Annamalai University

(Accredited with 'A' Grade by NAAC)

Faculty of Science

DEPARTMENT OF PHYSICS

(DST - FIST Supported)

M.Sc. PHYSICS

Programme Code : SPHY51

Regulations, Curricula and Syllabi
(2019 - 2020)

Annamalai University

Faculty of Science

DEPARTMENT OF PHYSICS

M.Sc. PHYSICS (Five Year)

Programme Code : SPHY51

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

1. Definitions and Nomenclature

1.1 **University** refers to Annamalai University.

1.2 **Department** means any of the academic department and academic center at the University.

1.3 **Discipline** refers to the specialization or branch of knowledge taught and researched in higher education. For example, Physics is a discipline in the Physical Sciences.

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

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

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

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

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

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

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

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

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

1.13 **Language Course** is a mandatory course includes Tamil/Hindi/French and English.

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

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

1.16 **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.

1.17 **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.

1.18 **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.

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

1.20 **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.

1.21 **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.

1.22 **Cumulative Grade Point Average** (CGPA) is a measure of overall cumulative performance of a student over all the semesters. The GCPA is the ratio of total credit points secured by a student in various courses in all semesters to the sum of the total credits of all courses in all the semesters is given in section 11.4.

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

2. Programme Offered and Eligibility Criteria

The Department of Physics offers a M.Sc. in Physics (Five year) programme. A pass in HSC (10+2 level) or equivalent thereto with a minimum of 50% under academic stream in the following subjects viz. Physics, Chemistry, and Mathematics.

2.1 In the case of SC/ST and differently-abled candidates, a pass is minumam qualification for gthe above programme.

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 Master's Programme consists of five academic years.

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

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

5. Programme Structure

5.1 The Master's Programme consists of Language courses, Allied courses, Core Courses, Elective Courses (Departmental & Interdepartmental), Experiential Learning and Project. Students shall also participate in extension activities as a part of the 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 core course (Allied I and Allied II) of the programme in the first four semsters.

5.5 Elective courses

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

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.

5.6 Soft Skills

5. 6.1 Soft Skills are intended to enable the 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 among others.

5.7 Value Education

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

5.7.2 Value education is categorized as Non-Credit Compulsory Course

5.8 Experiential Learning

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

5.8.2 In-plant training/field trips/internships/laboratory visits fall under this category.

5.8.3 Experiential learning is categorized as Non-Credit Compulsory Course.

5.9 Extension Activities

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

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

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

5.9.4 Extension activity is categorized as Non-Credit Compulsory Course.

5.10 Project

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

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

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

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

5.11 Value added Courses (VACs)

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

5.11.2 These courses impart employable and life skills. VACs are listed in the Hand Book which is available in the University website.

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

5.12 Online Courses

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

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

5.13 Credit Assignment

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

1 Credit is defined as

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

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

1 Practical period of one and a half hours/two hours duration per week over a

Semester

1 Project period of one hour duration per week over a semester

5.14 **Credit Distribution :**

The credit distribution is organized as follows

COURSES	CREDITS
Semester I to VI	
Language-I (Tamil or any other Language)	12
Language-II (English)	12
Core Courses	85
Allied-I (1st Year- SEM I & II)	10
Allied-II (2nd Year- SEM III & IV)	10
Electives	09
Soft Skill (Computer Skill)	03
Environmental Studies (UGC mandated)	03
Value Education	02*
Experiential learning	02*
Extension Activities	01*
Total credits (Semester I to VI)	**144**
Semester VII to X	
Core Courses	72
Electives (DE)	06
Electives (IDE)	09
Project	06
Constitution of India	02*
Total Credits (Semester VII to X)	**93**
Total Credits (Semester I to X)	**237**

Note : * Non-Credit Compulsory Course

6. Attendance

6.1 Each faculty handling a course shall be responsible for the maintenance of attendance and assessment record for candidates who have registered for the course.

