ANNAMALAI UNIVERSITY

REGULATIONS FOR THE FIVE YEAR INTEGRATED POST GRADUATE PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

These Regulations are common to all the students admitted to the Five Year Integrated Master’s Programmes in the Faculties of Arts, Science, Languages, Marine Sciences, and Education from the academic year 2019-2020 onwards.

1. Definitions and Nomenclature

1.1 **University** refers to Annamalai University.

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

1.3 **Discipline** refers to the specialization or branch of knowledge taught and researched in.

1.4 **Higher education**. For example, Botany is a discipline in the Natural Sciences, while Economics is a discipline in Social Sciences.

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

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

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

1.8 **Syllabus** is an academic document that contains 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.

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

1.10 **Semester** is a half-year term that lasts for a minimum of 90 working days. Each academic year is divided into two semesters.

1.11 **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.

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

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

1.14 **Value Added Courses** are optional courses that complement the students’ knowledge and skills and enhance their employability.

1.15 **Experiential Learning** is a process of learning through experience. It is specifically defined as “learning through reflection on doing”.

1.16 **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).

1.17 **Credit** refers to the quantum of course work in terms of the 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.
1.18 **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.

1.19 **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.

1.20 **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.

1.21 **Learning Objectives (also known as Course Objectives)** are statements that define the expected goal of a course in terms of demonstrable skills or knowledge that will be acquired by a student as a result of instruction.

1.22 **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.

1.23 **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.

1.24 **Cumulative Grade Point Average (CGPA)** is a measure of the overall cumulative performance of a student in all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters.

1.25 **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, and RA.

2. **Programmes Offered and Eligibility Criteria**
   The Integrated Programmes offered by the University and the eligibility criteria are detailed below.

| Faculty of Science | M.Sc. Physics | A pass in H.S.E. (10+2 level) OR Equivalent thereto with a minimum aggregate of 40% marks under academic stream in the following subjects viz. Physics, Chemistry & Mathematics |

2.1 In the case of SC/ST and Differently-abled candidates, a pass is the minimum qualification for all the above Programmes.

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 Programmes consist of five academic years and ten semesters.
   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, Soft Skills, 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.

5.4.2 In Science and Marine Sciences, there will be two Theory courses and one Practical course each for Allied-I and Allied-II.

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 Parent Department offering the Programme.

5.5.2 **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.

5.5.3 *Students shall take a combination of both DEs and IDEs.*

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.

5.6.2 Soft skills include communication skills, computer skills, social skills, leadership traits, teamwork, and development of emotional intelligence quotients, among others.

5.6.3 Each student shall choose four courses on soft skills from a range of courses offered from the First to the Sixth Semester.

5.7 **Value Education**

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

5.8 **Experiential Learning**

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

5.8.2 In-plant training/field trips/internships/industrial visits (as applicable) fall under this category.

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 Co-ordinator.

5.9.4 Extension activities shall be conducted outside the class hours.

5.10 **Project**

5.10.1 Each student shall undertake a Project in the final semester.

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

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

5.10.4 Students who wish to undertake project work in recognised institutions/industry shall obtain prior permission from the University. The Project Supervisor will be from the host institute, while the Co-Supervisor shall be a faculty in the parent department.
5.11 Value Added Courses (VACs)
5.11.1 Students may also opt to take Value Added Courses beyond the minimum credits required for the award of the Degree. VACs are outside the normal credit paradigm.
5.11.2 VACs enhance the students’ employability and life skills. VACs are listed on the University website and in the Handbook on Interdepartmental Electives and VACs.
5.11.3 Each VAC carries 2 credits with 30 hours of instruction, of which 60% (18 hours) shall be Theory and 40% (12 hours) Practical.
5.11.4 Classes for VACs are conducted beyond the regular class hours and preferably in the VIII and IX Semesters.

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 MOOC platform shall be exempted from one elective course of the programme.

5.12.3 Credit Distribution
The credit distribution is detailed in the Table.

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester I to VI</td>
</tr>
<tr>
<td>Language-I (Tamil or any other Language)</td>
</tr>
<tr>
<td>Language-II (English)</td>
</tr>
<tr>
<td>Core Courses</td>
</tr>
<tr>
<td>Allied-I</td>
</tr>
<tr>
<td>Allied-II</td>
</tr>
<tr>
<td>Electives</td>
</tr>
<tr>
<td>Soft skills</td>
</tr>
<tr>
<td>Environmental studies (UGC mandated)</td>
</tr>
<tr>
<td>Value Education</td>
</tr>
<tr>
<td>Experiential learning</td>
</tr>
<tr>
<td>Extension activities</td>
</tr>
<tr>
<td>Total Credits (Semester I to VI)</td>
</tr>
<tr>
<td>Semester VII to X</td>
</tr>
<tr>
<td>Core Courses</td>
</tr>
<tr>
<td>Electives</td>
</tr>
<tr>
<td>Project</td>
</tr>
<tr>
<td>Total Credits (Semester VII to X)</td>
</tr>
<tr>
<td>Total Credits Semester I to X (Minimum requirement for the award of Degree)</td>
</tr>
</tbody>
</table>

*Each Department shall fix the minimum required credits for award of the Degree within the prescribed range of 230-240 credits.

5.13 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 per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical/Project period of two or three hours (depending on the discipline) 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 students 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 organisation of lesson plan of the Course Instructor.

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

6.4 At the end of the semester, the record shall be duly signed by the Course Instructor and the Head of the Department and placed in safe custody for any future verification.

6.5 The Course Instructor 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 should earn a minimum of 75% attendance in 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.

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 a 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, seminars, and viva-voce that would be suitable for the course. 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 pattern of question paper will be decided by the respective faculty.

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 to three 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.

8.5 End Semester Examinations (ESEs)

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

8.5.2 A candidate who does not pass the examination in any course(s) will be permitted to reappear in such course(s) in the subsequent semester/year.

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 Each course, both Theory and Practical as well as Project/Internship/Field work/In-plant training shall be evaluated for a maximum of 100 marks.

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

9.1.3 For the Practical courses, the CIA Tests will constitute 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 Instructor

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

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test-I &amp; Test-II</td>
<td>15</td>
</tr>
<tr>
<td>Seminar</td>
<td>5</td>
</tr>
<tr>
<td>Assignment</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test-I</td>
<td>15</td>
</tr>
<tr>
<td>Test-II</td>
<td>15</td>
</tr>
<tr>
<td>Viva-voce and Record</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
</tr>
</tbody>
</table>

9.3 Assessment of End-Semester Examinations

9.3.1 Double Evaluation for the ESE is done by the University Teachers.

9.3.2 In case of a discrepancy of more than 10% between the two examiners in awarding marks, third evaluation will be resorted to.

9.4 Assessment of Project/Dissertation

9.4.1 The Project Report/Dissertation shall be submitted as per the guidelines laid down by the University.

9.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.
9.4.3 CIA for Project will consist of Review of literature, 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 of the Head of the Department, Project Supervisor, and a senior faculty.

9.4.7 The marks shall be distributed as follows:

<table>
<thead>
<tr>
<th>Continuous Internal Assessment (25 Marks)</th>
<th>End Semester Examination (75 Marks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review-I 10</td>
<td>Project / Dissertation Evaluation</td>
</tr>
<tr>
<td>Review-II: 15</td>
<td>Viva-voce</td>
</tr>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

9.5 Assessment of Value Added Courses

9.5.1 VACs shall be evaluated completely by Internal Examiners.

9.5.2 Two CIA Tests shall be conducted during the semester by the Department(s) offering VAC.

9.5.3 A committee consisting of the Head of the Department, faculty handling the course and a senior faculty member shall monitor the evaluation process.

9.5.4 The grades obtained in VACs will not be included for calculating the GPA.

9.6 Passing Minimum

9.6.1 A candidate is declared to have passed in each course if he/she secures not less than 40% marks in the ESE and not less than 50% marks in aggregate taking CIA and ESE marks together.

9.6.4 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 of 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 from the first semester to the current semester.

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 \(i\) and \(n\) 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 \( i \) and
\( n \) is the number of Courses passed in that semester.
\( m \) is the number of semesters.

11.5 Evaluation of the performance of the student will be rated as shown in the Table.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>10</td>
<td>90 and above</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>80-89</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>70-79</td>
</tr>
<tr>
<td>C</td>
<td>7</td>
<td>60-69</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>55-59</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
<td>50-54</td>
</tr>
<tr>
<td>RA</td>
<td>0</td>
<td>Less than 50</td>
</tr>
<tr>
<td>W</td>
<td>0</td>
<td>Withdrawn from the examination</td>
</tr>
</tbody>
</table>

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

11.6.1 For **First Class with Distinction**: Candidates who have passed all the courses prescribed in the Programme *in the first attempt* with a CGPA of 8.25 or 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 **For First Class**: Candidates who have passed all the courses with a CGPA of 6.5 or above.

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

11.6.4 Candidates who obtain highest marks in all examinations at the first appearance alone will be considered 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 candidate 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 completed successfully, 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 card 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 student has reappeared.
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 or more 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.

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

12.4 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.

12.5 Withdrawal is not granted for arrear examinations of courses in previous semesters (for which the student has secured RA Grade) and for the final semester examinations.

12.6 Candidates who have been granted permission to withdraw from the examination shall reappear for the course(s) in the subsequent semester.

12.7 Withdrawal shall not be taken into account as an appearance for the examination when considering the eligibility of the student 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 department library or computer resources, stealing other students’ notes/assignments, 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 sensitised 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. Notwithstanding anything contained in the above pages as Rules and Regulations governing the Five Year Integrated 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.
**PROGRAM OUTCOMES (POs):**

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

<table>
<thead>
<tr>
<th>PO1</th>
<th><strong>Domain knowledge:</strong> Demonstrate knowledge of basic concepts, principles and applications of the specific science discipline.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO2</td>
<td><strong>Resource Utilisation:</strong> 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.</td>
</tr>
<tr>
<td>PO3</td>
<td><strong>Analytical and Technical Skills:</strong> Ability to handle/use appropriate tools/techniques/equipment with an understanding of the standard operating procedures, safety aspects/limitations.</td>
</tr>
<tr>
<td>PO4</td>
<td><strong>Critical thinking and Problem solving:</strong> 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.</td>
</tr>
<tr>
<td>PO5</td>
<td><strong>Project Management:</strong> 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.</td>
</tr>
<tr>
<td>PO6</td>
<td><strong>Individual and team work:</strong> Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
</tr>
<tr>
<td>PO7</td>
<td><strong>Effective Communication:</strong> 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.</td>
</tr>
<tr>
<td>PO8</td>
<td><strong>Environment and Society:</strong> Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.</td>
</tr>
<tr>
<td>PO9</td>
<td><strong>Ethics:</strong> Commitment to professional ethics and responsibilities.</td>
</tr>
<tr>
<td>PO10</td>
<td><strong>Life-long learning:</strong> Ability to engage in life-long learning in the context of the rapid developments in the discipline.</td>
</tr>
</tbody>
</table>

**PROGRAM SPECIFIC OUTCOMES (PSOs):**

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

<table>
<thead>
<tr>
<th>PSO1</th>
<th>Understand principles of physics for the scientific phenomena in classical domain.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSO2</td>
<td>Understand the mathematical techniques for describing in depth knowledge of physical concepts.</td>
</tr>
<tr>
<td>PSO3</td>
<td>Understand and apply statistical methods for describing the classical and quantum particles in various physical systems and processes.</td>
</tr>
<tr>
<td>PSO4</td>
<td>Understand and apply inter-disciplinary concepts and for understanding and describing the natural phenomena.</td>
</tr>
<tr>
<td>PSO5</td>
<td>Understand the principles of Quantum mechanics for knowing the physical systems in quantum arena.</td>
</tr>
<tr>
<td>PSO6</td>
<td>Provide exposure in various specializations of Physics (Solid State Physics/Nuclear Physics/Particle Physics).</td>
</tr>
<tr>
<td>PSO7</td>
<td>Provide exposure to modern experimental/theoretical methods for measurement, observation and fundamental understanding of physical phenomena/systems.</td>
</tr>
<tr>
<td>PSO8</td>
<td>Engage in research and life-long learning to adapt to changing environment.</td>
</tr>
</tbody>
</table>
## MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

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

<table>
<thead>
<tr>
<th>Programme Specific Outcomes (PSOs)</th>
<th>Programme Outcomes (POs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>PSO1</td>
<td>✓</td>
</tr>
<tr>
<td>PSO2</td>
<td>✓</td>
</tr>
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<td>PSO3</td>
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## M. Sc. PHYSICS (Five Year) Programme

**PROGRAMME CODE: SPHY51**

Programme Structure

(For students admitted from the academic year 2019 - 2020)

**DETAILS OF COURSE WITH CREDIT**

Total Credits up to three years: 144  
Total Credits up to five years: 237

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LEARNING OBJECTIVES:

- To know about the gravity and the laws of gravitation.
- To understand the concept of elasticity.
- To understand the behaviour of fluids.

