><br> • Riemann –Stieltjes Integral, <br><br> • Sequence of functions, <br><br> • Multivariate Differential Calculus. |

**Unit-1:Functions of Bounded Variation:**

Properties of monotonic functions, Functions of bounded variation, Total variation, Additive property of total variation, Total variation on [a, x] as a function of x, Functions of bounded variation expressed as the difference of increasing functions, Continuous functions of bounded variation.

Riemann-Stieltjes Integral: The definition of the Riemann-Stieltjes integral, Linear properties, Integration by parts.

**Unit-2:Riemann-Stieltjes Integral (Continued) :**

Change of variable in a Riemann-Stieltjes integral, Reduction to a Riemann integral, Step functions as integrators, Reduction of a Riemann-Stieljes integral to a finite sum, Euler's summation formula, Monotonically increasing integrators, Upper and lower integrals, Additive and linearity properties of upper and lower integrals, Reimann's condition, Comparison theorems, Integrators of bounded variation.

### Unit–3:Riemann-Stieltjes Integral (Continued):

Sufficient conditions for existence of Riemann-Stieltjes integrals, Necessary conditions for existence of Riemann-Stieltjes integrals, Mean value theorems for Riemann-Stieltjes integrals, The integral as a function of the interval, Second fundamental theorem of integral calculus, Change of variable in a Riemann integral, Second mean-value theorem for Riemann integrals, Riemann-Stieltjes integrals depending on a parameter, Differentiation under the integral sign, Interchanging the order of integration.

### Unit–4:Sequence of functions:

The Taylor's series generated by a function, Bernstein's theorem, Abel's limit theorem, Tauber's theorem.

Multivariable differential calculus: The directional derivative, directional derivatives and continuity, the total derivative, the total derivative expressed in terms of partial derivatives.

### Unit–5:Multivariable differential calculus (Continued):

The Jacobian matrix.

Implicit functions: Functions with non-zero Jacobian determinant, the inverse function theorem, the implicit function theorem.

### Text Book:

Tom. M. Apostol, (1974), *Mathematical Analysis*, Second Edition, Narosa Publishing House, New Delhi.

Unit – I        Chapter 6 Sections 6.1 to 6.8;

            Chapter 7 Sections 7.1 to 7.5;

Unit – II       Chapter 7 Sections 7.6 to 7.15;

Unit – III      Chapter 7 Sections 7.16 to 7.25;

Unit – IV       Chapter 9 Sections 9.19; 9.20, 9.22, and 9.23;

            Chapter 12 Sections 12.1 to 12.5;

Unit – V        Chapter 12: Section 12.8;

            Chapter 13 Sections 13.1 to 13.4.

Unit – VI     Chapter 14 Sections 14.1 to 14.3

**Supplementary Reading:**

1. Walter Rudin, (2013), *Principles of Mathematical Analysis*, McGraw-Hill International Book Company, New Delhi.
2. Malik S.C and Arora, S., (1991), *Mathematical Analysis*, Wiley Eastern Ltd., New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC73: Core – 22 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| VII | **Advanced Differential Equations** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This Course aims to provide problem solving techniques in ordinary differential equations with variable coefficients and some special partial differential equations of Mathematical Physics such as Elliptic and Parabolic equations. |
|-----|---|

**Course Outcomes (CO)**

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

| CO1 | Apply the fundamental concept of ordinary and partial differential equation to demonstrate their understanding of how physical phenomena are modelled by second order differential equations and dynamical systems; and perform operations with Bessel, Hermite and Legendre differential  equations  along with the corresponding recurrence formulas of different functions. |
|-----|---|

| CO2 | Solve various first order and higher orders differential equations with their applications. |
|-----|----------------------------------------------------------------------------|
| CO3 | Illustrate the mathematical aspects that contribute to the solution of heat, wave and diffusion equations. |

### Unit-1: Linear Equation with Variable Coefficients

Initial value problems - Existence and uniqueness theorems - Solutions to solve a non-homogeneous equation - Wronskian and linear dependence - reduction of the order of a homogeneous equation - homogeneous equation with analytic coefficients -The Legendre equation.

### Unit-2: Linear Equation with Regular Singular Points

Euler equation - Second order equations with regular singular points - Exceptional cases - Bessel Equation.

### Unit-3: Existence and Uniqueness of Solutions to First Order Equations

Equation with variable separated - Exact equations - method of successive approximations - the Lipschitz condition - convergence of the successive approximations and the existence theorem.

### Unit-4: Elliptic Differential Equations

Derivation of Laplace and Poisson equation - BVP - Separation of Variables - Dirichlet Problem and Newmann Problem for a rectangle - Interior and Exterior Dirichlet problems for a circle - Interior Newmann problem for a circle - Solution of Laplace equation in Cylindrical and spherical coordinates - Examples.

### Unit-5: Parabolic Differential Equations

Formation and solution of Diffusion equation - Dirac-Delta function - Separation of variables method - Solution of Diffusion Equation in Cylindrical and spherical coordinates - Examples.

**Text Books:**

1. Coddington E.A.,(1987) *An Introduction to Ordinary Differential Equations*, Prentice Hall of India, New Delhi.

    Unit-I  Chapter 3: Sections 1 to 8 [Omit Section 9]

    Unit-II Chapter 4: Sections 1 to 4 and 6 to 8 [Omit  Sections 5 and 9]

    Unit-III Chapter 5: Sections 1 to 6 [Omit Sections 7 to 9]

    Unit – VI Chapter 6: Sections 2 and 3

2. Sankar Rao S., (2005), *Introduction to Partial Differential Equations*, 2<sup>nd</sup> Edition, Prentice Hall of India, New Delhi,.

> Unit-IV Chapter 2: Sections 2.1, 2 2, 2.5 to 2.13 (omit Sections 2.3 and 2.4)
>
> Unit-V Chapter 3: Sections 3.1 to 3.7 and 3.9  (omit Section 3.8)
>
> Unit – VI Chapter 4: Sections 4.1 to 4.3

## Supplementary Reading:

1. George F. Simmons, (2004),*Differential equations with applications and historical notes*, Second Edition, Tata McGraw Hill  Publishing Company, New Delhi.
2. Hildebrand, F.B.,  (1976) *Advanced calculus for applications*, Prentice - Hall. Inc.
3. Sneddon I.N., (2006), *Elements of Partial Differential Equations*, McGraw Hill, New Delhi.
4. Raisinghania, M.D., (2001), *Advanced Differential Equations*, S.Chand & Company Ltd., New Delhi.
5. King A.C., Billingham J. and Otto S.R., (2006), *Differential Equations*, Cambridge University Press.

## Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC74: Core – 23 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| VII | **Differential Geometry** | 5 | 0 | 0 | 5 |

## Learning Objective (LO):

| LO1 | To introduce space curves, surfaces, curves on surfaces and study some of their properties. |
|-----|---------------------------------------------------------------------------------------------|

| LO2 | To study the notion of geodesic and its properties. |
|-----|-----------------------------------------------------|
| LO3 | To understand some type of special surfaces such as developables and minimal surfaces. |

## Course Outcomes (CO)

After successful completion of the course the student will be able to:

| CO1 | understand the concept of a space curve in 3D and compute the curvature and torsion of space curves; |
|-----|------------------------------------------------------------------------------------------------------|
| CO2 | understand the fundamental existence theorem for space curves; |
| CO3 | find geodesics equations on a surface; |
| CO4 | understand surfaces of constant curvature (Minding's  theorem) and Gaussian curvature; |
| CO5 | determine the second fundamental form and developables associated with space curves. |

### Unit–1: Space curves

Space curves, Arc length, Tangent, normal and binormal, Curvature and torsion of a curve given as the intersection of two surfaces.