6.2 The Record shall contain details of the students' attendance, marks obtained in the continuous internal assessment (CIA) tests, assignments and seminars. In addition the record shall also contain the organization of lesson plan of the course teacher.

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

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

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

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

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

7 Mentor-Mentee System

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

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

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

8 Examinations

8.1 The examination system of the University is designed to systematically test the students' progress in class, laboratory and project work through continuous internal assessment (CIA) tests and end-semester examination (ESE).

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

8.3 The question papers will be framed to test different levels of learning based on Bloom's taxonomy viz. knowledge, comprehension, application, analysis, synthesis and evaluation/creativity.

8.4 Continuous Internal Assessment Tests

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

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

8.4.3 The question paper will be set by the respective faculty using Blooms Taxonomy.

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

8.4.5 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 course teacher in consultation with the Head of the Department.

8.4.6 For the CIA tests, the assessment will be done by the course teacher.

8.5 End Semester Examinations

8.5.1 The ESE for the first and third semester will be conducted in November and for the second and fourth semester in May.

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

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

9 Evaluation

9.1 Marks Distribution

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

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

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

9.2 Assessment of CIA Tests

9.2.1 For CIA tests, the assessment will be done by the course teacher.

9.2.2 For the theory courses, the break-up of marks shall be as follows :

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

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

CIA for Practical	Marks
Test-I	15
Test-II	15
Record	10
Total	40

9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by the internal examiners.

9.4 Assessment of Project/Dissertation

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

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

9.4.3 CIA for Project work will consist of a review of literature survey, experimentation and attendance etc.

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

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

9.4.6 The marks shall be distributed as follows :

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

9.5 Assessment of Value-added Courses

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

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

9.6 Passing Minimum

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

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

10. Conferment of the Master's Degree

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

11. Marks and Grading

11.1 The performance of students in each course is evaluated in terms 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 in all the courses completed.

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

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

where, C_i is the credit earned for the course i in any semester

G_i is the grade point obtained by the student for the course i 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

n is the number of courses passed in that semester.

m is the number of semester.

11.5 **Evaluation:**

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

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

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

CGPA	CLASSIFICATION OF FINAL RESULT
8.25 and above	First Class with Distinction
6.5 and above but below 8.25	First Class
5.0 and above but below 6.5	Second Class
0.0 and above but below 5.0	Re-appear

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

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

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

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

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

11.7 **Course-Wise Letter Grades**

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

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

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

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

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

12. Provision for Withdrawal from the End Semester Examination

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

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

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

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

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

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

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

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

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

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

15. Notwithstanding anything contained in the above pages as Rules and Regulations governing the 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.

Annamalai University

Department of Physics

M.Sc. Physics (Five Year) Programme

Programme Code: SPHY51

Curricula and Scheme of Examination

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

Course Code	Course Title	Hours/Week			C	Marks		
		L	T	P		CIA	ESE	Total
Semester – I								
19ITAMC11	Language - I: Tamil/Hindi/French	3	-	-	3	25	75	100
19IENGC12	Language - II: English Through Literature - I Prose	3	-	-	3	25	75	100
19IENSC13	Environmental Studies	3	-	-	3	25	75	100
19IPHYC14	Properties of Matter	4	2	-	4	25	75	100
19IMATA01	Allied Mathematics - I	5	-	-	5	25	75	100
	Elective 1: Department Elective	3	2	-	3	25	75	100
	Total Credits	-	-	-	**21**	-	-	-
Semester – II								
19ITAMC21	Language - I: Tamil/Hindi/French	3	-	-	3	25	75	100
19IENGC22	Language - II: English Through Literature-II Poetry	3	-	-	3	25	75	100
19ICISC23	Soft Skill - Computer Applications - I	3	-	-	3	25	75	100
19IPHYC24	Heat and Thermodynamics	4	2	-	4	25	75	100
19IPHYP25	Practical – I	-	-	2	3	40	60	100
19IMATA02	Allied Mathematics - II	5	-	-	5	25	75	100
	Total Credits	-	-	-	**21**	-	-	-
Semester – III								
19ITAMC31	Language - I: Tamil/Hindi/French	3	-	-	3	25	75	100
19IENGC32	Language – II: English Through Literature-III Drama	3	-	-	3	25	75	100
19IPHYC33	Mechanics	4	-	-	4	25	75	100
19IPHYC34	Oscillations, Waves and Acoustics	4	-	-	4	25	75	100
19IPHYP35	Practical – II	-	-	2	3	40	60	100
19ICHEA01	Allied Chemistry – I	4	-	-	4	25	75	100
	Elective 2: Department Elective	3	-		3	25	75	100
	Total Credits	-	-	-	**24**	-	-	-
Semester – IV								
19ITAMC41	Language - I : Tamil/Hindi/French	3	-	-	3	25	75	100
19IENGC42	Language - II: English Through Literature – IV Short story	3	-	-	3	25	75	100
19IPHYC43	Optics and Spectroscopy	4	-	-	4	25	75	100