UNIT– I: GRAVITY AND GRAVITATION

Kepler's laws - Newton’s law of gravitation – Determination of ‘G’ by Boy’s method - Simple pendulum, Bar pendulum - Variation of g with altitude and latitude - Gravitational potential and field due to a spherical shell - Solid sphere - Hollow sphere and thin circular plate.

UNIT– II: ELASTICITY


UNIT– III: SURFACE TENSION


UNIT– IV: VISCOSITY


UNIT– V: DIFFUSION AND OSMOSIS


TEXT BOOKS:


SUPPLEMENTARY READING:

1. D.S. Mathur, Elements of Properties of Matter, S.Chand & Co., New Delhi, 2005

COURSE OUTCOMES (COs):

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

CO1: Acquire a practical knowledge about the gravity and the applications of the laws of gravitation.
CO2: Understand and apply the concept of elasticity.
CO3: Understand the behaviour of fluids and practical applications of the same in real life.
CO4: Recall the principles and basic equations and apply them to unseen problems

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SEMESTER - II 19IPHYC24 - HEAT AND THERMODYNAMICS

Credit : 4
Hours : 4

LEARNING OBJECTIVES:

➢ To gain in depth knowledge regarding the effects of heat and its applications.
➢ To study the aspects related to the measurement of temperature and heat
➢ To understand the concepts of thermodynamics.

UNIT– I: THERMOMETRY

Centigrade, Fahrenheit and Kelvin scale of temperature - constant volume
Hydrogen thermometer - Platinum resistance thermometer - Callendar and Griffith’s bridge - Thermoelectric effect – Seebeck effect - Thermoelectric thermometers- International temperature scale - Thermistor.

UNIT– II: CALORIMETRY


UNIT– III: TRANSMISSION OF HEAT


UNIT – IV: KINETIC THEORY OF GASES AND LOW TEMPERATURE PHYSICS


UNIT– V: THERMODYNAMICS


Entropy – change of entropy in reversible and irreversible processes – temperature – entropy diagrams – physical significance of entropy - change of entropy when ice converted into steam - third law of thermodynamics – Extensive and intensive thermodynamic variables – distinction between them – Maxwell thermodynamical relations – derivation and application.

TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Gain in depth knowledge of heat and its effects.
CO2: Understand the behavior of thermal properties of materials.
CO3: Know the theory of heat and thermodynamics with applications.
CO4: Finding applications of the physical quantities.
LEARNING OBJECTIVES:

➢ To gain in depth knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
➢ To study the aspects related to the application side of the experiments
➢ To understand the usage of basic laws and theories to determine various properties of the materials given.
➢ To provide hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat and electricity.

(Any Twelve experiments)

1. Surface Tension – Capillary rise method.
2. Young’s modulus – Non uniform bending (pin and microscope).
3. Young’s modulus – uniform bending (pin and microscope).
4. Young’s modulus – Koenig’s method.
5. Potentiometer – Low range voltmeter.
7. Compound pendulum- Determination of g and k.
8. Coefficient of viscosities- Hare’s apparatus.
10. Thermal conductivity -Forbe’s method.
13. Quincke’s drop – Surface tension of Mercury.
15. Rigidity Modulus – Static torsion.
16. q, n, σ – Searle’s method.

COURSE OUTCOMES (COs):

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 thermal properties of materials.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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LEARNING OBJECTIVES:

- To educate the students related to the various aspects of mechanics.
- To understand the basic concepts of projectile motion, impulse, impact, rockets and satellites.
- To provide the concepts of dynamics of rigid bodies.
- To provide in depth knowledge about static, centre of gravity, hydrodynamics and basic concepts of classical mechanics.

UNIT – I: PROJECTILE, IMPULSE, AND IMPACT


UNIT – II: ROCKETS AND SATELLITES


UNIT – III: DYNAMICS OF RIGID BODIES

Rigid body - Moment of inertia - Radius of gyration - Moment of inertia - Solid cylinder - cylindrical shell - Solid sphere - Spherical shell - Hollow sphere - Compound pendulum - Theory - Equivalent simple pendulum - Reversibility of centers of suspension and oscillation - Determination of g and k - Kater’s pendulum.

UNIT – IV: STATICS, CENTRE OF GRAVITY AND HYDRODYNAMICS

Centre of gravity of a solid and hollow cone – Solid and hollow hemisphere – Thrust – Centre of pressure – Vertical rectangular lamina.


UNIT – V: BASIC CONCEPTS OF CLASSICAL MECHANICS

Mechanics of single and system of particles - Conservation law of linear momentum, angular momentum and mechanical energy for a particle and a system of particles - Centre of mass and equation of motion – Constraints - Classification - Degrees of freedom and Generalized coordinates – Principle of virtual work.

TEXT BOOKS:

SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Understand and define the laws involved in mechanics.
CO2: Understand the concepts of projectile motion, impulse and impact.
CO3: Understand the rockets and satellites and its importance for scientific developments.
CO4: Understand the concepts of dynamics of rigid bodies and the knowledge about static, centre of gravity, hydrodynamics and basic ideas of classical mechanics.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - III 19IPHYC 34 - OSCILLATIONS, WAVES AND ACOUSTICS

Credit : 4
Hours : 4

LEARNING OBJECTIVES:

➢ To gain knowledge about the wave motion and wave propagation.
➢ To know more about the basics of Acoustics.
➢ To get more exposure to the ultrasonic sound and its applications.

UNIT – I: OSCILLATIONS


Unit– II: WAVE PROPAGATION AND VIBRATING SYSTEMS

Unit I–III: ACOUSTICS


Unit– IV: ULTRASONICS

Ultrasonics – Production of ultrasonic waves - Piezo electric method – Measurement of velocity of ultrasonic waves – Acoustic grating – Applications of ultrasonic waves –medical, industrial, scientific – Non-Destructive Testing (NDT)

Unit –V: FOURIER ANALYSIS

Fourier theorem – Fourier Series - Fourier coefficients – Definition - Evaluation of Fourier coefficients – Fourier Analysis of Square wave and Saw tooth wave

TEXT BOOKS:


SUPPLEMENTARY READING:

3. P.K Mittal, Oscillations, waves and Acoustics, I.K International Pvt Ltd, 2010

COURSE OUTCOMES (COs):

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

CO1: Thorough understanding about the terms such as frequency, wavelength and amplitude

CO2: Involving personally doing the sonometer experiment and determining the frequency of a given tuning fork

CO3: Having personal experience in identifying the difference between the reverberation, and reflection of sound waves or echo.

CO4: Gain deeper understanding of ultrasonics and its applications.

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LEARNING OBJECTIVES:

- To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
- To study the aspects related to the application side of the experiments.
- To understand the usage of basic laws and theories to determine various properties of the materials given.
- To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

(Any Twelve experiments)

2. Sonometer – Verification of laws.
5. Spectrometer – Hollow prism.
11. Coefficient of viscosities- Ostwald’s apparatus.
12. Rigidity modulus by torsional pendulum (with symmetric masses).
13. Potentiometer – Comparison of e.m.f of the cells.
15. Latent heat of Ice (Half time cooling correction)
16. Latent heat of Steam (Half time cooling correction)

COURSE OUTCOMES (COs):

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.

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22
LEARNING OBJECTIVES:

- To understand and acquire an in-depth knowledge regarding the behaviour of light and also the essential concepts of geometrical optics.
- To understand the theoretical explanation of the phenomenon of interference, diffraction and polarization.
- To educate the students about the fundamental aspects of molecular spectroscopy.

UNIT– I: GEOMETRICAL OPTICS


UNIT– II: INTERFERENCE


UNIT – III: DIFFRACTION


UNIT– IV: POLARISATION


UNIT– V: SPECTROSCOPY

TEXT BOOKS:

SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):
By the end of the course, the students will be able to
CO1: Understand and acquire an in-depth knowledge regarding the behaviour of light and also the essential concepts of geometrical optics.
CO2: Understand the phenomenon of interference, diffraction and polarization.
CO3: Use of tools needed to formulate problems in optics and spectroscopy.
CO4: Understand the fundamental aspects of molecular spectroscopy.

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SEMESTER - IV 19IPHYC44 - ELECTRICITY AND MAGNETISM  
Credit :4  
Hours :4

LEARNING OBJECTIVES:
- Fundamental laws viz, Gauss’s law in electro & magnetostatics, Faraday’s law and Ampere’s law are emphasised.
- Basics of electrostatics, magnetostatic and time varying fields from the fundamentals of electromagnetic theory.
- Galvanometer, thermocouple, transformer principle are discussed.

UNIT— I ELECTROSTATICS
Columb’s law,Electric field and intensity-Electric dipole- P.E of dipole in an electric field-field due to a dipole.
Gauss’s law-differential and integral form-Application of Gauss’s law-field due to a uniformly charged sphere, plane charged conductor and uniform charged cylinder-field due to two parallel sheets of charge.

UNIT– II DIELECTRICS
Introduction-parallel plate capacitor with a dielectric-Dielectric constant, polarization and polarization vector- Displacement vector-boundary conditions satisfied by E and D. at the interface of homogenous dielectrics- Capacity of a spherical, parallel and cylindrical capacitor-Energy of a charged capacitor.

UNIT– III MAGNETOSTATICS

UNIT– IV ELECTROMAGNETIC INDUCTION
Growth and decay of charge in a circuit containing L, C and R-condition for discharge to be oscillatory-frequency of oscillator- theory, construction and working of transformers-skin effect.

UNIT– V THERMOELECTRICITY
Definition of ampere and the value of permeability of free space-emf and internal resistance of a cell – Calibration of ammeter and voltmeter (high and low range).
Thermoelectricity-Measurement of thermo emf using potentiometer-Peltier and Thomson coefficients-applications of thermodynamics to thermocouple-determination of the coefficients-Thermoelectric diagrams.

TEXT BOOKS FOR STUDY:
2. Electricity and Magnetism, D.N.Vaudeva, S.Chand and Co., 2012.

SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):
By the end of the course, the students will be able to

CO1: Recognize basic terms in electricity and magnetism.
CO2: Basic of electrostatics and magnetostatics can be very well understood.
CO3: Concepts of e.m. theory could be enlightened.
CO4: Various equipments (B.G, transformers, thermocouples) principles and working are very well perceived.
MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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LEARNING OBJECTIVES:

➢ To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
➢ To study the aspects related to the application side of the experiments
➢ To understand the usage of basic laws and theories to determine various properties of the materials given.
➢ To providing a hands-on learning experience such as in measuring the basic concepts in Electricity and Magnetism.

(Any Twelve experiments)

1. Spectrometer – Cauchy’s constant.
2. Air wedge - Diameter of a thin wire.
3. Newton’s rings.
4. B.G. – Figure of merit.
5. Field along the axis of a circular coil - Determination of H (Using Vibration Magnetometer).
6. Carey Foster bridge – Temperature co-efficient of resistance of a coil.
8. Internal resistance of a cell –using B.G.
9. Thermo e.m.f using B.G.
10. Series and parallel resonance circuits.
12. B.G. – Absolute capacity of a condenser.
13. Potentiometer – High range voltmeter.
15. Resistance by Post Office box.
16. Resistance by Meter Bridge.
17. Dead beat (aperiodic) Galvanometer – figure of merit.
18. Field along the axis of a circular coil – deflection magnetometer.

COURSE OUTCOMES (COS):

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: Acquire in depth knowledge regarding the basic concepts in electricity and magnetism.
LEARNING OBJECTIVES:

- To study the aspects related to discharge of electricity through gases.
- To study the principles, applications of photoelectric effect and various atomic models and their importance.
- To understand the concepts of the production and characterization of X-rays.

UNIT– I: CATHODE RAYS AND POSITIVE RAYS

Discharge of electricity through Gases – Cathode rays – Properties - Specific charge of an electron - Dunnington’s method-Millikan’s oil drop method-free electron theory of metals-expressions for electrical conductivity-electron microscope-positive rays-Thomson’s parabola method-mass spectrographs.