### Unit–2: Space curves (continued)

Contact between curves and surfaces, Tangent surface, involutes and evolutes, Intrinsic equations, Fundamental existence theorem for space curves, Helices.

### Unit–3: Metric

Surface, Curves on a surface, Metric, Direction coefficients, Geodesics, Canonical geodesic equations, Normal property of geodesics, Geodesic curvature.

### Unit–4: Metric (continued)

Gauss-Bonnet theorem, Gaussian curvature, Surfaces of constant curvature, Conformal mapping, Only statements of Dini's theorem and Tissot's theorem.

### Unit–5: Second Fundamental form

Second fundamental form, Developables, Developables associated with space curves, Developables associated with curves on surfaces, Minimal surfaces.

**Text Book:**

1. Willmore, T.J., (1959), *An Introduction to Differential Geometry*, Oxford University Press, New Delhi.

   Unit-I    Chapter 1 Sections 1 to 5

   Unit-II   Chapter 1 Sections 6 to 9

   Unit-III  Chapter 2 Sections 1, 2, 5, 6, 10, 11, 12 and 15

   Unit-IV  Chapter 2 Sections 16 to 20

   Unit-V   Chapter 3 Sections 1, 4, 5, 6, 7.

**Supplementary Reading:**

1. Struik, D.T., (1950), *Lectures on Classical Differential Geometry,* Addison-Wesley Press.
2. Andrew Pressley, (2001), *Elementary Differential Geometry*, Springer.
3. Heinrich, W. Guggenheimer, (1977), *Differential Geometry*, Dover Publications Inc., New York.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IMATC81: Core – 24 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| VIII | **Advanced Abstract Algebra – II** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| | |
|---|---|
| *LO1* | This course aims to provide a continuation of Advanced Abstract Algebra-I. |
| *LO2* | The focus of the course will be the study of Rings, Polynomial rings, Euclidean ring, Unique factorization domains, Module Theory, Field theory and Splitting fields.. |

**Course Outcomes (CO)**

Students will be introduced to and have knowledge of many mathematical concepts of

| | |
|---|---|
| *CO1* | abstract structures |
| *CO2* | proof  techniques |
| *CO3* | problem solving  studied in Abstract Algebra such as <ul><li>Rings,</li><li>Irreducibility,</li><li>Modules, a generalization of vector spaces,</li><li>Fields.</li></ul> |

**Unit-1: Introduction to Rings:**

Examples: Polynomial rings - Matrix rings and group rings - Ring Homomorphisms and quotient rings - Properties of Ideals - Rings of fractions - The Chinese remainder theorem.


**Unit-2: Rings (continued):**

Euclidean domains, principal ideal domains and unique factorization domains.

Polynomial rings: Definitions and basic properties – Polynomial rings over fields.

**Unit-3: Polynomial rings (continued):**

Polynomial rings that are unique factorization domains – Irreducibility criteria – Polynomial ring over fields. Introduction to Module Theory: Basics definitions and examples – Quotient modules and Module homomorphism.

**Unit-4: Field theory:**

Basic Theory of field extensions - Algebraic Extensions.

**Unit-5: Field theory (continued):**

Splitting fields and Algebraic closures - Separable and inseparable extensions - Cyclotomic polynomials and extensions.

**Text Book:**

1. David S. Dummit and Richard M. Foote, (2004), *Abstract Algebra*, Third Edition, Wiley Student Edition.

   Unit I:   Chapter 7: (Sections 7.2,7.3,7.4,7.5,7.6)

   Unit II:  Chapter 8: (Sections 8.1,8.2,8.3) and

         Chapter 9: (Sections 9.1,9.2)

   Unit III: Chapter 9: (Sections 9.3,9.4,9.5),

         Chapter 10: (Sections 10.1,10.2)

   Unit IV: Chapter 13: (Sections 13.1,13.2)

   Unit V:  Chapter 13: (Sections 13.4,13.5,13.6)

## Supplementary Reading:

1. HersteinI.N., (2007), *Topics in Algebra,* Second Edition, John Wiley & Sons, New Delhi, Third Reprint.
2. Jacobson N. and Van D.,(1951), *Lectures in Abstract  Algebra*, Nostrand Co., Vol. I, New York.
3. Anderson,M. and Feil T., (2005), *A First Course in Abstract  Algebra – Rings, Groups, and Fields*, Chapman &Hall/CRC,.
4. Artin, M., (2015), *Algebra*, Prentice Hall of  India, New Delhi.

## Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC82: Core – 25 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| VIII | **Measure Theory and Integration** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | The concept of Lebesgue measure is introduced. |
| --- | --- |
| LO2 | Measure space and integration with respect to a measure are introduced |
| LO3 | Convergence in measure and properties of $L^p$ space are discussed. |

**Course Outcomes (CO)**

Students will be introduced to and have knowledge of many mathematical concepts of

| CO1 | measures and spaces |
| --- | --- |
| CO2 | proof  techniques |
| CO3 | problem solving<br><br>studied in Measure theory & Integration such as<br><br>•     Measurable sets and Measurable functions,<br><br>•     Integration with respect to Measure,<br><br>•     Convergence in Measure. |

**Unit-1:**

Lebesgue Outer measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue measurability.

**Unit-2:**

Integration of nonnegative functions, General integral, Integration of series, Riemann and Lebesgue integrals.

**Unit-3:**

Continuous non-differentiable functions, Lebesgue differential theorem (statement only), Differentiation and Integration, Lebesgue set, Convergence in measure, Almost uniform convergence.

**Unit–4:**

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

**Unit-5:**

$L^p$ spaces, Convex functions, Jensen's inequality, The inequalities of Holder and Minkowski, Completeness of $L^p$ (μ).

**Text Book:**

1. G. de Barra, (2005), *Measure Theory and Integration*, New Age International Publishers, Chennai.

   Unit – I        Chapter 2: Sections 2.1 to 2.5

   Unit – II        Chapter 3: Sections 3.1 to 3.4

   Unit – III        Chapter 4: Sections 4.2, 4.4 to 4.6 and

   Chapter 7: Sections 7.1,7.2

   Unit – IV        Chapter 5: Sections 5.1 to 5.6

   Unit – V        Chapter 6: Sections 6.1 to 6.5.