19IPHYC44	Electricity and Magnetism	4	-	-	4	25	75	100
19IPHYP45	Practical – III	-	-	2	3	40	60	100
19ICHEA02	Allied Chemistry – II	4	-	-	4	25	75	100
19ICHEP01	Allied Chemistry Practical	-	-	1	2	40	60	100
19IPHYF40	Extension Activities	-	-	2	1*	40	60	100
Total Credits		-	-	-	**23**	-	-	-
Semester – V								
19IPHYC51	Atomic Physics	4	-	-	4	25	75	100
19IPHYC52	Laser and Fibre Optics	4	-	-	4	25	75	100
19IPHYC53	Analog Electronics	4	-	-	4	25	75	100
19IPHYC54	Energy Physics	4	-	-	4	25	75	100
19IPHYC55	Solid State Physics	4	-	-	4	25	75	100
19IPHYP56	Practical – IV	-	-	3	6	40	60	100
	Elective 3: Department Elective	3	-	-	3	25	75	100
19IPHYV50	Value Education	2	-	-	2*	25	75	100
Total Credits					**29**			
Semester – VI								
19IPHYC61	Numerical Methods of Analysis	4	-	-	4	25	75	100
19IPHYC62	Digital Electronics	4	-	-	4	25	75	100
19IPHYC63	Nuclear Physics	4	-	-	4	25	75	100
19IPHYC64	Relativity and Quantum Mechanics	4	-	-	4	25	75	100
19IPHYC65	Astrophysics	4	-	-	4	25	75	100
19IPHYP66	Practical – V	-	-	3	6	40	60	100
19IPHYF60	Experiential Learning	-	-	4	2*	40	60	100
Total Credits					**26**			
Semester – VII								
19IPHYC71	Classical and Statistical Mechanics	4	-	-	4	25	75	100
19IPHYC72	Electronics	4	-	-	4	25	75	100
19IPHYC73	Mathematical Physics – I	4	-	-	4	25	75	100
19IPHYP74	Practical - VI	-	-	3	6	40	60	100
	Elective 4: Interdepartmental Elective	3	-	-	3	25	75	100
Total Credits		-	-	-	**21**	-	-	-
Semester – VIII								
19IPHYC81	Mathematical Physics – II	4	-	-	4	25	75	100
19IPHYC82	Quantum Mechanics – I	4	-	-	4	25	75	100
19IPHYC83	Electromagnetic Theory	4	-	-	4	25	75	100
19IPHYP84	Practical – VII	-	-	3	6	40	60	100
	Elective 5 : Department Elective	3	-	-	3	25	75	100
	Elective 6 : Interdepartmental Elective	3	-	-	3	40	60	100