UNIT– II: STRUCTURE OF ATOM


UNIT – III: FINE STRUCTURE OF SPECTRAL LINES


UNIT– IV: PHOTO ELECTRIC EFFECT

Einstein’s photoelectric equation-Photoelectric cells-photo emissive cells-photovoltaic cells-photoconductive cells-Applications of photoelectric cells

UNIT – V: X-RAYS

TEXT BOOKS:


SUPPLEMENTARY READING:

4. K. Gopala Krishnan, Atomic and Nuclear Physics, Macmillan Ltd, India.

COURSE OUTCOMES (COs):

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

CO1: Explain the concept of discharge of electricity through the gases.
CO2: Describe the various atomic model and fine structure of spherical lines.
CO3: Understand the photoelectric effect and its important applications.
CO4: Understand the central concepts of X-ray production, properties and theory.

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SEMESTER - V  |
19IPHYC52 - LASERS AND FIBRE OPTICS  |
Credit : 4  
Hours: 4  

LEARNING OBJECTIVES:

This paper aims to provide in depth knowledge about

- Laser Principle.
- Types of Lasers and its applications.
- Fibre optics and its communications.

UNIT– I: BASIC THEORY


UNIT– II: LASER BEAM CHARACTERISTICS

UNIT –III: TYPES OF LASERS


UNIT– IV: APPLICATIONS OF LASERS


UNIT– V: FIBRE OPTICS


TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Understand the basic principles of laser.
CO2: How to construct various types of lasers and its functions.
CO3: Applications of fiber optic communication.
CO4: Acquire in depth knowledge related to the applications of laser.

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SEMESTER - V 19IPHYC53 - ANALOG ELECTRONICS

LEARNING OBJECTIVES:

➢ To impart knowledge about the linear circuit analysis.
➢ To provide the basic ideas of semiconductor devices.
➢ To enable the students to know about the basic ideas of analog operations for various analog circuit problems.

UNIT-I: LINEAR CIRCUIT ANALYSIS

Constant voltage source-constant current source- Maximum power transfer theorem - Thevanin’s theorem - Norton’s theorem – two port network and h-parameters.

UNIT-II: SEMICONDUCTOR DIODES

Characteristics and applications of PN Junction diode - Zener diode - Gunn diode - Tunnel diode - photo diode LED - schottkey diode - Impatt diode. Diode voltage doubler and multipliers - filters - regulated power supply.

UNIT-III: AMPLIFIERS


UNIT-IV: OPERATIONAL AMPLIFIER AND OSCILLATORS


UNIT-V: OSCILLATORS AND WAVE SHAPING CIRCUITS


TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Be familiar with the basic concepts of construction and working of electronic devices.
CO2: Acquire an in-depth knowledge about the linear circuit analysis.
CO3: Understand the basic ideas of semiconductor devices.
CO4: Enable the students to know the basic ideas of analog operations for various analog circuit problems.

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SEMESTER - V  19IPHYC54 - ENERGY PHYSICS  Credit : 4  Hours: 4

LEARNING OBJECTIVES:

➢ To create an awareness among the students regarding the forms of energy and the availability of their resources
➢ To educate regarding the utilization and conservation of energy
➢ To impart a knowledge about the Sustainable forms of energy

UNIT– I: CONVENTIONAL ENERGY SOURCES

Energy sources and their availability – Various forms of energy – Renewable and conventional energy systems – Comparison – Coal, oil and natural gas.

UNIT – II: SOLAR ENERGY


UNIT – III: THERMAL ENERGY STORAGE


UNIT – IV: PHOTO CONVERSION

Photovoltaic conversion - Principle and working of solar cells - Conversion efficiency - Single crystal and Polycrystalline silicon - Cadmium sulphide - Cadmium telluride.

UNIT – V: SUSTAINABLE FORMS OF ENERGY

Reserves of Energy Resources – Environmental aspects of energy extraction, conversion and utilization – challenges associated with the non-sustainable energy sources with regard to future Supply and the environment

Hydrogen: principle of operation and system components-comparisons among energy uses, resources, and technologies-technical and economic challenges in the integration of sustainable energy form-potential solutions and application.
TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Be aware of various forms of energy and the effective utilization of their resources.
CO2: Be exposed to the practical usage of solar energy.
CO3: Be exposed to the practical usage of thermal energy.
CO4: Acquire an in-depth knowledge about the sustainable forms of energy.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - V  19IPHYC55 - SOLID STATE PHYSICS  Credit : 4  Hours: 4

LEARNING OBJECTIVES:

- This paper provides the elementary ideas about the crystalline solids and their physical properties.
- To understand the basic concept of superconductors and their applications.
- To know the basic facts of bond formation, ionic distribution and magnetic behavioural characters of solids.

UNIT–I: BONDING IN SOLIDS

Types of bonds in crystals - Ionic, covalent, Metallic, Vander waal's and Hydrogen Bonding
- Bond energy of sodium chloride molecule - variation of inter atomic force with inter atomic spacing - cohesive energy of ionic solids - application to sodium chloride crystal
- evaluation of Madelung constant for sodium chloride.
UNIT– II: CRYSTAL STRUCTURE AND CRYSTAL DIFFRACTION


UNIT – III: MAGNETIC PROPERTIES


UNIT – IV: DIELECTRIC PROPERTIES


Dielectrics - Polarization – frequency and temperature effects on polarization-dielectric loss-Clausius Mosotti relation-determination of dielectric constants.

UNIT–V: SUPER CONDUCTIVITY


TEXT BOOKS:

SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):
By the end of the course, the students will be able to

CO1: Explore the relationships between chemical bonding and crystal structure.
CO2: Get the concrete idea about the superconductivity, high temperature superconductors and applications.

CO3: Inculcate the core concept of bond formation, ionic transition and variation of magnetic behaviour of elements by the ionic contribution.

CO4: Discuss logically the region for variation of dielectric behaviours of the elements.

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LEARNING OBJECTIVES:

- To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
- To study the aspects related to the application side of the experiments
- To understand the usage of basic laws and theories to determine various properties of the materials given.
- To providing a hands-on learning experience such as in measuring the basic concepts in Electronic circuits.

(Any Twelve experiments)

1. V-I characteristics of junction diode.
2. Characteristics of Transistor CB and CE Configuration.
3. Characteristics of UJT.
4. R-C Coupled amplifier- Single stage.
5. Characteristics of FET.
6. Hartley oscillator- BJT.
7. Colpitt’s oscillator - BJT.
9. Half wave and full wave rectifier.
11. Regulated power supply - Zener diode.
14. Basic logic gates using transistors.
15. NAND and NOR as universal building blocks.
16. Adder and Subtractor.

COURSE OUTCOMES (COS):

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

CO1: Basic laws and theories involving diodes, transistors, etc.,

CO2: Understand the given concepts and its physical significance
CO3: Apply the theory to design the basic electrical circuits
CO4: Use of these basic circuits to create amplifier circuits, oscillator, regulated power
supplies etc.,

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SEMESTER - VI 19IPHYC61 - NUMERICAL METHODS OF ANALYSIS  Credit: 4  Hours: 4

LEARNING OBJECTIVES:

- To be familiar with numerical solution of equations.
- To get exposed to finite difference and interpolation.
- To be familiar with the numerical differentiation and integration.
- To find numerical solution of ordinary and partial differential equations.

UNIT– I: ALGEBRAIC AND TRANSCENDENTAL EQUATIONS


UNIT– II: INTERPOLATION


UNIT– III: NUMERICAL DIFFERENTIATION AND INTEGRATION


UNIT– IV: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS


UNIT– V: CURVE FITTING

TEXT BOOKS:

SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):
By the end of the course, the students will be able to

CO1: Appreciate the numerical techniques of interpolation in various intervals.
CO2: Apply the numerical techniques of differentiation and integration for engineering problems.
CO3: Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO4: Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

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SEMESTER - VI | 19IPHYC62 - DIGITAL ELECTRONICS | Credit : 4 Hours: 4

LEARNING OBJECTIVES:

➢ To provide the students a sound understanding of Number system, coding, and Boolean algebra for designing the digital circuits.
➢ To make the students understand the characteristics of basic logic gates, flip flops, Registers and counters. To give exposure in understanding digital instruments with the help of logic gates.
➢ To highlights the concept of digital electronics and functioning of various digital devices.
UNIT– I: BINARY SYSTEMS AND BOOLEAN ALGEBRA

Binary numbers - Number base conversions - Octal and Hexa decimal numbers - Complements -1’s and 2’s complement addition and subtraction -Binary codes - BCD code - Excess-3 code - Gray codes - Binary logic - Boolean algebra - Basic definitions and properties of Boolean algebra - Demorgan's theorem-proof.

UNIT–II: DIGITAL LOGIC GATES AND BOOLEAN FUNCTIONS

Digital logic gates - IC digital logic families - Boolean functions - SOP - POS - Minterms and Maxterms - Karnaugh Map method - Two and Three variable maps - Four variable map - Product of sums simplification - sum of product simplification - Don't care conditions.

UNIT –III: COMBINATIONAL LOGIC


UNIT– IV: FLIP FLOPS AND REGISTERS


UNIT– V: COUNTERS

Design of counters - Ripple counters - Binary ripple counter – design of modulo N counter - BCD Ripple counter - Synchronous counters - Binary up-down counter.

TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):
At the end of the course, students will be able to

**CO1:** Construct simple electronics circuit using logic gates.

**CO2:** Understand the concepts of number systems and conversion and logical reasons based on Boolean theorems.

**CO3:** Understand the working of various flip flops, registers and counters.

**CO4:** Apply the principles of electronics in day to life

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**SEMESTER - VI**

| 19IPHYC63 - NUCLEAR PHYSICS | Credit : 4 | Hours: 4 |

**LEARNING OBJECTIVES:**

- To grasp knowledge and understanding on the general properties of Nucleus, Nuclear force and Nuclear models.
- To study the phenomena of radioactivity, nuclear fission and fusion reactions.
- To impart the basic knowledge about various detectors and cosmic rays.

**UNIT– I: PROPERTIES AND STRUCTURE OF NUCLEI**

General properties of nucleus- binding energy – BE/A curve - significance -proton electron theory- proton neutron theory -Nuclear forces –characteristics –Meson theory of nuclear forces – Yukava Potential- Nuclear models

**UNIT– II: RADIO ACTIVITY**


**UNIT– III: NUCLEAR REACTIONS**


**UNIT– IV: NUCLEAR DETECTORS AND PARTICLE ACCELERATORS**

UNIT– V: COSMIC RAYS AND ELEMENTARY PARTICLES

Cosmic rays-introduction-discovery-latitude,altitude and azimuth effects-longitudinal effect-north –south effect-seasonal and diurnal changes-primary and secondary cosmic rays-nature of cosmic rays- cosmic ray showers-Van Allen belt- origin of cosmic radiation.

Elementary particles-introduction-particles and antiparticles-antimatter-the fundamental interaction-elementary particle quantum numbers-conservation laws and symmetry-the quark model.

TEXT BOOKS FOR STUDY:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Acquire knowledge of the fundamental physics underspinning nuclear physics.
CO2: Understand the nuclear structure and radioactivity and its applications.
CO3: Understand the fission and fusion reactors and how these are used for production of the energy as well as weapons.
CO4: Understand the fundamental concepts of cosmic rays and elementary particles.

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SEMESTER - VI 19IPHYC64 - RELATIVITY AND QUANTUM MECHANICS Credit : 4 Hours : 4

LEARNING OBJECTIVES:

➢ To understand relativity and its consequences
➢ To classify the velocities associated with wave packets
➢ To formulate the Schrodinger’s equation for the given problem
➢ To solve the simple quantum mechanical problems
UNIT– I: RELATIVITY


UNIT– II: WAVE NATURE OF MATTER


UNIT– III: SCHRODINGER EQUATION

Inadequacy of classical mechanics - Basic postulates of quantum mechanics - Schrodinger equation - Properties of wave function - Probability interpretation of wave function - linear operators - self adjoint operators - expectation value - eigenvalues and eigenfunctions - commutativity and compatibility.

UNIT– IV: ANGULAR MOMENTUM IN QUANTUM MECHANICS

Orbital angular momentum operators and their commutation relations - separation of three dimensional Schrodinger equation into radial and angular parts - Elementary ideas of spin angular momentum of an electron - Pauli matrices.