   Unit – VI        Chapter 7: Sections 7.1 to 7.3

**Supplementary Reading:**

1. Royden, (1968), *Real Analysis*, MacMillan Publishing Company, New York.
2. Ganapathy Iyer, V., (1977), *Mathematical Analysis*, Tata McGraw Hill Publication Co. Ltd., New Delhi.
3. Halmos, P.R., (1950), *Measure Theory*, Van Nostr and Princeton, New Jersey.
4. Michael E. Taylor, (2006), *Measure Theory and Integration by Graduate Studies in Mathematics*, Indian Edition, Volume 76, American Mathematical Society.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC83: Core – 26 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| VIII | **Advanced Complex Analysis** | 5 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | This course aims to train the students to get essential knowledge in functions of a complex variable. |
|-----|----------------------------------------------------------------------------------------------------------|
| LO2 | Analytic functions and their properties, Residue theorem and its applications, Riemann mapping theorem are discussed in detail. |

## Course Outcomes (CO)

After successful completion of the course the student will be able to

| CO1 | use Cauchy's integral theorem or formula to compute complex line integrals; |
|-----|-----------------------------------------------------------------------------|
| CO2 | compute the Taylor's theorem, to determine the nature of the removable singularities; |
| CO3 | explain the convergence of power series and develop analytical capabilities in Taylor or Laurent series in a given domain; |
| CO4 | determine the concept of conformal mapping of polygons, to find Schwarz – Christoffel formula. |

### Unit–1:Complex integration:

Line integrals, Rectifiable arcs, Line integrals as functions of arcs, Cauchy's theorem for a rectangle, Cauchy's theorem in a Disc.

Cauchy's integral Formula:

The index of a point with respect to a closed curve, The integral formula, Higher derivatives.

### Unit–2:Local Properties of Analytic Functions:

Removable Singularities, Taylor's theorem, Zeros and poles, The Local Mapping and The Maximum Principle.

The General Form of Cauchy's Theorem:

Chains and cycles, Simple connectivity, Locally exact differentials, Multiply connected regions.

### Unit–3:Harmonic Functions:

Definition and basic properties, The mean-value property, Poisson's Formula, Schwarz's theorem, The Reflection principle.Power Series Expansions:Weierstrass's Theorem, The Taylor series, The Laurent Series.

### Unit–4:Partial Fractions and Factorization:

Partial fractions, Infinite products and Canonical products. Normal Families: Equicontinuity, Normality and Compactness, Arzela's Theorem, Families of Analytic Functions, The classical definition.

**Unit–5:The Riemann Mapping Theorem:**

Statement and Proof Conformal mapping of Polygons: The behaviour at an angle, The Schwarz-Christoffel formula, Mapping on a rectangle, The triangle functions of Schwarz. A Closer look at Harmonic Functions: Functions with the Mean-value Property, Harmack's Principle.

**Text Book:**

1.  AhlforsL.V., (2014), *Complex Analysis*, Third Edition, McGraw Hill Inc., New Delhi.

    Unit-I    Chapter 4 Sections 1 & 2.

    Unit-II   Chapter 4 Sections 3,  4 (4.1, 4.2, 4.6 and 4.7 only).

    Unit-III  Chapter 4 Section  6; Chapter 5 Section 1.

    Unit-IV  Chapter 5 Section 2 (2.1, 2.2 and 2.3 only).

             Chapter 5 Section 5.

    Unit-V  Chapter 6 Sections 1 (1.1 only), 2 and 3.

**Supplementary Reading:**

1.  Conway J.B., (1973), *Functions of One Complex Variable,* Springer-Verlag.
2.  Silverman H., (1975), *Complex Variables*, Hughton Miffin  Company.
3.  Ponnusamy S., (2005), *Foundations of Complex Analysis*, Second Edition, Narosa Publishing House, New Delhi,
4.  James Ward Brown and Ruel V. Churchill, (2014), *Complex  Variables and Applications*, McGraw Hill Education (India), New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IMATC84: Core – 27 | L | T | P | C |
|---|---|---|---|---|---|
| VIII | **C++   Computer Practical** | 0 | 0 | 4 | 2 |

**Learning Objective (LO):**

| **LO1** | The objective are acquire the practical knowledge to solve problems including the fields of optimization, number theory and matrix theory. |
|---|---|

**Course Outcomes (CO)**

By the end of the course,

| **CO1** | the students will be able to gain knowledge between theory and practical. |
|---|---|

**1. Solution of Linear Programming Problem.**

**2. Deterministic Inventory Models.**

 i. Single-item Static Model.
ii. Single-item Static Model with Price Breaks.
iii. Multi-item Static Model with Storage Limitation.

**3. Number Theory:**

i. Reversing of an integer series.
ii. Generating Fibonocci series.
iii. Average and Standard Deviation of numbers.
iv. Identification of Prime, Even and Odd integers.

**4. Matrix Theory**

i. Determinant of a matrix.
ii. Rank of a matrix.
iii. Inverse of a matrix.
iv. Product of matrices.

**Text Books:**

1. Hamdy A. TAHA, (2014), *Operations Research – An  Introduction*, Macmillan Publishing Company, New  York.
2. Ivan Niven, Herbert  S.Zuckerman and Hugh L. Montgomery, (2015), *An Introduction to the theory of  Numbers*, Wiley, New Delhi.
3. Grewal,  B.S.,(2014),  *Higher  Engineering  Mathematics*,  $40^{th}$   Edition,  Khanna Publications, New Delhi.

.**Supplementary Reading:**

1. Premkumar Gupta and D.S.Hira, (2016), *Operations Research*, S.Chand Publications, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | 3 | 2 | 3 | 2 | | | | 3 | 2 | 3 | 2 | 3 |

| Semester | 19IMATC91: Core – 28 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| IX | **Topology** | 3 | 0 | 0 | 5 |

**Learning Objective (LO):**

| LO1 | The idea and method of topology have transformed large parts of geometry and analysis. |
|-----|--------------------------------------------------------------------------------------|
| LO2 | This subject is of interest in its own right, and it also serves to lay the foundations for future studies in analysis and geometry. |
| LO3 | In this course we teach the basics of topology including connectedness, compactness, countability, separation axioms, Tychonoff theorem and complete metric spaces. |

**Course Outcomes (CO)**

Students will be introduced to and have knowledge of many mathematical concepts of,

| CO1 | spaces |
|-----|--------|
| CO2 | proof techniques |
| CO3 | problem solving studied in Topology such as<br>• Connectedness<br>• Compactness<br>• Completeness<br>which are studied in Real Numbers. |

**Unit-1:**

Topological spaces, Basis for a topology, The order topology, The product topology on $X \times Y$.

**Unit-2:**

The subspace topology, Closed sets and limit points, Continuous function, The product topology.

The metric topology, Connected spaces, Connected subspaces of the real line, Components and Local connectedness.

**Unit-3:**

Compact spaces, Compact subspaces of the real line, Limit point compactness, Local compactness.

**Unit-4:**

Countability axioms, The separation axioms, Normal spaces, Urysohn Lemma, Urysohn metrization theorem, Tietze extension theorem.

**Unit-5:**

The Tychonoff Theorem, Stone-Cech compactification, Complete metric spaces, Compactness in metric spaces.

**Text Book:**

1. James R. Munkres, (2000), *Topology*, Second Edition, Prentice Hall of India, New Delhi.

   | | |
   |---|---|
   | Unit – I | Chapter 2: Sections 12 to 15. |
   | Unit – II | Chapter 2: Sections 16 to 21 and |
   | | Chapter 3: Sections 23 to 25. |
   | Unit - III | Chapter 3: Sections 26 to 29. |
   | Unit - IV | Chapter 4: Sections 30 to 35. |
   | Unit - V | Chapter 5: Sections 37 and 38; |
   | | Chapter 7: Sections 43 and 45 only. |

   | | |
   |---|---|
   | Unit - VI | Chapter 4: Sections 36 |
   | | Chapter 6: Sections 41 |

**Supplementary Reading:**

1. Hu, S.T., (1964), *Elements of General topology*, Holden-Day Inc, San Francisco.
2. Hocking, J.G. and Young,G.S., (1961), *Topology*, Addison-Wesley Pub. Com.
3. Simmons, G.F., (1963), *Introduction to Topology and Modern Analysis*, McGraw Hill International Edition, Singapore.

4. Kumaresan ,S., (2005), *Topology of Metric Spaces*, Narosa Publishing House, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC92: Core – 29 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| **IX** | **Linear Algebra** | **4** | **0** | **0** | **5** |

**Learning Objective (LO):**

| *LO1* | This course aims learning the students to solve systems of linear equations using multiple methods, echelon Matrices, matrix operations, including inverses and invertible matrix using determinants. |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *LO2* | Applying principles of matrix algebra to linear transformations, double dual, commutative rings, Characteristic values, Annihilating polynomials and Decompositions of Invariant Direct sums are studied. |

**Course Outcomes (CO)**

Students will be introduced to and have the knowledge of many mathematical concepts of

| *CO1* | transformations |
|-------|-----------------|
| *CO2* | proof techniques |
| *CO3* | problem solving in (studied in Linear Algebra such as) <br> • Systems of linear Equations, |

- The algebra of linear transformations,
- Determinant functions,
- Diagonalization,
- Decompositions.

## Unit-1: Linear Equations and Vector spaces

Systems of linear Equations – Matrices and Elementary Row operations – Row-Reduced echelon Matrices – Matrix Multiplication – Invertible Matrices - Vector spaces – Subspaces – Bases and Dimension – Computations concerning Subspaces.

## Unit-2: Linear Transformations

The algebra of linear transformations – Isomorphism of Vector Spaces – Representations of Linear Transformations by Matrices - Linear Functionals -  The Double Dual – The Transpose of a Linear Transformation.

## Unit-3: Determinants

Commutative rings – Determinant functions – Permutations and the uniqueness of determinants – Classical Adjoint of a (Square) matrix – Inverse of an invertible matrix using determinants.

## Unit-4: Canonical Forms

Characteristic values – Annihilating polynomials, Invariant subspaces.

## Unit-5: Canonical Forms (continued)

Simultaneous triangulation and simultaneous Diagonalization – Direct-sum Decompositions - Invariant Direct sums – The Primary Decomposition Theorem.

## Text Book:

1. Kenneth Hoffman and Ray Kunze, (1971)  *Linear Algebra*, Second Edition, Prentice – Hall of India Private Limited, New Delhi.

   Chapters 1 to 3, Chapter 5 (5.1 to 5.4) and Chapter 6.

## Supplementary Reading:

1. HersteinI.N., (2007) *Topics in Algebra,* Second Edition, Third Reprint, John Wiley & Sons, New Delhi.
2.  Rao,A.R. and Bhimasankaram, P., (2000). *Linear Algebra*, Second Edition, TRIM series 19, Hindustan  Book Agency, New Delhi.
3. Charles W. Curtis, (1984). *Linear Algebra – An Introductory  Approach,* Springer.
4. Keith Nicholson. W., (2006).  *Linear Algebra with Applications*, Fifth Edition, Mc Graw Hill.

## Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMATC93: Core – 30 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| IX | **Probability Theory** | 4 | 0 | 0 | 5 |

## Learning Objective (LO):

| LO1 | The objective are |
|-----|-------------------|
| | (i) acquire quantative skills and an understanding of rigorous concepts and methods in probability theory through measure theoretic approach |
| | (ii) acquire understanding of diverse characteristics like convergence, law of large numbers and central limit theorems. |
| | (iii) Acquire the ability to solve widely varied problems. |

## Course Outcomes (CO)

By the end of the course, students will be able to gain

| CO1 | knowledge related to probability problems |
|-----|-------------------------------------------|
| CO2 | a basic knowledge for studying advanced courses in this area like stochastic processes. |

**Unit-1**: **Distribution Function:**

Monotone functions, Distribution functions, Absolutely continuous and Singular distributions.

Measure Theory:

Classes of sets, Probability measures and their distribution functions.

Random variable, Expectation, Independence:

General definitions, Properties of mathematical expectation, Independence.

**Unit-2**: **Convergence Concepts:**

Various modes of convergence, Almost sure Convergence; Borel-Cantelli lemma, Vague Convergence, Continuation.

**Unit-3:Law of Large Numbers. Random series:**

Simple limit theorems, Weak law of large numbers, Convergence of series, Strong law of large numbers.

**Unit-4:Characteristic Function:**

General properties; Convolutions, Uniqueness and inversion, Convergence theorems, Simple applications.

**Unit-5:Central limit theorem and its Ramifications:**

Liapounov's theorem, Lindeberg-Feller theorem, Ramification of the central limit theorem.

**Text Book:**

1. Chung,K.L., (1974). *A Course in Probability Theory*, Second Edition, Academic Press, New York.

    | | |
    |---|---|
    | Unit - I | Chapter 1 (Sections 1 to 3). |
    | | Chapter 2 (Sections 1 and 2). |
    | | Chapter 3 (Sections 1 to 3). |
    | Unit – II | Chapter 4 (Sections 1 to 4). |
    | Unit - III | Chapter 5 (Sections 1 to 4). |
    | Unit – IV | Chapter 6 (Sections 1 to 4). |
    | Unit - V | Chapter 7 (Sections 1 to 3). |

**Supplementary Reading:**

1. Bhat, B.R., (2018) *Modern Probability Theory*, New Academic Science, UK.
2. Sheldon M. Ross, (2010). *A first Course in Probability*, Eight Edition, Pearson Education Ltd, London.
2. Burril, C.W., (1972) *Measure, Integration and Probability*, McGraw Hill, New York.

**Outcome Mapping:**

| CO / | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| PO | | | | | | | | | | | | | |
|----|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | | | | 3 | 3 | 3 | 3 | 3 | |
| CO2 | 3 | 3 | 3 | 3 | | | | 3 | 3 | 3 | 3 | 3 | |

| Semester | 19IMATC94: Core – 31 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| IX | **Numerical Methods Practical** <br> **(Using C++ language)** | 0 | 0 | 4 | 2 |

**Learning Objective (LO):**

| *LO1* | The objectives are acquire the practical applicability of C++ Programming to some of the problems in numerical mathematics. |
|-------|---------------------------------------------------------------------------------------------------------------------------|

**Course Outcomes (CO)**

By the end of the course:

| *CO1* | students will be able to gain knowledge between theory and practical. |
|-------|----------------------------------------------------------------------|

1. Solution of transcendental and polynomial equations in one variable:

> i.   Method of Bisection
>
> ii.  Method of Regula Falsi
>
> iii. Newton's Method

2. Solution of Linear Equations:

> i. Jacobi's Iterative Method
>
> ii. Gauss-Seidal Iterative Method

3. Numerical Solution of Ordinary Differential Equations:

> i. Euler's Method.
>
> ii. Modified Euler's Method
>
> iii. Runge-Kutta Method of order four

4. Numerical Integration:

> i. Simpson's one third rule

ii. Simpson's three eighth rule

iii. Weddle's rule.