UNIT– V: SOLUTIONS OF SCHRODINGER EQUATION

Free particle solution - Particle in a box - Potential well of finite depth (one dimension) - linear harmonic oscillator - rigid rotator and hydrogen atom.

TEXT BOOKS:

3. V. Devanathan, Quantum Mechanics, Wiley Eastern, 2005

SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Understand relativity and its consequences.
CO2: Classify the velocities associated with wave packets.
CO3: Formulate Schrodinger’s equation for the given problem.
CO4: Solve simple quantum mechanical problems.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - VI  | 19IPHYC65 – ASTROPHYSICS | Credit : 4
| Hours: 4 |

LEARNING OBJECTIVES:
- To understand the basics of Astrophysics with respect to our universe.
- To facilitate the students to understand about the sun and stars.
- To provide knowledge about the stellar structure and origin of universe.

UNIT –I: UNIVERSE

UNIT – II: SUN

UNIT-III: STARS
Constellations - Binary stars – their origin and types - star clusters - Globular clusters - types of variable stars - types of galaxies, Milky way galaxy – origin & morphology - evolution of Galaxy - quasars.

UNIT-IV: STELLAR STRUCTURE

UNIT-V: ORIGIN OF UNIVERSE
Big bang theory – pulsating theory - steady state theory - composition of universe expansion.

TEXT BOOKS FOR STUDY:

SUPPLEMENTARY READING:
COURSE OUTCOMES (COs):

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

CO1: Understand the basics of Astrophysics with respect to our universe.
CO2: Understand the Universe and its constituents.
CO3: Explain about the structure of sun and types of stars.
CO4: Describe about the stellar structure and the origin of universe.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - VI 19IPHYP66 - PRACTICAL – V

LEARNING OBJECTIVES:

▶ To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
▶ To study the aspects related to the application side of the experiments
▶ To understand the usage of basic laws and theories to determine various properties of the materials given.
▶ To providing a hands-on learning experience such as in measuring the basic concepts in Electronic circuits.

(Any Twelve experiments)

1. RC coupled amplifier – Two stage - BJT.
2. Feedback amplifier – BJT.
5. BCD-counter – Decode Seven Segment Display.
10. D/A Converter (Two methods).
11. Arithmetic Logic Unit - IC 74181.
14. Multiplexers and Demultiplexers.
15. Shift Registers - IC 7474.
16. Ring counter and Ripple counter – IC 7474.

COURSE OUTCOMES (COS):

CO1: Basic laws and theories involving amplifiers, integrated circuits, converters and flip flops etc.,
CO2: Understand the given concepts and its physical significance
**CO3:** Apply the theory to design the basic electrical circuits

**CO4:** Use of these basic circuits to create amplifier, integrated circuits, converters and flip-flops etc.,

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**SEMESTER - VII**

**19IPHYC71 - CLASSICAL AND STATISTICAL MECHANICS**

**Credit:** 4

**Hours:** 4

**LEARNING OBJECTIVES:**

- To develop familiarity with the physical concepts and facility with the mathematical methods of classical mechanics
- The main goal of this course is to acquire fundamental knowledge of classical and quantum statistical mechanics.
- Construct a bridge between macroscopic thermodynamics and microscopic statistical mechanics by using mathematical methods and fundamental physics for individual particles.

**UNIT-I: MECHANICS OF A PARTICLE AND SYSTEM OF PARTICLES**


**UNIT-II: CANONICAL TRANSFORMATIONS**


**UNIT-III: MAXWELL – BOLTZMANN STATISTICS**


**UNIT-IV: EQUIPARTITION OF ENERGY AND PARTITION FUNCTION**

Principle of equipartition of energy – Partition function and their properties – Connection between the partition function and thermodynamic quantities – Mean values obtained from

**UNIT-V: QUANTUM STATISTICS**


**TEXT BOOKS:**


**SUPPLEMENTARY READING:**


**COURSE OUTCOMES (COs):**

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

**CO1:** Formulate scientific questions about the mechanics of a particle and system of particles.

**CO2:** Use D’Alembert’s principle to derive the Lagrange equations of motion.

**CO3:** Identify the differences of Bose -Einstein, Fermi-Dirac and Maxwell – Boltzmann statistics.

**CO4:** Describe the relationship between the statistical mechanics with thermodynamics.

**MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)**

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**SEMESTER - VII**

| 19IPHYC72 - ELECTRONICS | Credit : 4 | Hours: 4 |

**LEARNING OBJECTIVES:**

- To gain in depth knowledge about semiconductor devices.
- To learn amplifiers, oscillators using transistors.
- To study the applications of operational amplifiers.
- To familiarise various classifications of Semiconductor Memories and
- To know the fabrication concepts of Integrated circuits.
UNIT - I: SEMICONDUCTOR DEVICES

UJT, JFET, MOSFET - Operation and static characteristics. SCR - Two transistor analogy, static characteristics, Half wave, full wave and bridge rectifier. DIAC, TRIAC - static characteristics.

UNIT - II: AMPLIFIERS AND OSCILLATORS

Transistor h - parameters - analysis of amplifiers using h - parameters. RC coupled amplifier - single stage - two stage - push pull amplifier - feedback principle and Barkhausen criterion - Hartley, Colpit's and Phase shift oscillators using transistors.

UNIT - III: OPERATIONAL AMPLIFIERS APPLICATIONS


UNIT - IV: SEMICONDUCTOR MEMORIES


UNIT - V: INTEGRATED CIRCUITS


Logic families - RTL, TTL, CMOS, interfacing CMOS and TTL.

TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

**CO1:** Understand the concept of various semiconductor devices by learning their characteristics.

**CO2:** Analyze the parameters of amplifiers, oscillators using transistors and familiarise with applications of operational amplifiers.

**CO3:** Understand the classifications of Semiconductor Memories.

**CO4:** Understand the concepts of Integrated circuits.

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SEMESTER - VII  19IPHYC73 - MATHEMATICAL PHYSICS – I  Credit : 4 Hours: 4

LEARNING OBJECTIVES:

- To develop knowledge in mathematical physics and its applications.
- To develop expertise in mathematical techniques required in physics.
- To enhance problem solving skills.
- To enable students to formulate, interpret and draw inferences from mathematical solutions.

UNIT-I: VECTOR ANALYSIS AND VECTOR SPACES

Concept of gradient, divergence and curl - Gauss's divergence theorem, Green's theorem and Stoke's theorem (statement and proof) - Orthogonal curvilinear coordinates - Expression for gradient, divergence, curl and Laplacian in cylindrical and spherical co-ordinates (Theory).

Linearly dependent and independent sets of vectors - Inner product (problems)- Schmidt's orthogonalization process.

UNIT-II: MATRICES

Types of Matrices and their properties, Rank of a Matrix, Eigenvalue Equations and their solutions, Theorems on Matrices; Diagonalisation and Diagonalisation of different matrices; Cayley-Hamilton’s theorem; Problems.

UNIT-III: TENSOR ANALYSIS


UNIT-IV: COMPLEX VARIABLE

UNIT-V: GROUP THEORY

Definition - Subgroups - Cyclic groups and abelian groups - Homomorphism and isomorphism of groups - Classes - Symmetry operations and symmetry elements - Representations of groups - Reducible and irreducible representations - Character tables for simple molecular types (C<sub>2v</sub> and C<sub>3v</sub> point group molecules).

TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Develop knowledge in mathematical physics and its applications.
CO2: Understand the use of complex variables for solving definite integral.
CO3: Understand the applications of group theory in all the branches of Physics problems.
CO4: Enable students to formulate, interpret and draw inferences from mathematical solutions.

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SEMESTER - VII 19IPHYP74- PRACTICAL – VI  Credit : 6 Hours: 9

LEARNING OBJECTIVES:

➢ To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
➢ To study the aspects related to the application side of the experiments
➢ To understand the usage of basic laws and theories to determine various properties of the materials given.
➢ To providing a hands-on learning experience such as in measuring the basic concepts and applications of microprocessor.
(Any Sixteen Experiments)

1. Young’s modulus of a specimen plate- by Newton’s interference method.
2. Bi-prism on spectrometer- Wavelength (λ) and Refractive index (μ) of a liquid-using Laser source.
3. Charge of an electron- Spectrometer
4. Study of Hall effect in semiconductors.
5. Polarizability of Liquids- Hollow prism on spectrometer.
6. Hg-Cu spectrum- Hartmann’s constants and wavelength.
7. Planck’s constant.
8. Zeeman Effect.
9. Thermoluminescence
11. Microprocessor 8085 - Addition, Subtraction, Multiplication & Division
12. Microprocessor 8085 - Logical operation
13. Microprocessor 8085 - Solving expression, Factorial of N Numbers
14. Microprocessor 8085 - Code conversion
15. Microprocessor 8085 – Flashing and Rolling of Name display
16. Microprocessor 8085 – Stepper Motor
17. Microprocessor 8085 – ADC Interfacing
18. Microprocessor 8085 – DAC Interfacing
19. Microprocessor 8085 – Biggest and Smallest Numbers
20. Microprocessor 8085 – Ascending and Descending Order

COURSE OUTCOMES (COS):

CO1: Basic laws and theories involving amplifiers, integrated circuits, converters and flip flops etc.,
CO2: Understand the given concepts and its physical significance
CO3: Apply the theory to design the basic electronic circuits
CO4: Provide a hands-on learning experience and understand the basic concepts and applications of microprocessor.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - VIII 19IPHYC81- MATHEMATICAL PHYSICS – II Credit : 4 Hours: 4

LEARNING OBJECTIVES:

- To develop knowledge in mathematical physics and its applications.
- To develop expertise in mathematical techniques required in physics.
- To enhance problem solving skills.
To enable students to formulate, interpret and draw inferences from mathematical solutions.

UNIT-I: DIFFERENTIAL EQUATIONS

Homogeneous linear equations of second order with constant coefficients and their solutions – ordinary second order differential with variable coefficients and their solution by power series and Frobenius methods – extended power series method for indicial equations.

UNIT-II: SPECIAL FUNCTIONS - I

Gamma and Beta function- Legendre’s differential equation: Legendre polynomials - Generating functions - Recurrence relation - Rodrigue’s formula - Orthogonality; Bessel’s differential equation: Bessel polynomials - Generating functions - Recurrence relation - Rodrigue’s formula – Orthogonality.

UNIT-III: SPECIAL FUNCTIONS - II


UNIT-IV: PARTIAL DIFFERENTIAL EQUATIONS

Solution of Laplace Differential Equation - Two dimensional flow of heat in cartesian and cylindrical co-ordinates. Solution of heat flow equation in one dimension - Solution of wave equation - Transverse vibrations of a stretched string (Theory).

UNIT - V: INTEGRAL TRANSFORMS


TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Develop knowledge in mathematical physics and its applications.
CO2: Develop expertise in mathematical techniques required in physics.
CO3: Use differential equations and special functions to solve mathematical problems of interest in Physics.
CO4: Enable students to formulate, interpret and draw inferences from mathematical solutions.

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SEMESTER - VIII 19IPHYC82- CONDENSED MATTER PHYSICS - I  Credit : 4

LEARNING OBJECTIVES:

- This course gives an insight into the basic elements of the physics of solid and in particular the study of the structure of crystalline solids and their physical properties.
- To develop a deep understanding of how condensed matter is characterized on the atomic scale.
- Understanding of Lattice vibrations, approximations, phonons and heat capacity to know the correlation between the structure and thermal properties of the materials.

UNIT-I: CRYSTAL PHYSICS: CRYSTAL STRUCTURE

Lattice representation - Simple symmetry operations - Bravais Lattices, Unit cell, Wigner - Seitz cell - Miller planes and spacing - Characteristics of cubic cells - Structural features of NaCl, CsCl, Diamond, ZnS – Close packing.


UNIT-II: DIFFRACTION OF WAVES AND PARTICLES BY CRYSTALS


UNIT-III: CRYSTAL IMPERFECTIONS AND ORDERED PHASES OF MATTER


Ordered phases of matter: Translational and orientation order - Kinds of liquid crystalline order - Quasi crystals - Superfluidity.
UNIT-IV: LATTICE DYNAMICS

Theory of elastic vibrations in mono and diatomic lattices - Phonons – Dispersion relations - Phonon momentum.

Heat Capacity

Specific heat capacity of solids – Dulong and Petit’s law - Vibrational modes - Einstein model - Density of modes in one and three dimensions - Debye Model of heat capacity.

Anharmonic Effects

Explanation for Thermal expansion, Conductivity and resistivity – Umklapp process.