**Text Book:**

1. Krishnamoorthy, E.V. and Sen, S.K., (1996) *Numerical Algorithms*, Second Edition, Affiliated East West Press Pvt. Ltd., New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | 2 | 3 | | | | 2 | 3 | 2 | 3 | 3 |

| Semester | 19IPSC090: CONSTITUTION OF INDIA | L | T | P | C |
|----------|----------------------------------|---|---|---|---|
| IX | | 2 | 0 | 0 | 2 |

**Learning Objectives:**

**Students will be able to:**

**LO 1.** To understand the basic features of Indian Constitution.

**LO 2.** To grasp about the basic Rights & duties of Indian Citizenry

**LO 3.** To ponder over the form of Indian Political System.

**LO 4**. To have broad understanding about the pivotal provisions related with liberty, Equality and fraternity.

**Course Outcomes:**

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

**CO 1.** Imbibed about the basic features of Indian Political System.

**CO 2.** Enlighten with the rights & duties of Indian Citizens.

**CO 3.** Understand the significance of rule of law.

**CO 4**. Inculcated with basic liberties.

**Unit I : Introduction**

Meaning of the Constructional law and Constitutionalism – Historical Perspective of the Constitution of India – Salient features Characteristics of the Constitution of India

### .Unit II : Rights and Duties

Scheme of the Fundamental Rights – The scheme of the Fundamental Duties and its legal status – The Directive Principles of State Policy-Its importance and implementation

### Unit III : Centre State Relationship

Federal Structure and distribution of legislative and financial powers between the union and the states- Parliamentary form of Government in India – The Constitution powers and status of the president of India.

### Unit IV : Amendments and Provisions

The Historical perspectives of the constitutional amendments in India – Emergency Provision: National Emergency, President Rule. Financial Emergency

### Unit V: Institutions

Judiciary –Judiciary Activism – Amending Procedures- Recent Trends –Rights to Information- Lokpal and LokAyukta


### Text Books :

1. Bipan Chandra, Mridula Mukherjee, Adility Makherjee 2016., India after Independence 1947-2000, Penguin Publishers, New Delhi.

2. Durga Das Basu,2018., Introduction to the Constitution of India Prentice Hall, New Delhi.

3. Jogendra Yadav  2000, Transforming India: Dynamics of Democracy, Oxford University Press  New Delhi


### Supplementary Readings:

1. The Constitution of India 1950 (Bare Act), Government Publications.

2. Busi S.N Ambedkar B.R 2015 Framing of Indian Constitution

3. Jain M.P 2014 Indian Constitution Law Lexis Nexis

4. Paul R.Brass 1999 The politics of India Since Independence Cambridge University Press

5. Granvila Austin 2006 The Indian Constitution: Cornerstone of a Nation, Oxford University Press, New Delhi

**OUTCOME MAPPING**

| CO/PO | PO | | | | | | | | | | | | PSO | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 |
| CO1 | | 3 | 3 | | 2 | | | | | 2 | | | 3 | 3 | | | |
| CO2 | | 3 | 2 | | 3 | 2 | | | | | | | 3 | | | 3 | 2 |
| CO3 | 3 | 2 | | 3 | 2 | | | | | 2 | | | | | 3 | 2 | 2 |

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

| Semester | 19IMAC101: Core – 32 | L | T | P | C |
|---|---|---|---|---|---|
| | **Functional Analysis** | | | | |
| **X** | | 4 | 0 | 0 | 4 |

### Learning Objective (LO):

| LO1 | There are many domains in the broad field of topology. |
|---|---|
| LO2 | The following are the few viz, the theory of Banach and Hilbert Spaces and their operators and Banach algebras. |
| LO3 | In this course we teach some results on Banach spaces, Hilbert spaces, operator theory and Banach algebras. |
| LO4 | Each of these subjects starts from the fundamental knowledge and develops its own methods of dealing with its own characteristic problems. |

### Course Outcomes (CO)

In the board field of topology, students gain knowledge related to

| CO1 | examples and counter examples to the corresponding theory |
|---|---|
| CO2 | proof  techniques |
| CO3 | problem solving |

in Banach space, Hilbert space and spectral operator theory.

### Unit–1: Linear transformations and Banach spaces

Linear transformations, Banach spaces, Continuous linear transformations, The Hahn-Banach theorem.

### Unit–2: Banach spaces (continued)

The natural embedding of N into N**, The open mapping theorem, The conjugate of an operator.

### Unit–3: Hilbert spaces

Hilbert space, Orthogonal complements, Orthonormal sets, The Conjugate space H*, The adjoint of an operator, Self adjoint operators, Normal and Unitary operators.

### Unit–4: Finite dimensional Spectral theory

Matrices, Determinants and Spectrum of an operator, The spectral theorem.

### Unit–5: Banach algebras

Definition and some examples, Regular and singular elements, Topological divisors of zero, The spectrum, The formula for the spectral radius.

**Text Book:**

1. Simmons, G.F., (2015) *Introduction to Topology and Modern Analysis*, McGraw Hill Book Company, New Delhi.

   Unit-I  Chapter 8: Section 44 only and

        Chapter 9: Sections 46, 47 and 48.

   Unit-II  Chapter 9: Sections 49, 50 and 51.

   Unit-III  Chapter 10: Sections 52 to 58.

   Unit-IV  Chapter 11: Sections 60, 61 and 62.

   Unit-V  Chapter 12: Sections 64 to 68.

   Unit-VI  Appendices 1,3

**Supplementary Reading:**

1. Limaye, B.V.(1996),*Functional Analysis*,  Prentice - Hall of India, New Delhi.
2. Bachmann and Narishi,(2000) *Functional Analysis*,  Academic Press, Cambridge.
3. Karen Saxe, (2002) *Beginning Functional Analysis*, Springer.

4. Goffman, C. and Padrick, G., (1974) *A First Course in  Functional Analysis,* Chelsea Publishing Company, New York.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMAC102: Core – 33 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| **X** | **Stochastic Processes** | 4 | 0 | 0 | 4 |

**Learning Objective (LO):**

| *LO1* | The objectives are to |
|-------|------------------------|
| | (i)      acquire the skill of advanced level of mathematical sophistication and enhancing the horizons of knowledge. |
| | (ii)     acquire understanding of applicability of different concepts of stochastic processes on some physical situation. |
| | **(iii)**      to familiarize the students with the use of stochastic models in different areas. |

**Course Outcomes (CO)**

By the end of the course, students will be able to gain

| *CO1* | working knowledge related to the problems of uncertainty. |
|-------|-----------------------------------------------------------|
| *CO2* | a basic knowledge for doing research in this area. |

**Unit-1: Stochastic Processes:**

Introduction, Specification of Stochastic Processes, Stationary Process, Martingales.

Markov Chains:

Definition and Examples, Higher Transition Probabilities, Generalization of independent Bernoulli Trials: Sequence of Chain Dependent Trials, Classification of States and Chains.

**Unit-2: More on Markov Chains:**

Determination of Higher Transition Probabilities, Stability of a Markov System, Markov Chain with Denumerable Number of States, Reducible Chains.