UNIT-V: THEORY OF ELECTRONS

Energy levels and Fermi-Darac distribution for a free electron gas – Periodic boundary condition and free electron gas in three dimensions – Heat capacity of the electron gas – Ohm’s law, Matthiessen’s rule – Hall effect and magnetoresistance – Wiedemann – Franz law.


TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Describe different types of crystal structures.
CO2: Understand the types of lattice vibrations and heat conduction.
CO3: Describe and understand the various imperfections in crystal.
CO4: Understand the band-structure of the solid.
MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - VIII | 19IPHYC83 - ELECTROMAGNETIC THEORY | Credit : 4 Hours: 4

LEARNING OBJECTIVES:

- To understand the nature of electric and magnetic fields and the intricate connection between them.
- To develop a strong background in electromagnetic theory, understand and use various mathematical tools to solve Maxwell equations in problems of wave propagation and radiation.
- To develop skills on solving analytical problems in electromagnetism.

UNIT - I: ELECTROSTATICS

Coulomb’s law; the electric field – line, flux and Gauss’s Law in differential form - the electrostatic potential; conductors and insulators; Gauss’s law - application of Gauss’s law – curl of E - Poisson’s equation; Laplace’s equation – work and energy in electrostatics – energy of a point charge distribution – energy of continuous charge distribution – induced charges – capacitors. Potentials: Laplace equation in one dimension and two dimensions – Dielectrics – induced dipoles – Gauss’s Law in the presence of dielectrics.

UNIT- II: MAGNETOSTATICS


UNIT - III: ELECTROMOTIVE FORCE


UNIT - IV: ELECTROMAGNETIC WAVES

The wave equation for E and B – Monochromatic Plan waves – energy and momentum in electromagnetic waves – electromagnetic waves in matters – TE waves in rectangular wave guides.

52
– the co-axial transmission line. **Potentials**: potentials and fields – scalar and vector potentials – Gauge transformation – Coulomb Gauge and Lorentz Gauge – Lorentz force law in potential form.

**UNIT - V: APPLICATION OF ELECTROMAGNETIC WAVES**

Boundary conditions at the surface of discontinuity – Reflection and refraction of E.M waves at the interface of non – Conducting media – Kinematic and dynamic properties – Fresnel’s equation – Electric field vector ‘E’ parallel to the plane of incidence and perpendicular to the plane of incidence – Reflection and transmission co-efficients at the interface between two non–Conducting media – Brewster’s law and degree of polarization – Total internal reflection.

**TEXT BOOKS:**


**SUPPLEMENTARY READING:**


**COURSE OUTCOMES (COs):**

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

**CO1:** Applying vector calculus operations and developing knowledge of vector fields and scalar fields

**CO2:** Describing the fundamental nature of static fields, including steady current, static electric and magnetic fields

**CO3:** Formulating potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media etc.,

**CO4:** Applying Maxwell’s equations and their application to boundary conditions, wave equations, and Poynting’s power-balance theorem.

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**SEMESTER - VIII | 19IPHP84- PRACTICAL – VII | Credit : 6 Hours: 9**

**LEARNING OBJECTIVES:**

➢ To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
➢ To study the aspects related to the application side of the experiments
To understand the usage of basic laws and theories to determine various properties of the materials given.

To providing a hands-on learning experience such as in measuring the basic concepts and applications of laser and microprocessor.

(Any Sixteen Experiments)

1. Michelson Interferometer – Wavelength Determination.
2. Energy gap – Four Probe Apparatus.
3. Elastic constants of Glass- Cornu's interference method (Hyperbolic fringes).
4. Solar Spectrum
5. Thermistor characteristics-Band gap energy
6. Reflection grating-Spectrometer
7. Ultrasonic diffractometer – Velocity and compressibility of liquids
10. Magnetostriiction
11. Numerical Aperture and Acceptance Angle-Fibre Optics
12. Microprocessor 8086 I – Addition and Subtraction (16 & 32 bits)
13. Microprocessor 8086 II – Multiplication and Division (16 & 32 bits)
14. Microprocessor 8086 - Biggest and Smallest Numbers
15. Microprocessor 8086 - Code conversion
16. Microprocessor 8086 - Solving expression, Factorial of N Numbers
17. Microprocessor 8086 – Sum of elements in an array and factorial
18. Microprocessor 8086 – Sorting of N Elements (Ascending and Descending Order)
19. Microprocessor 8086 – String Operations
20. Wave form generations using 8086.

COURSE OUTCOMES (COS):

CO1: Basic laws and theories involving amplifiers, integrated circuits, converters and flip flops etc.,
CO2: Understand the given concepts and its physical significance
CO3: Apply the theory to design the basic electrical circuits
CO4: provide a hands-on learning experience and understand the basic concepts and applications of laser and microprocessor.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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LEARNING OBJECTIVES:

- To study the fundamentals of wave mechanics.
- To study the stationary state and eigen spectrum of systems using time dependent Schrodinger equation.
- To solve the exactly soluble eigen value problems.
- To know the matrix formulation of quantum theory and how it can be used to understand the equation of motion.
- To understand the theory of identical particles and Angular momentum.

UNIT-I: FOUNDATIONS OF WAVE MECHANICS


Matter waves- Equation of motion- Schrodinger equation for the free particle – physical interpretation of wave function-normalised and orthogonal wave functions-expansion theorem-admissibility conditions- stationary state solution of Schrodinger wave equation - expectation values-probability current density- Ehrenferts theorem.

UNIT-II: STATIONARY STATE AND EIGEN SPECTRUM

Time independent Schrodinger equation - Particle in a square well potential – Bound states – eigen values, eigen functions –Potential barrier – quantum mechanical tunnelling- alpha emission.


UNIT-III: EXACTLY SOLUBLE EIGENVALUE PROBLEMS


UNIT-IV: MATRIX FORMULATION OF QUANTUM THEORY, EQUATION OF MOTION & ANGULAR MOMENTUM


Angular momentum -commutation relation of $J_z$, $J_+$, $J_-$ - eigen values and matrix representation of $J^2_+, J_+, J_-$. – Spin angular momentum – spin $\frac{1}{2}$, spin-1- addition of angular momenta- Clebsch-Gordan coefficients.
UNIT-V: SCATTERING THEORY

Kinematics of scattering process - wave mechanical picture- Green’s functions – Born approximation and its validity –Born series – screend coulombic potential scattering from Born approximation.


TEXT BOOKS:

SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):

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

CO1: Study the stationary state and eigen spectrum of systems using time dependent Schrodinger equation.
CO2: Know to solve the exactly soluble eigen value problems.
CO3: Know the matrix formulation of quantum theory and how it can be used to understand the equation of motion.
CO4: Understand the theory of identical particles and Angular momentum.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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LEARNING OBJECTIVES:

- This course develops analytical thinking to understand the phenomenon that decides various properties of solids.
- Provides a valuable theoretical introduction and overview of the fundamental application of physics of solids.
- To impart the basic knowledge about superconductors and high temperature superconductors.

UNIT – I: THEORY OF DIELECTRICS


UNIT – II: THEORY OF FERROELECTRICS AND PIEZOELECTRICS


UNIT – III: MAGNETIC PROPERTIES OF MATERIALS


UNIT – IV: SUPERCONDUCTIVITY

Occurence of super conductivity - Destruction of super conductivity by magnetic fields - Meissner Effect – Type I and Type II Super conductors - Heat Capacity - Energy gap - Microwave and infrared properties - Isotope effect - Thermodynamics of the superconducting transition - London equation - Coherence Length - BCS theory of superconductivity, BCS ground state - Flux quantisation in a super conduction ring - Duration of persistence currents - Single particle
tunnelling - DC Josephson effect - AC Josephson effect - Macroscopic quantum interference – High temperature super conductors – Applications.

UNIT – V: PHYSICS OF NANOSOLIDS


TEXT BOOKS:

SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):

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

**CO1:** Understand the dielectric properties of the solid systems.

**CO2:** Understand the ferroelectric and piezoelectric properties of the solid systems and its application.

**CO3:** Understand deeply the electrical and magnetic properties of crystalline solids with theoretical background.

**CO4:** Understand the theoretical basis of nanotechnology and carbon in nanotechnology.

**MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)**

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LEARNING OBJECTIVES:

- To understand the forces of binding the nucleons in detail and the perspective of various models proposed with dipole and quadropole moments of the nucleus.
- To make them realize the cause of various nuclear particles in the strong short range interaction among the nucleons.
- To understand the concepts of elementary particles.

UNIT-I: NUCLEAR FORCES


UNIT-II: NUCLEAR MODELS


UNIT-III: NUCLEAR REACTIONS

Nuclear reaction - Q- value – Nuclear reaction cross section – Direct Nuclear Reactions: Knock out reaction, Pick-up reaction, Stripping reaction – Compound nucleus theory – Formation – Disintegration energy levels – Partial wave analysis of Nuclear reaction cross-section - Resonance Scattering and Reaction cross-section (Breit-Wigner dispersion formula) – Scattering matrix - Reciprocity theorem – Breit -Wigner one level formula – Resonance scattering – Absorption cross section at high energy.

UNIT – IV: NUCLEAR FISSION AND FUSION

Nuclear fission- Energy release in fission reaction - Distribution of fission products- neutron emission in fission - Fissile and fertile materials - Bohr Wheeler theory. Nuclear chain reaction - Four factor formula - Nuclear reactors - Classification of reactors - Critical size of a reactor - Reactor materials.

Nuclear fusion – nuclear reaction in stars – Fusion reactors – Pinched discharge - Stellarator – Magnetic mirror systems.

UNIT-V: ELEMENTRY PARTICLE PHYSICS

Classification of elementary particles - Types of interaction between elementary particles – Hadrons and leptons – Symmetry and conservation laws – Strangeness and associate production - CPT theorem – classification of hadrons – Quark model - Isospin multiples - SU(2)- SU(3) multiplets- Gell-Mann - Okubo mass formula for octet and decuplet hadrons – Phenomenology of
weak interaction hadrons and leptons - Universal Fermi interaction – Elementary concepts of weak interactions.

TEXT BOOKS:

3. V. Devanathan Nuclear Physics, , Narosa Publishing house.

SUPPLEMENTARY READING:

3. H. Enge, Addition-Wesley, Introduction to Nuclear Physics, Reading MA., 1975

COURSE OUTCOMES (COs):

By the end of the Course, the student will be able to

CO1: Understand about nuclear forces and their dependence on various parameters.
CO2: Compare various nuclear models and properties of the nucleus.
CO3: Understand the Nuclear energy sources through various nuclear reactions with are realized.
CO4: Know the causes for short range interaction inside the nucleons with mathematical formulations.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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To providing a hands-on learning experience such as in measuring the basic concepts and applications of microcontroller.

(Any Sixteen Experiments)

1. Low field Hysterisis
2. Susceptibility of liquids using Guoy-Balance
3. Susceptibility of liquids by Quinke’s method
4. Photo elastic constant
5. Hysterisis loop tracer
6. Cu-Salt (visible) Spectrum
7. Molecular constants-CN Band
8. Channel Spectrum
10. Ultrasonic velocity of liquid mixtures- Interferometer
12. G.M. Counter characteristics
13. Microcontroller 8051 Experiment-I (Addition and Subtraction and Logical operations)
14. Microcontroller 8051 Experiment-II(Multiplication and Division and Solving expressions)
15. Microcontroller 8051 Experiment-III (Logical operations, 1’s and 2’s compliment)
16. Array Operations-I Microcontroller 8051(Sum of elements, biggest and smallest numbers)
17. Array Operations-II Microcontroller 8051(Ascending and descending order)
18. Microcontroller 8051 - Code conversion
19. Microcontroller 8051 – ADC interfacing
20. Microcontroller 8051 - Stepper motor interfacing

COURSE OUTCOMES (COS):

CO1: Basic laws and theories involving amplifiers, integrated circuits, converters and flip flops etc.,
CO2: Understand the given concepts and its physical significance
CO3: Apply the theory to design the basic electrical circuits
CO4: Provide a hands-on learning experience and understand the basic concepts and applications of microcontroller.

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SEMESTER - X

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LEARNING OBJECTIVES:

➢ To learn about the approximation methods for time independent and time dependent perturbation theory.
➢ To understand the kinematics of scattering process and partial wave analysis.
➢ To study the theory of relativistic quantum mechanics and field quantization.
➢ To study the quantum theory of atomic and molecular structures.
UNIT-I: APPROXIMATION METHODS FOR TIME INDEPENDENT PROBLEMS


UNIT-II: APPROXIMATION METHODS FOR TIME DEPENDENT PERTURBATION THEORY


UNIT-III: VARIATION METHOD


UNIT-IV: QUANTUM THEORY OF ATOMIC AND MOLECULAR STRUCTURE

Central field approximation: Residual electrostatic interaction-spin-orbit interaction- Determination of central field: Thomas Fermi statistical method-Hartree and Hartree-Fock approximations (self consistent fields) – Atomic structure and Hund’s rule.


UNIT-V: RELATIVISTIC QUANTUM MECHANICS & QUANTIZATION OF THE FIELD


Quantization of wave fields- Classical Lagrangian equation- Classical Hamiltonian equation- Field quantization of the non-relativistics Schrodinger equation- Creation, destruction and number operators- Anticommutation relations- Quantization of Electromagnetic field energy and momentum.

TEXT BOOKS:

SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

By the end of the Course, the student will be able to

**CO1:** Apply and appreciate the approximation methods to various problems

**CO2:** Identify the time dependent and time independent cases

**CO3:** Grasp the developments in relativistic quantum mechanics

**CO4:** Evaluate the quantum field parameters

**MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)**

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SEMESTER - X 19IPPHYC102 - SPECTROSCOPY

Credit : 4
Hours: 4

LEARNING OBJECTIVES:

- To educate the students about the fundamental aspects of Rotational and Vibrational Spectroscopy.
- To import knowledge regarding the fundamental aspects of Resonance Spectroscopy.
- To expose the students to the effective applications of various molecular Spectroscopic techniques to study the chemical and structural properties of materials.

UNIT–I: MICROWAVE SPECTROSCOPY


UNIT –II: INFRARED SPECTROSCOPY
Vibrational energy of a diatomic molecule- Infrared selection rules-Vibrating diatomic molecule-Diatomic vibrating rotator- Vibrations of polyatomic molecules-Fermi resonance-Rotation vibration spectra of polyatomic molecules-Normal modes of vibration in crystal-Interpretation of vibrational spectra-Group frequencies-IR spectrophotometer-Instrumentation-Sample handling techniques-Fourier Transform Infrared spectroscopy-Applications

UNIT– III: RAMAN SPECTROSCOPY


UNIT– IV: NUCLEAR MAGNETIC AND ELECTRON SPIN RESONANCE SPECTROSCOPY


UNIT– V: NUCLEAR QUADRUPOLE RESONANCE AND MOSSBAUER SPECTROSCOPY


Mossbauer effect - recoilless emission and absorption - hyperfine interaction - chemical isomer shift - magnetic hyperfine and electric quadruple interactions – Instrumentation – applications.

TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

By the end of the Course, the student will be able to

CO1: Appreciate the principle of spectroscopy in different regions of the EM spectrum.
CO2: Relate the theory of spectroscopy to the study of molecular structure.
CO3: Identify the appropriate spectral technique as an analytical tool to investigate the
characteristics of materials.

CO4: Outline and correlate for providing solution to interdisciplinary problem.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - X 19IPHYE103 - PHYSICS OF NANOMATERIALS

LEARNING OBJECTIVES:

- To distinguish nanomaterials from bulk materials
- To apply their acquired knowledge in research level to synthesis and characterize the nanomaterials.
- To identify the various techniques to investigate the different properties such as optical, structural and morphology of nanoparticles.
- To select the nanomaterials for various applications.

UNIT – I: INTRODUCTION


UNIT – II: SPECIAL NANOMATERIALS


UNIT – III: PROPERTIES


UNIT – IV: SYNTHESIS

Synthesis of nano materials: Physical vapour deposition - Chemical vapour deposition - Sol gel - Ball milling technique - Reverse miceller technique - Electro deposition. Nanostructures fabrication by physical techniques – Nano lithography – Nanomanipulator.
UNIT – V: CHARACTERIZATION AND APPLICATIONS


TEXT BOOKS:

SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):

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

CO1: Distinguish nanomaterials from bulk materials.
CO2: Apply their acquired knowledge in research level to synthesis and characterize the nanomaterials.
CO3: Identify the various techniques to investigate the different properties such as optical, structural and morphology of nanoparticles.
CO4: Select the nanomaterials for various applications.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER - X 19IPHYP104 - PRACTICAL – IX

Credit : 6
Hours: 9

LEARNING OBJECTIVES:

- To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
- To study the aspects related to the application side of the experiments
- To understand the usage of basic laws and theories to determine various properties of the materials given.
To providing a hands-on learning experience such as in measuring the basic concepts and applications of microcontroller.

(Any Sixteen experiments)

1. Spectrophotometer
2. Co-effiecient of linear expansion-Interference Method.
3. R.F. Oscillator- Dipole moment of Liquids
4. Susceptibility of Salt solutions/ Solids-Guoy method
5. Susceptibility of liquid mixture- Quincke’s method-Calculation of Bohr magneton.
6. Phase diagram-Two component system.
7. Molecular constants –AlO Band
8. Molecular constants- CN Band.
10. Optical rotation of quartz.
11. G.M. Counter -Absorption co-efficient of a foil.
12. F.P. Etalon.
13. Dielectric of Solids
15. Stark Effect.
17. 8051 Micro controller - Setting bits and Masking bits in an 8-bit number.
18. Microcontroller 8051 - Generate a delay.

COURSE OUTCOMES (COS):

CO1: Basic laws and theories involving amplifiers, integrated circuits, converters and flip flops etc.,

CO2: Understand the given concepts and its physical significance

CO3: Apply the theory to design the basic electrical circuits

CO4: Provide a hands-on learning experience and understand the basic concepts and applications of microcontroller.

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LEARNING OBJECTIVES:

To learn the basics of research work by carrying out selective academic and applied projects.

COURSE OUTCOMES:

At the end of the course, the students will

CO1: Acquire the practical knowledge of understanding research problems.
CO2: Gain knowledge basic principles of various components of research
CO3: Apply the principles of chemistry in various fields

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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DEPARTMENT ELECTIVES

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LEARNING OBJECTIVES:

- To impart knowledge about the basic electrical devices.
- To make the students understand the working of transformers.
- To give exposure in understanding the functioning of various household appliances.
- To highlights the concept of electrical switches, inverters and motors.

UNIT- 1:
Resistance - capacitance - inductance and its units - electrical charge - current - potential - units and measuring meters - Ohm’s law - Galvanometer, ammeter, voltmeter and multimeter.
Electrical energy - power - watt - kWh - consumption of electrical power.

UNIT- 2:
Transformer - principle and working - classification of transformers - testing of transformers - Core, Shell and Berry types, auto transformer - construction and uses. Cooling of transformers - Losses in transformer.

UNIT - 3:

UNIT- 4:
AC and DC - Single phase and three phase connections - RMS and peak values - house wiring - Star and delta connection - overloading - earthing - short circuiting - colour code for insulation wires.

UNIT- 5:

TEXT BOOKS:
3. B L Theraja, Basic Electronics, S Chand & Co.

SUPPLEMENTARY READING:
1. M G Say, Performance and design of AC machines - ELBS Edn.
2. P K Palanichamy, Semi conductor physics and opto electronics.
COURSE OUTCOMES (COs):

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

CO1: Be familiar with the basic concepts of construction and working of electrical devices.

CO2: Understand the concepts and understand the working of transformers

CO3: Understanding the functioning of various house hold appliances

CO4: Apply the principles of electrical appliances in day to life.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER – I 19IPHYE 15.2 - PHYSICS OF HUMAN ANATOMY Credit : 3 Hour : 4

LEARNING OBJECTIVES:

- To provide an understanding of the physics of human anatomy and body systems.
- To understand the medical applications of light to human body.
- To understand the law of physics to explain several bodily functions including the mechanics of breathing, acoustic properties of the ears and vision optics.
- To know the basic ideas in understanding the heat and work and energy of human body.

UNIT- 1:

PHYSICS OF LIGHT AND ITS MEDICAL APPLICATION TO HUMAN BODY

UNIT- 2:

PHYSICS OF BREATHING:

UNIT- 3:

ENERGY OF HUMAN BODY
Heat loss of the body due to conduction, convection, evaporation, radation-Wind chill – Mechanism to decrease body temperature – Medical implication of high temperature.

UNIT- 4:

THE ACOUSTICS OF BODY
UNIT- 5:

PHYSICS OF EYE

COURSE OUTCOMES (COs):
By the end of the course, the students will be able to

- **CO1**: Understand the medical applications of light to human body.
- **CO2**: Understand the law of physics to explain several bodily functions including the mechanics of breathing, acoustic properties of the ears and vision optics.
- **CO3**: To understand the law of physics to explain several bodily functions including the mechanics of breathing, acoustic properties of the ears and vision optics.
- **CO4**: Know the basic ideas in understanding the heat and work and energy of human body.

TEXT BOOKS:

SUPPLEMENTARY READING:
1. web.khu.ac.kr/~bil/lecture/MedicalPhysics/Ch14.PDF

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER – III  19IPHYE 35.1 - BASIC ELECTRONIC DEVICES  Credit : 3  Hour : 4

LEARNING OBJECTIVES:

- To impart knowledge about the resistors, capacitors and inductors.
- To provide the basic ideas of semiconductors.
- To enable the students to know about the ideas of transistors and working operations for various diodes.
UNIT -1
PASSIVE DEVICES

Types of resistor –color code –Construction of various types of resistors (carbon composition, carbon film, wire-wound etc.) –power ratings-Capacitors (ceramic, mica polystrene, electrolytic etc.) –fixed and variable capacitors –Inductors, types.

UNIT- 2
ATOMIC STRUCTURE


UNIT- 3
PN JUNCTION

PN junction-Biasing a PN junction –forward and reverse biasing –PN junction diode: Characteristics -static and dynamic resistance -Diode Rectifiers,clippers and clamps -Zener diode –Characteristics-voltage regulation using Zener diode.

UNIT- 4
TRANSISTORS


UNIT-5
FET

FET Constructional features-working Principle, features and characteristics –JFET and MOSFET and their characteristics –enhancement and depletion type –LED, LDR and photodiode.

TEXT BOOKS:
2. B.L.Theraja, Basic solid state Electronics II, S.Chand & Co

SUPPLEMENTARY READING:
2. Basic Electronics, 6th edition by B Grob, McGraw Hill NY 1

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to
CO1: Be familiar with the basic concepts of construction and working of electronic devices.
CO2: Acquire an in-depth knowledge about the resistors, capacitors and inductors.

CO3: Understand the basic ideas of semiconductors.
CO4: Enable the students to know the ideas of transistors and working operations for various diodes.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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SEMESTER – III 19IPHYE 35.2 - ENVIRONMENTAL PHYSICS Credit : 3 Hour : 4

LEARNING OBJECTIVES:

➢ To provide the basic ideas regarding the atmosphere.
➢ To impart knowledge regarding weather and climate.
➢ To familiarize the concept of distribution of temperature and temperature inversion.
➢ To enable the students to understand atmospheric and wind pressure.
➢ To highlight the concept of energy in Biology.

Unit -1

Atmospheric Science-I

Atmosphere as part of the biosphere ecosystems- Evolution of atmosphere- Composition and structure of the atmosphere- Need of atmospheric studies in environmental sciences.

Transport of matter; energy and momentum in nature; Stratification and stability of the atmosphere; Laws of motion; Hydrostatic equilibrium; General circulation of the tropics.

Unit -2

Atmospheric Science-II

Elements of weather and climate- Weather parameters (temperature, wind, pressure, relative humidity, rainfall)- Climatology of weather parameters, long-term and short term climatic effects.

Unit -3

Temperature measurements and Controls

Temperature measurements- Horizontal and vertical distribution of temperature- Temperature inversion- Types of inversion- Temperature gradients- Urban heat island effect.

Unit -4

Atmospheric Pressure and Winds

Pressure measurement and distribution- Wind observations-Factors affecting wind pressure- Wind belts- Local winds- Geostrophic and gradient winds.
Unit -5


Deforestation- Degradation of soils- Agriculture and land use changes- Changing composition of local and global environment- Introduction to Remote sensing techniques.