**Unit-3**: **Markov Processes with Discrete State Space:** Poisson Process and its Extensions:

Poisson Process, Poisson Process and Related Distributions, Generalization of Poisson Process, Birth and Death Process, Markov Process with Discrete State Space (Continuous Time Markov Chains).

**Unit-4: Markov Chains and Markov Processes with Continuous State Space:**

Markov Chains with Continuous State Space, Introduction, Brownian Motion, Wiener Process, Differential Equations for a Wiener Process, Kolmogorov Equations, First Passage Time Distribution for Wiener Process.

**Unit-5: Renewal Processes and Theory:**

Renewal Process, Renewal Processes in Continuous Time, Renewal Equation, Stopping time: Wald's Equation, Renewal Theorems, Delayed and Equilibrium Renewal Processes.

**Text Book:**

1. Medhi.J., (1994) ,*Stochastic Processes*, Second Edition, New Age International (P) Limited, Publishers, New Delhi. .

   Unit-I    Chapter 2: Sections 1 to 4 and

              Chapter 3:  Sections 1 to 4.

   Unit-II   Chapter 3: Sections 5,6,8 and 9.

   Unit-III  Chapter 4: Sections 1 to 5.

   Unit-IV   Chapter 3: Section 11

              Chapter 5: Sections 1 to 5.

   Unit-V    Chapter 6: Sections 1 to 6.

   Unit-VI   Chapter 10: Sections 1,2 and5.

**Supplementary Reading:**

1. Karlin S. and Taylor H.M., (2011) *A First Course in Stochastic Processes*, Second Edition, Academic Press, New York.

2. Ross, S.M., (2008) *Stochastic Processes*, Second Edition, Wiley India Pvt., Ltd, New Delhi.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IMAC103: Core – 34 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| X | **Fluid Dynamics** | 4 | 0 | 0 | 4 |

**Learning Objective (LO):**

| *LO1* | This course aims to discuss kinematics of fluids in motion, Equations of motion of a fluid, three dimensional flows, two dimensional flows and viscous flows. |
|-------|---|

**Course Outcomes (CO)**

On successful completion of the course, the student will be able to,

| *CO1* | Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions. |
|-------|---|
| *CO2* | Recognize these principles written in form of mathematical equations. |
| *CO3* | Apply dimensional analysis to predict physical parameters that influence the flow in fluid dynamics. |

**Unit-1:Kinematics of Fluids in Motion:**

Real fluids and ideal fluids – Velocity of a fluid at a point stream lines – path lines – Steady and unsteady flows – Velocity potential – The velocity vector – Local and particle rates of changes – Equations of continuity – Examples.

### Unit-2: Equation of Motion of a fluid:

Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Condition at a boundary of two invicid immersible fluids. Euler's equation of motion – Discussion of the case of steady motion under conservative body forces.

### Unit-3: Some three dimensional flows:

Introduction – Sources – Sinks and doublets – Images in rigid infinite plane – Axis symmetric flows – Stokes stream function.

### Unit-4:Some two-dimensional flows:

Two dimensional flows – Meaning of two dimensional flow – Use of cylindrical polar co-ordinates – The stream function – Complex potential for two dimensional – Irrational incompressible flow – Complex velocity potential for standard two dimensional flows – Examples.

### Unit-5:Viscous flows:

Viscous flows – Stress components in a real fluid –Relation between Cartesian components of stress – Translation motion of fluid elements – The rate of strain quadric and principle stresses – Further properties of the rate of strain quadric – Stress analysis in fluid motion – Relation between stress and rate of strain – The coefficients of viscosity and Laminar flow – The Navier – Stokes equations of motion of a viscous fluid.

### Text Book:

1. Chorlton, F., (1985),  *Fluid Dynamics*, CBS Publication, New Delhi.

   Unit – I          Chapter 2: Sections 2.1 to 2.8
   Unit – II         Chapter 3: Sections 3.1 to 3.7
   Unit – III        Chapter 4: Sections 4.1 to 4.3 and 4.5
   Unit – IV        Chapter 5: Sections 5.1 to 5.6
   Unit – V         Chapter 8: Sections 8.1 to 8.9.
   Unit – VI        Chapter 9: Sections 9.1 to 9.4

### Supplementary Reading:

1. Batchaelor, G.K., (1994)  *An Introduction to Fluid Mechanics*, Foundation Books, New Delhi.
2. Yuan, S.W., (1976) *Foundations of Fluid Mechanics*, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Rathy, R.K., (1976) *An Introduction to Fluid Dynamics*, IBH Publ. Comp. New Delhi.

3. Pijush K. Kundu, Ira M. Cohen and David R. Dowling, (2010) *Fluid Mechanics*, Fifth Edition, Academic Press, New York.

**Outcome Mapping:**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 |

| Semester | 19IMAC104: Core – 35 | L | T | P | C |
|----------|---------------------|---|---|---|---|
| **X** | **Graph Theory** | 4 | 0 | 0 | 4 |

**Learning Objective (LO):**

| LO1 | Graph Theory is an integral part of Discrete Mathematics. |
|-----|---|
| LO2 | It has applications to many fields, including Computer Science, Physics, Chemistry, Psychology and Sociology. |
| LO3 | In this course we teach basic topics in graph theory such as Trees, Connectivity, Euler tours, Hamilton cycles, Matchings, Colourings, Planar graphs. |

**Course Outcomes (CO)**

Students will be introduced to and have knowledge of many mathematical concepts

| *CO1* | to give examples and counter examples corresponding to the theory |
|-------|---|
| *CO2* | proof techniques |
| *CO3* | problem solving |

| CO4 | Applications studied in Graph Theory such as |
|---|---|
| | <ul><li>Trees,</li><li>Connectivity,</li><li>Euler tours,</li><li>Hamilton cycles,</li><li>Matchings,</li><li>Colourings,</li><li>Planar graphs</li></ul> |

**Unit–1: Basic Concepts:**

Graphs – Subgraphs – Degrees of vertices – Paths and connectedness – Automorphism of a simple graph, Line Graphs. Connectivity: Vertex cuts and Edge cuts – Connectivity and edge-connectivity, Blocks.

**Unit–2: Trees:**

Trees – Characterization and Simple properties. Independent sets and Matchings: Vertex Independent sets and Vertex Coverings – Edge-Independent Sets – Matchings and Factors, Matchings in Bipartite Graphs (except the proof of Tutte's 1-factor theorem).

**Unit–3:**

Eulerian Graphs. Hamiltonian Graphs.

**Unit–4 :Graph Colorings:**

Vertex Colorings – Critical Graphs – Brooks' Theorem.

Edge Colorings of Graphs – Vizing's Theorem – Chromatic Polynomials.

**Unit–5: Planarity:**

Planar and Nonplanar Graphs – Euler's Formula and its Consequences – $K_5$ and $K_{33}$ are Nonplanar graphs – Dual of a Plane Graph – The Four Color Theorem and the Heawood Five-Color Theorem – Hamiltonian plane graphs.