TEXT BOOKS:


SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):

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

CO1: Describe various aspects of atmosphere.
CO2: Acquire knowledge regarding weather and climate
CO3: Appraise the concept of distribution of temperature and temperature inversion.
CO4: Analyze the factors affecting atmospheric and wind pressure.
CO5: Interpret the concept of Energy in Biology

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SEMESTER – V 19IPHYE 56.1 - COMMUNICATION SYSTEM

Credit : 3 Hour : 4

LEARNING OBJECTIVES:

➢ To provide the basic ideas regarding the various aspects of communication system.
➢ To impart knowledge about analog and Pulse communication.
➢ To enable to students understand digital and data fiber optical communication.
➢ To highlight the concept of fiber optical future developments communication system.

To make the students understand the basic knowledge about various communication systems.

Unit - 1 : Basics Of Communication

Communication systems- modulation- need for modulation- bandwidth requirements- noise-thermal agitation noise- noise calculations- signal to noise Ratio- noise figure- calculation of noise figure- measurement of noise figure.
**Unit - 2 : Analog Communication**

Amplitude modulation- frequency spectrum of AM wave- power relations in the AM wave-frequency modulation- mathematical representation of FM- frequency spectrum- phase modulation- comparisons: frequency and phase modulation, frequency and amplitude modulations.

**Unit - 3 : Pulse Communication**

Pulse communication- pulse modulation types- pulse amplitude modulation- pulse width modulation- pulse position modulation- pulse code modulation- telegraphy- telemetry.

**Unit - 4 : Data Communication**

Data communication systems- data transmission circuits- error detection and correction-interconnection requirements- modern classification- network and control considerations.

**Unit - 5 : Fiber Optical Communication**

Optical fiber cables- losses in fibers- measurements of fiber characteristics- analog and digital modulation schemes- fiber optical communication systems- operating wavelength- emitter design-detector design- fiber choice- future developments.

**TEXT BOOKS:**


**SUPPLEMENTARY READING:**

1. 5. Gerd Keiser, Optical fiber communications, McGraw Hill, Singapore, 2000

**MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)**

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**SEMESTER – V 19IPHYE 56.2 - AUDIO AND VIDEO SYSTEMS**

**Credit : 3**

**Hour : 4**

**LEARNING OBJECTIVES:**

- To know the characteristics of sound.
- To understand the working principles and main features of audio and video devices
Unit - I Characteristics of Sound


Unit - II Audio System

MICROPHONES : Characteristics of microphones – Requisites of a good microphones – Types of microphones – Moving coil microphone – Crystal microphone – Carbon microphone – Special microphone.


Unit - III Television Monochrome Television


Unit - IV Digital Television

Digital Television-Transmission and Reception: Digital system hardware, Signal quantizing and encoding, digital satellite television, Direct –To – Home (DTH) satellite television, Digital TV receiver, Merits of digital TV receivers, Digital Terrestrial Television (DTT), CCTV.

Unit - V Liquid Crystal Screen Television

LCD technology - LCD matrix types and operation - LCD screens for television - LED TV - Edge LEDs, Differences between LED and LCD displays.

TEXT BOOKS:


SUPPLEMENTARY READING:

COURSE OUTCOMES (COs):

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

CO1: Describe the various aspects of sound.

CO2: Acquire knowledge regarding Audio and Video system.

CO3: Appraise the concept of Digital and LCD Television.

CO4: Highlight the concept of LED and LCD

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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LEARNING OBJECTIVES:

- To learn the architecture of 8085 microprocessor and its programming.
- To study the architecture of 8086 microprocessor.
- To familiarize the architecture of 8051 microcontroller and its programming
- To study the interfacing devices of microprocessor 8085.

UNIT-I: MICROPROCESSORS 8085 ARCHITECTURE


UNIT-II: 8085 ASSEMBLY LANGUAGE PROGRAMMING

Instruction set: Data transfer operations - Arithmetic operations Logical operations – Branching and machine control operations. Addressing modes. Writing assembly language programs: Looping, counting and indexing. Counters and time delays - Stack - subroutine. Translation from assembly language to machine language

UNIT-III: MICROPROCESSOR 8086


UNIT - IV: MICROCONTROLLER 8051 ARCHITECTURE AND PROGRAMMING

Introduction to microcontroller and embedded system. Difference between microprocessor and microcontroller. 8051 microcontroller : Pin configuration, Architecture and Key features. 8051. Data types and directives Instruction set: Data transfer instructions - Arithmetic instructions –

UNIT – V: INTERFACING OF MICROPROCESSOR 8085

Basic concepts of programmable device - 8255 Programmable Peripheral Interface (PPI) – interface of ADC and DAC. 8257 Direct Memory Access (DMA) controller. Basic concepts of serial I/O and data communication – interface of 8251 Universal Synchronous Asynchronous Receiver Transmitter (USART)

TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Describe basic concept and architecture of 8051 microprocessor and implement programs in 8051.

CO2: Learn the architecture of 8086 microprocessor.

CO3: Understand the architecture of 8051 microcontroller and develop assembly language programs.

CO4: Discuss concept of interfacing in microprocessor 8085.

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SEMESTER - VIII 19IPHYE85.2 - PHYSICS OF THE EARTH

LEARNING OBJECTIVES:

➢ To understand the physical structure and behaviour of the earth as well as geomagnetic properties of rocks in the Earth’s crust.
To study the elastic behaviour in earth by applying various theories and hypothesis.
To highlight the concept of solar system and behaviour of planets in this system.

UNIT – I: SOLAR SYSTEM

The earth and the solar system – Important physical parameters and properties of the planet earth; Stress and Strain, Wave and motion, Seismic waves. Travel time Tables and Velocity – Depth curves – Variation of Density within the Earth.

UNIT – II: GRAVITATION


UNIT – III: THERMAL HISTORY OF EARTH


UNIT – IV: ELASTIC PROPERTIES


UNIT – V: GEOMAGNETISM AND PALAEOEARTH


TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1 : Think and analyse the concept of the Earth and its properties.
CO2 : Accumulate the various concept proposed by theories and laws.
CO3 : Enlighten the concept solar system.
CO4: Acquire basic knowledge about geomagnetism and paleomagnetism.
LEARNING OBJECTIVES:

- To create an awareness among the students regarding the forms of energy and the availability of their resources
- To educate regarding the utilization and conservation of energy
- To impart a knowledge about the Sustainable forms of energy

UNIT– I: CONVENTIONAL ENERGY SOURCES

Energy sources and their availability – Various forms of energy – Renewable and conventional energy systems – Comparison – Coal, oil and natural gas.

UNIT – II: SOLAR ENERGY


UNIT – III: THERMAL ENERGY STORAGE


UNIT – IV: PHOTO CONVERSION

Photovoltaic conversion - Principle and working of solar cells - Conversion efficiency - Single crystal and Polycrystalline silicon - Cadmium sulphide - Cadmium telluride.

UNIT – V: SUSTAINABLE FORMS OF ENERGY

Reserves of Energy Resources – Environmental aspects of energy extraction, conversion and utilization – challenges associated with the non-sustainable energy sources with regard to future Supply and the environment

Hydrogen: principle of operation and system components-comparisons among energy uses, resources, and technologies-technical and economic challenges in the integration of sustainable energy form-potential solutions and application.

TEXT BOOKS:


SUPPLEMENTARY READING:


COURSE OUTCOMES (COs):

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

CO1: Be aware of various forms of energy and the effective utilization of their resources.
CO2: Be exposed to the practical usage of solar energy.
CO3: Be exposed to the practical usage of thermal energy.
CO4: Acquire an in depth knowledge about the sustainable forms of energy.

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SEMESTER - IX 19IPHYE95.1 – INSTRUMENTATION Credit : 3 Hours: 3

ELECTIVE-IV (DE 2)

LEARNING OBJECTIVES:

- To understand the types of transducer for a particular measurement.
- To develop knowledge in digital, analytical and biomedical instruments for different applications.
- To know the functioning of medical imaging instruments.

UNIT – I: TRANSDUCERS

Basic functional elements of measuring system-Transducers: Definition-Parts-Classification-Types of primary sensing element.
Piezo electric transducers: Principle, theory and working of piezo electric crystals.

UNIT – II: DIGITAL INSTRUMENTATION


UNIT – III: ANALYTICAL INSTRUMENTATION

Principle, working, Instrumentation and applications of UV-Vis Spectrophotometer, ICP-AES, (Inductively coupled plasma-Atomic emission spectroscopy), SEM (Scanning Electron Microscope) and AFM (Atomic Force Microscopy).

UNIT – IV: BIO-MEDICAL INSTRUMENTATION

Components of the Bio-medical instrument system-Electrodes: Equivalent circuit-Theoy - Types. Principle, block diagram and functioning of ECG, EEG and EMG.

UNIT – V: MEDICAL IMAGING INSTRUMENTATION

Computed Tomography: Principle-CAT scanning-Instrumentation-Contrast scale-Scanning components.

TEXT BOOKS FOR STUDY:

2. Electronic measurements and Instrumentation, Dr.Rajendra Prasad, Khanna Publishers, 2002

TEXT BOOKS FOR REFERENCE:

COURSE OUTCOMES (COs):

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

**CO1:** Select the types of transducer for a particular measurement.

**CO2:** Test and use the digital instruments for different applications.

**CO3:** Understand the various analytical and biomedical instrumentation and their uses.

**CO4:** Know the functioning of medical imaging instruments.

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SEMESTER - IX | 19IPHYE95.2- BIO-MEDICAL INSTRUMENTATION | Credit : 3 Hours: 3

LEARNING OBJECTIVES:

- To gain the knowledge about the bio medical instruments used for measuring bio-electric potentials and the electrodes used for sensing the bio potentials.
- To understand the working principles of imaging equipments and bio medical instruments used for determining the physiological parameters.
- To update the knowledge of various lasers used for medical applications for the students.

UNIT – I: BIO-ELECTRIC POTENTIALS


UNIT – II: BIO-POTENTIAL ELECTRODES

Biopotential Electrodes – Types of Electrodes -Microelectrodes – Body surface electrodes – Depth and Needle electrodes- Chemical electrodes –Distortion in measured bioelectric signals using electrodes-Electrode paste

UNIT – III: IMAGING EQUIPMENTS

Ultrasonic Imaging-Reflection-Scattering-A mode display-B mode display-T-M mode display-Ultrasonic imaging instrumentation-Biomedical applications- Magnetic Resonance Imaging (MRI)-Principle-Instrumentation-Advantages of MRI over other medical imaging techniques-Thermography-Endoscopy
UNIT – IV: MEASUREMENT OF PHYSIOLOGICAL PARAMETERS

Blood Pressure Measurement-Introduction-Direct Measurement using Catheters-Advance of Direct Method-Indirect Method-Oscillometric measurement method-


UNIT – V: LASER IN MEDICINE


TEXT BOOKS FOR STUDY:


TEXT BOOKS FOR REFERENCE:


COURSE OUTCOMES (COs):

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

CO1: Understand the importance of bio medical instruments and accuracy of the measured physical parameters and their practical implementation in the medical field.
CO2: Understand experimentally recording data, its inference to diagnose the diseases.
CO3: Understand various techniques and its relevance in various defects in the body parts.
CO4: Solve the health issues from the bio medical instruments and applicability in physics concepts may give the clear idea about the health issues.

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SEMESTER - IX 19IPHYE95.3 - PETRO PHYSICS

Credit : 3
Hours: 3

LEARNING OBJECTIVES:

➢ To understand the various magnetites and behaviour of the remenance properties.
To study the geomagnetic elements of the earth and various magnetometer instruments.
To understand the classification and properties of rock forming minerals
To highlight the concept of seismic waves and various dating methods.

UNIT – I


UNIT – II
Geomagnetic elements of the earth – Field variation and detection - The Magnetic observatory – mapping of secular variations. Diurnal variation of magnetic disturbances – initial susceptibility of rocks – single and multidomain cases – Curie point determination and its importance.

Laboratory and field instruments for magnetic measurements – Astatic magnetometer – spinner magnetometer – Fluxgate magnetometer, Proton procession magnetometer – Theory, practice and applications.

UNIT -III
Classification of rock forming minerals – physical properties of minerals with special reference to optical properties – elementary details of a polarizing microscope and petrographic analysis.


UNIT – IV

UNIT – V

Text Books for study:
Text Books for Reference:


COURSE OUTCOMES (COs):

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

CO1: Understand the various magnetites and behaviour of the remanence properties.

CO2: Study the geomagnetic elements of the earth and various magnetometer instruments.

CO3: To understand the classification and properties of rock forming minerals

CO4: To highlight the concept of seismic waves and various dating methods.