**Note:** Theorems, Propositions and results which are starred are to be omitted.

**Text Book:**

1. Balakrishnan R. and Ranganathan K., (2012), Second Edition, *A Textbook of Graph Theory*, Springer, New York.

   Unit - I        Chapter 1: 1.1 to1.6; Chapter 3: 3.1 to 3.3;

   Unit - II       Chapter 4: 4.1, 4.2; Chapter 5: 5.1 to 5.5;

   Unit - III      Chapter 6: 6.2, 6.3;

   Unit - IV       Chapter 7: 7.1, 7.2, 7.3

(except 7.3.2 and 7.3.3), 7.6, 7.9;

Unit - V        Chapter 8: 8.1 to 8.6; 8.8.

## Supplementary Reading:

1. Bondy J, A.  and Murty, U.S.R., (2008) *Graph Theory*, Springer, New York.

2. Douglas B. West, (2011), *Introduction to Graph Theory*, PHI Learning Private Ltd,

   New Delhi.

2. Chartrand, G., Linda Lesniak and Ping Zhang, (2011), *Graphs and Digraphs,* Fifth Edition, CRC Press.

## Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 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 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

| Semester | 19IMAC105: Core – 36 | L | T | P | C |
|----------|----------------------|---|---|---|---|
| X | **Calculus of Variations and Integral Equations** | 4 | 0 | 0 | 4 |

## Learning Objective (LO):

| *LO1* | The aim of the course is to introduce to the students the concept of calculus of variations and its applications. |
|-------|------------------------------------------------------------------------------------------------------------------|
| *LO2* | Various types of integral equations have been introduced and method of solving these equations are given. |

## Course Outcomes (CO)

On Successful completion of the course student will be able to

| CO1 | Recognize the difference between Volterra & Fredholm integral equations, First kind & second kind, homogeneous and non-homogeneous etc. |
|---|---|
| CO2 | understand the fundamental concepts related to the space of admissible variations and concepts of a weak and a strong relative minimum of an integral. |

**Unit-1:**

Calculus of Variations and Applications:

Maxima and Minima - The Simplest case-Illustrative examples-Natural boundary conditions and transition conditions – The variational notation-The more general case.

**Unit-2:**

Constraints and Lagrange multipliers-Variable end points - Sturm- Liouville problems-Hamilton's principle- Lagrange's equations.

**Unit-3:**

Integral Equations: Introduction – Relations between differential and integral equations – The Green's function – Alternative definition of the Green's function.

**Unit-4:**

Linear equation in cause and effect: The influence function – Fredholm equations with separable kernels – Illustrative example.

**Unit-5:**

Hilbert – Schmidt theory – Iterative methods for solving equations of the second kind – Fredholm theory.

**Text Book:**

1. Francis B. Hildebrand, (1965), *Methods of Applied Mathematics*, Second Edition, Prentice Hall, N.J.

   Unit I:        Chapter 2: Sections 2.1 to 2.6

   Unit II:       Chapter 2: Sections 2.7 to 2.11

   Unit III:      Chapter 3: Sections3 .1 to 3.4

   Unit IV:       Chapter 3: Sections3.5 to 3.7

   Unit V:        Chapter 3: Sections3.8 to 3.9 and 3.11

## Supplementary Reading:

1. Ram.,P. Kanwal, (1971) *Linear Integral Equations Theory and Practice*, Academic Press, New York.
2. ElsgoltsL., (2003) *Differential equations and the calculus of variations*, University Press of the Pacific, U.K.
3. Mikhlin, S.J, (1960) *Linear Integral Equations* (translated from Russian), Hindustan Book Agency, New Delhi.
3. Snedden Ian N., (1966) *Mixed Boundary Value Problems in Potential Theory*, North Holland.
4. Lev D. Elsgole, (2007) *Calculus of Variations*, Dover Publications Inc, New York.
5. Rahman M., (2007) *Integral Equations and their Applications*, WIT Press, Boston.

## Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 3 |

## Elective Courses (DE):

| Semester | 19IMATE86-1: Programming Language C++ | L | T | P | C |
|----------|---------------------------------------|---|---|---|---|
| VIII | | 3 | 0 | 0 | 3 |

### Learning Objective (LO):

| LO1 | The language C++ is a Object Oriented Programming Language. |
|-----|-----------------------------------------------------------|
| LO2 | First the syntax of the language C++ is introduced. |
| LO3 | This is followed by Control statement, Arrays, Functions, Pointers, Structures and Classes. |
| LO4 | Many problems are solved after writing algorithms and programs in C++. |

| CO1 | On Successful completion of C++ course, the students gathered computer knowledge in C++ to write programmes for various types of mathematical problems. |
|---|---|

## Unit-1: C++ Programming Basics:

Basic Program Construction: Functions, Program Statements, White Space. Output Using Cout: String Constants. Preprocessor Directives: The # include Directive, Header Files. Comments: Comment Syntax, When to Use Comments, Alternative Comment Syntax. Integer variables: Defining Integer Variables, Declarations and Definitions, Variable Names, Assignment Statement, Integer Constants, Output variations. Character Variables: Character Constants, Initialization, Escape Sequences. Input with Cin: Variables Defined at Point of Use, Cascading, Expressions, Precedence. Type float: Floating-Point Constants, The Const Qualifier, The # define Directive. Manipulators: The end L Manipulator, The set W Manipulator, Type Long, Cascading the Insertion Operator, Multiple definitions, The IOMANIP.H Header File. Variable Type Summary: Unsigned data types. Type Conversion: Automatic Conversions, Casts. Arithmetic operators: The Remainder Operator, Arithmetic Assignment operators, Increment Operators. Library Functions: Header Files, Library Files, Header Files and Library Files, Two Ways to Use # include.

## Unit-2: Loops and Decisions:

Relational operators. Loops: The for Loop, Using Turbo C++ Debugging Features, for Loop Variations, The while Loop, Precedence: Arithmetic and Relational Operators, The do loop, When to Use Which Loop. Decisions: The if Statement, The if...else Statement, The else...if Construction, The Switch Statement. The Conditional Operator. Logical Operators: Logical OR Operator, Logical AND Operator, The Logical NOT Operator, Precedence Summary, Other Control Statements, The break Statement, The continue Statement, The GOTO Statement.

## Unit-3: Structures:

A simple structure, Specifying the structure, Defining a structure variable, Accessing structure members.

Functions:

Simple Functions: The Function Declaration, Calling the Function, The Function Definition, Comparison with Library Functions, Eliminating the Declaration. Passing Arguments to Functions: Passing Constants, Passing Variables, Passing by Value, Passing Structure Variables, Names in the Declaration. Returning Values from Functions: The return Statement, Returning structure Variables. Reference Arguments: Passing Simple Data Types by Reference. Overloaded Functions: Different Numbers of Arguments, Different Kinds of Arguments. Inline Functions: Default Arguments, Variables and Storage Classes: Automatic Variables, External Variables, Static Variables, Storage, Returning by Reference.

### Unit-4: Arrays:

Array Fundamentals. Defining Arrays, Array Elements, Accessing Array Elements, Averaging Array Elements, Initializing Arrays, Multidimensional Arrays, Passing Arrays to Functions, Arrays of Structures. String: Variables, Avoiding Buffer Overflow, String Constants, Reading Embedded Blanks, Reading Multiple Lines,Copying a String the Hard Way, Copying a String the Easy Way, Arrays of Strings, Strings as Class Members, A User-Defined String Type.

### Unit-5: Pointers:

Addresses and Pointers, The Address of Operator & Pointer Variables, Accessing the Variable Pointed To, Pointer to void. Pointers and Arrays: Pointer Constants and Pointer Variables. Pointers and Functions: Passing Simple Variables, Passing arrays, Sorting Array Elements. Pointers and Strings: Pointers to String Constants, Strings as Function Arguments, Copying a String Using Pointers, Library String Functions, Arrays of Pointers to Strings.

### Text Book:

1. Robert Lafore, (1996),*Object-Oriented Programming in TURBO C++*, Galgotia Publications Pvt. Ltd., New Delhi.

   | Unit-I | Chapter 3 |
   | Unit-II | Chapter 4 |
   | Unit-III | Chapters 5 and 6 |
   | Unit-IV | Chapter 8 |
   | Unit-V | Chapter 12 |

### Supplementary Reading:

1. Balagurusamy, E., (2006), *Programming in ANSI C*, Seventh Edition, Tata McGraw Hill Publishing Ltd., New Delhi.
2. Kanthane, A. N., (2006), *Object Oriented Programming in ANSI & Turbo C++,* Pearson Education, New Delhi.

### Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 3 | 2 | 3 | 2 | | | | 3 | 2 | 3 | 3 | 2 |

| Semester | 19IMATE96-1: Number Theory | L | T | P | C |
|----------|---------------------------|---|---|---|---|
| IX | | 3 | 0 | 0 | 3 |

**Learning Objective (LO):**

| LO1 | The prime aim of this paper is to enrich the knowledge of Number Theory. |
|-----|--------------------------------------------------------------------------|
| LO2 | The concepts of primes, congruences, prime power moduli, power residues, quadratic residues, greatest integer function, Mobius inversion formula are introduced. |
| LO3 | Diophantine equations and their positive solutions are discussed. Simple continued functions are also considered. |

**Course Outcomes (CO)**

On successful completion of the course, the student will be able to understand the concepts

| CO1 | to give examples and counter examples corresponding theory |
|-----|------------------------------------------------------------|
| CO2 | proof  techniques |
| CO3 | problem solving of<br><br>• Divisibility relation,<br>• Congruence relation,<br>• Special number theoretic functions,<br>• Diophantine equations and<br>• Algebric numbers. |

**Unit-1: Divisibility and Congruences**

Divisibility, Primes, Congruences, Solutions of Congruences, The Chinese Remainder Theorem.

**Unit-2: Congruences (continued)**

Prime power moduli, Prime modulus, Primitive Roots and Power Residues, Congruences of degree two, Prime Modulus.

Quadratic Reciprocity and Quadratic Forms:

Quadratic Residues, Quadratic reciprocity and the Jacobi symbol.

### Unit-3: Some functions of Number Theory

Greatest integer function, Arithmetic functions, The Mobius inversion formula, Recurrence Functions, Combinatorial Number Theory.

### Unit-4: Some Diophantine Equations

The equation ax+by=c, Simultaneous Linear Equations, Pythagorean Triangles, Assorted Examples, Ternary Quadratic Forms.

### Unit-5: Simple Continued Fractions

The Euclidean Algorithm, Uniqueness, Infinite Continued Fractions, Irrational Numbers, Approximations to Irrational Numbers.

**Text Book:**

1. Ivan Niven, H.S. Zuckerman and Hugh L. Montgomery (1991). *An Introduction to the Theory of Numbers*, . Fifth Edition, Wiley Eastern Limited, New Delhi.

    Unit - I          Chapter 1 Sections 1 to 3 and

                         Chapter 2 Sections 1 to 3

    Unit – II         Chapter 2 Sections 6 to 9 and

    Chapter 3 Sections 1 to 3

    Unit – III        Chapter 4 Sections 1 to 5

    Unit - IV        Chapter 5 Sections 1 to 5

    Unit - V         Chapter 7 Sections 1 to 5

**Supplementary Reading:**

1. Tom M. Apostal,  (2013), *Introduction to Analytic Number Theory*, Narosa Publishing Company, New Delhi.
2. Hsiung C.Y., (1995), *Elementary Theory of Numbers*, World Scientific, Singapore.
3. Hardy G.H.  and Wright E.M.,  (1989), *An Introduction to the Theory of Numbers*, . Fourth Edition, Clarendon Press, U.K.

## Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |

| Semester | 19IMATE96-2: Fuzzy Sets and their Applications | L | T | P | C |
|----------|-----------------------------------------------|---|---|---|---|
| IX | | 3 | 0 | 0 | 3 |

### Learning Objective (LO):

| LO1 | This course aims to offer fuzzy sets, fuzzy relations, fuzzy logic, fuzzy composition and applications. |
|-----|--------|

### Course Outcomes (CO)

On successful completion of the course, the student will be able to identify the basic concepts

| CO1 | to give examples and counter examples corresponding theory |
|-----|--------|
| CO2 | Proof techniques |
| CO3 | problem solving on <br> • characteristics of fuzzy logic, <br> • α cuts, <br> • operations on fuzzy sets, <br> • extension principles, <br> • fuzzy norms, <br> • lattice of fuzzy numbers. |

### Unit-1:Fuzzy sets:

Fuzzy sets – Basic types – Basic concepts - Characteristics – Significance of the paradigm shift – Additional properties of α- Cuts.

### Unit-2: Fuzzy Sets Versus CRISP Sets:

Representation of Fuzzy sets – Extension principle of Fuzzy sets – Operation on Fuzzy Sets – Types of Operation – Fuzzy complements.

### Unit-3: Operations on Fuzzy Sets:

Fuzzy intersection – t-norms, Fuzzy unions – t conorms – Combinations of operations – Aggregation operations.

### Unit-4: Fuzzy Arithmetic:

Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Lattice of Fuzzy numbers.

### Unit-5: Constructing Fuzzy Sets:

Methods of construction: An overview – Direct methods with one expert – Direct method with multiple experts – indirect method with multiple experts and one expert – Construction from sample data.

### Text Book:

1. Klir G.J. and Bo Yuan, (2005), *Fuzzy Sets and fuzzy Logic: Theory and Applications,* Prentice Hall of India Ltd., New Delhi.

   | Unit – I | Chapter 1: Sections 1.3 to 1.5 and |
   | --- | --- |
   | | Chapter 2: Sections 2.1 |
   | Unit – II | Chapter 2: Sections 2.2 to 2.3 and |
   | | Chapter 3: Sections 3.1 to 3.2 |
   | Unit – III | Chapter 3: Sections 3.3 to 3.6 |
   | Unit – IV | Chapter 4: Sections 4.1 to 4.4 |
   | Unit – V | Chapter 10: Sections 10.1 to 10.7 |

### Supplementary Reading:

1. Zimmermann H.J., (1996), *Fuzzy Set Theory and its Applications*, Allied Publishers, Chennai.
2. Kaufman A., (1975), *Introduction to the Theory of Fuzzy Subsets*, Academic Press, New York.
3. Novak V., (1969), *Fuzzy Sets and Their Applications*, Adam Hilger, Bristol.

### Outcome Mapping:

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 2 | | | | | | 3 | 2 | 3 | 2 | 3 |