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SEMESTER - IX 19IPHYE95.4 - MEDICAL PHYSICS Credit: 3 Hours: 3

LEARNING OBJECTIVES:

- To gain the knowledge about the bio medical instruments used for measuring bioelectric potentials and the electrodes used for sensing the bio potentials.
- To understand the working principles of imaging equipments and bio medical instruments used for determining the physiological parameters.
- To update the knowledge of various nuclear medicine and biological effects of radiation.

Unit – I: Bio-Electric Potentials


Unit – II: Digital X-ray imaging and Computed Tomography

Unit – III: Imaging with Ultrasound and MRI

Unit – IV: Physics of Nuclear Medicine and Biological effects of Radiation

Unit – V: Medical Imaging Instrumentation

Text Books for study:

Text Books for References:

COURSE OUTCOMES (COs):
By the end of the course, the student will be able to

CO1 : To gain the knowledge about the bio medical instruments used for measuring bio-electric potentials and the electrodes used for sensing the bio potentials.

CO2: To understand the working principles of imaging equipments used for determining the physiological parameters.

CO3 : To understand the working principles of bio medical instruments used for determining the physiological parameters.

CO4 : To update the knowledge of various nuclear medicine and biological effects of radiation.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)
LEARNING OBJECTIVES:

- To understand the applications of various microscopic tools in cell biology.
- To understand the fundamentals of macromolecular structure.
- To understand the analytical techniques in characterizing biomolecular interactions and its structure.

UNIT I: CELL ORGANIZATION

Cell as the basic structural unit- Origin & organization of Prokaryotic and Eukaryotic cell-

UNIT II: TOOLS IN CELL BIOLOGY


UNIT- III: MACROMOLECULAR STRUCTURE

Nucleic acid structure: Chemical structure of the nucleic acid - Conformational possibilities of monomers and polymers- Double helix structure of DNA- Polymorphism of DNA- DNA nanostructures and the structure of transfer RNA.


UNIT-IV: SEPERATION TECHNIQUES


UNIT V: OPTICAL & DIFFRACTION TECHNIQUES

Circular Dichroism and optical rotator dispersion:- Plane, circular and elliptical polarization of light- Absorption by oriented molecules- Dichroic ratio of proteins and nucleic acids- Circular dichroism (CD) - optical rotatory dispensor (ORD) - Relation between CD and ORD- Application of ORD in conformation and interactions of biomolecules.


TEXT BOOKS FOR STUDY:


TEXT BOOKS FOR REFERENCE:


COURSE OUTCOMES (COs):

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

CO1: Have in-depth knowledge of the structure of cells and the macromolecular structure.

CO2: Understand the basic principles of the various microscopic techniques presented in the course, their advantages and limitations.

CO3: Provide an introduction to various separation techniques that are used in biological samples.

CO4: Understand the different processes of optical and diffraction techniques.

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19IPHYA-1- ANCILLARY PHYSICS-I

Credit : 3
Hours: 3
LEARNING OBJECTIVES:

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

UNIT - I: MECHANICS

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

UNIT - II: RELATIVITY


UNIT-III: LASER PHYSICS


UNIT- IV: NUCLEAR PHYSICS


UNIT- V: BASIC ELECTRONICS

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

TEXT BOOKS FOR STUDY:

2. Modern Physics, Murugasen & Kiruthiga Sivaprasath S.Chand & Co Ltd., 2016

TEXT BOOKS FOR REFERENCES:

COURSE OUTCOMES (COs):
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.

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19IPHYA-2- ANCILLARY PHYSICS – II

[Common for Five year M.Sc: Chemistry, Mathematics, Geology and Marine (OST)]

LEARNING OBJECTIVES:

➢ To educate the interdisciplinary students to understand the fundamental concepts of various topics of physics.
➢ To understand about atom model, X-rays, photoelectric effect and wave mechanics.
➢ To know about the ideas of nuclear physics, polarization and digital electronics.

UNIT - I: ATOMIC PHYSICS

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


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


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.

TEXT BOOKS FOR STUDY:
1. Modern Physics, R. Murugasen, & Kiruthiga Sivaprasath S.Chand & Co Ltd., 2016

TEXT BOOKS FOR REFERENCES:

COURSE OUTCOMES (COs):

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

CO1 : Understand the atomic models, production of X-rays and photoelectric 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.

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LEARNING OBJECTIVES:

➢ To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
➢ To study the aspects related to the application side of the experiments
➢ To understand the usage of basic laws and theories to determine various properties of the materials given.
➢ To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

Any Eight Experiments
1. Sonometer – Verification of laws.
2. Spectrometer – Refractive index of a solid prism.
4. Potentiometer – Low range voltmeter.
5. Potentiometer – Internal resistance of a cell.
6. Coefficient of viscosities- Ostwald’s apparatus.
7. Rigidity modulus by torsional pendulum.
8. Potentiometer – Comparison of e.m.f of the cells.
9. Young’s modulus – Non uniform bending (pin and microscope).
10. Coefficient of viscosities- Hare’s apparatus.
11. Drop weight method - Surface tension of a liquid.

COURSE OUTCOMES (COs):

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.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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LEARNING OBJECTIVES:

➢ To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
➢ To study the aspects related to the application side of the experiments
➢ To understand the usage of basic laws and theories to determine various properties of the materials given.
➢ To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

(Any Ten experiments)

1. Young’s modulus – uniform bending (pin and microscope).
5. Field along the axis of a circular coil - Determination of H (Using Vibration Magnetometer).
6. Potentiometer – Low range Ammeter.
7. Potentiometer – High range voltmeter.
8. Field along the axis of a circular coil – deflection magnetometer.
9. V-I characteristics of junction diode.
10. Logic gates – Discrete components.
11. Half wave and full wave rectifier.

COURSE OUTCOMES (COS):

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: Acquire in depth knowledge regarding the basic concepts in electricity and magnetism.

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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LEARNING OBJECTIVES:

- To develop familiarity with the physical concepts and facility with the mathematical methods of classical mechanics
- The main goal of this course is to acquire fundamental knowledge of classical mechanics.
- To understand relativity and its consequences

Unit – I


Unit – II


Unit – III


Unit – IV

Newtonian relativity- Michelson Morley experiment- Lorentz transformation and Consequences- relativity of simultaneity- the Lorenz-Fitz Gerald length contraction, Time dilation- Addition velocities.

Unit – V

Variation of mass with velocity, Mass energy relation, Minkowski four dimensional contiumum- Four vectors Compton scattering.

TEXT BOOKS FOR STUDY:

1. Introduction to classical mechanics, R.G.Takwale and P.S.Purani Tata Macgraw Hill Publishing co Ltd., New Delhi.

TEXT BOOKS FOR REFERENCE:

COURSE OUTCOMES (COs):

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

CO1: Know the physical concepts and facility with the mathematical methods of classical mechanics
CO2: Use D’Alembert’s principle to derive the Lagrange equations of motion.
CO3: Acquire fundamental knowledge of classical mechanics.
CO4: Understand relativity and its consequences

MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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19IPHYIE85.2: PHYSICS OF THE EARTH

Credit : 3
Hours: 3

LEARNING OBJECTIVES:

➢ To understand the physical structure and behaviour of the earth as well as geomagnetic properties of rocks in the Earth’s crust.
➢ To study the elastic behaviour in earth by applying various theories and hypothesis.
➢ To highlight the concept of solar system and behaviour of planets in this system.

UNIT – I: SOLAR SYSTEM

The earth and the solar system – Important physical parameters and properties of the planet earth; Stress and Strain, Wave and motion, Seismic waves. Travel time Tables and Velocity – Depth curves – Variation of Density within the Earth.

UNIT – II: GRAVITATION


UNIT – III: THERMAL HISTORY OF EARTH


UNIT – IV: ELASTIC PROPERTIES

UNIT – V: GEOMAGNETISM AND PALAEO MAGNETISM


TEXT BOOKS FOR STUDY:


TEXT BOOKS FOR REFERENCE:


COURSE OUTCOMES (COs):

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

CO1 : Think and analyse the concept of the Earth and its properties.
CO2 : Accumulate the various concept proposed by theories and laws.
CO3 : Enlighten the concept solar system.
CO4: Acquire basic knowledge about geomagnetism and paleomagnetism.

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SEMESTER - IX | 19IPHYIE95.1: BIO-MEDICAL INSTRUMENTATION | Credit : 3 Hours: 3

LEARNING OBJECTIVES:

➢ To gain the knowledge about the bio medical instruments used for measuring bio-electric potentials and the electrodes used for sensing the bio potentials.
➢ To understand the working principles of imaging equipments and bio medical instruments used for determine the physiological parameters.
➢ To update the knowledge of various lasers used for medical applications for the students.
UNIT – I: BIO-ELECTRIC POTENTIALS


UNIT – II: BIO-POTENTIAL ELECTRODES


UNIT – III: IMAGING EQUIPMENTS


UNIT – IV: MEASUREMENT OF PHYSIOLOGICAL PARAMETERS


UNIT – V: LASER IN MEDICINE


TEXT BOOKS FOR STUDY:


TEXT BOOKS FOR REFERENCE:


COURSE OUTCOMES:

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

CO1: Understand the importance of bio medical instruments and accuracy of the measured physical parameters and their practical implementation in the medical field.

CO2: Understand experimentally recording data, its inference to diagnose the diseases.
CO3: Understand various techniques and its relevance in various defects in the body parts.

CO4: Solve the health issues from the bio medical instruments and applicability in physics concepts may give the clear idea about the health issues.

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**19IPHYIE95.2: ENERGY PHYSICS**

Credit : 3

Hours: 3

**LEARNING OBJECTIVES:**

- To create an awareness among the students regarding the forms of energy and the availability of their resources
- To educate regarding the utilization and conservation of energy
- To impart a knowledge about the Sustainable forms of energy

**UNIT– I: CONVENTIONAL ENERGY SOURCES**

Energy sources and their availability – Various forms of energy – Renewable and conventional energy systems – Comparison – Coal, oil and natural gas.

**UNIT – II: SOLAR ENERGY**


**UNIT – III: THERMAL ENERGY STORAGE**


**UNIT – IV: PHOTO CONVERSION**

Photovoltaic conversion - Principle and working of solar cells - Conversion efficiency - Single crystal and Polycrystalline silicon - Cadmium sulphide - Cadmium telluride.

**UNIT – V: SUSTAINABLE FORMS OF ENERGY**

Reserves of Energy Resources – Environmental aspects of energy extraction, conversion and utilization – challenges associated with the non-sustainable energy sources with regard to future Supply and the environment

Hydrogen: principle of operation and system components-comparisons among energy uses, resources, and technologies-technical and economic challenges in the integration of sustainable energy form-potential solutions and application.
TEXT BOOKS FOR STUDY:

TEXT BOOKS FOR REFERENCES:

COURSE OUTCOMES (COs):
By the end of the course, the student will be able to

CO1: Be aware of various forms of energy and the effective utilization of their resources.
CO2: Be exposed to the practical usage of solar energy.
CO3: Be exposed to the practical usage of thermal energy.
CO4: Acquire an in depth knowledge about the sustainable forms of energy.

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VALUE ADDED COURSE
(COMBINEDLY OFFERED BY DEPARTMENT OF PHYSICS AND ZOOLOGY)
BIO- MEDICAL INSTRUMENTATION

LEARNING OBJECTIVES:

- To understand the basic structural and functional elements of human body
- To understand the working principles of various instruments in bio-medical field
- To update the knowledge of various bio-instrumentation techniques.

Unit – I: Basic Elements of human Body


**Unit II: Separation techniques for Bio-molecules**


Chromatography: Principles, methods and application of paper chromatography, thin layer chromatography (TLC), Gas chromatography (GC) Gas liquid chromatography (GLC), High performance liquid chromatography (HPLC), Ion-Exchange chromatography.

**Unit III: Bio-Electric Potentials**


**Unit IV: Bio-Potential Electrodes**


**Unit V: Imaging Equipments**


**TEXT BOOKS FOR STUDY:**


**TEXT BOOKS FOR REFERENCE:**


**COURSE OUTCOMES (COs):**

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

**CO1:** Understand the structure and physiological functioning of various organ systems of human body
**CO2:** Master the common bio-separation techniques used for clinical applications

**CO3:** Operate various medical equipments working on the principles of bio-electric potentials

**CO4:** Understand the basic principles and operations of various imaging equipments used in the clinical field

### MAPPING WITH PROGRAMME OUTCOMES (POs) and PROGRAMME SPECIFIC OUTCOMES (PSOs)

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