Total Credits		-	-	-	**24**	-	-	-
Semester – IX								
19IPHYC91	Condensed Matter Physics – I	4	-	-	4	25	75	100
19IPHYC92	Quantum Mechanics – II	4	-	-	4	25	75	100
19IPHYC93	Nuclear and Elementary Particle Physics	4	-	-	4	25	75	100
19IPHYP94	Practical – VIII	-	-	3	6	40	60	100
	Elective 7: Department Elective	3	-	-	3	25	75	100
	Elective 8: Interdepartmental Elective	3	-	-	3	25	75	100
19IPSC090	Constitution of India	2	-	-	2*	25	75	100
Total Credits		-	-	-	**24**	-	-	-
Semester – X								
19IPHYCX1	Condensed Matter Physics – II	4	-	-	4	25	75	100
19IPHYCX2	Spectroscopy	4	-	-	4	25	75	100
19IPHYEX3	Physics of Nanomaterials	4	-	-	4	25	75	100
19IPHYPX4	Practical – IX	-	-	3	6	40	60	100
19IPHYDX5	Project (Dissertation/Viva-Voce)	-	-	9	6	25	75	100
Total Credits		-	-	-	**24**	-	-	-

***Non Credit compulsory course**
L: Lecture, T: Tutorial, P: Practical, C : Credits, CIA : Continuous Internal Assessment, ESE: End Semester Examination

Note :

1. Students shall opt for both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available. The details of interdepartmental electives are given in the "**Handbook of Interdepartmental Electives – P.G. Programmes**" and listed in the University website.

2. Students may opt for any Value-Added Courses listed in the University website. The details of Value Added Courses are given in the "**Handbook of Value Added Courses**".

3. Guidance/Discussion with students on course specific **experiential learning** through the application of theory and academic content to real-world experiences, either within the classroom, within the community, or within the work place, which advances program or Course-based learning outcome that are specifically focused on employability skills.

DEPARTMENT ELECTIVE COURSES (DE)

S. No.	Course Code	Course Title	Hours/ Week			C	Marks		
			L	T	P		CIA	ESE	Total
Elective -1									
1.	19IPHYE15	Electrical Appliances	3	-	-	3	25	75	100
2.	19IPHYE16	Physics of human anatomy	3	-	-	-	25	75	100
Elective - 2									
3.	19IPHYE36	Basic electronic devices	3	-	-	3	25	75	100
4.	19IPHYE37	Environmental Physics	3	-	-	3	25	75	100
Elective - 3									
5.	19IPHYE57	Communication system	3	-	-	3	25	75	100
6.	19IPHYE58	Audio and video systems	3	-	-	3	25	75	100
Elective - 5									
7.	19IPHYE85	Microprocessor and Microcontroller	3	-	-	3	25	75	100
8.	19IPHYE86	Physics of the Earth	3	-	-	3	25	75	100
Elective - 7									
9.	19IPHYE95	Instrumentation	3	-	-	3	25	75	100
10.	19IPHYE96	Biomedical Instrumentation	3	-	-	3	25	75	100
11	19IPHYE97	Petrophysics	3	-	-	3	25	75	100
12.	19IPHYE98	Medical Physics	3	-	-	3	25	75	100
13.	19IPHYE99	Biophysics	3	-	-	3	25	75	100

ALLIED COURSES OFFERED TO OTHER DEPARTMENTS

S. No.	Course Code	Course Title	Hours/ week				Marks		
			L	T	P	C	CIA	ESE	Total
1.	19IPHYA01	Allied Physics – I	4	0	0	4	25	75	100
2.	19IPHYA02	Allied Physics – II	4	0	0	4	25	75	100
3.	19IPHYP01	Allied Physics Practical	-	-	1	2	40	60	100

ANNAMALAI UNIVERSITY

Department of Physics

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

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc. (Five Year) **Semester : All**

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

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

(Answer ALL of the questions)

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

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

(Answer any THREE of the questions)

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

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

(Answer any TWO of the questions)

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

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

(Answer any ONE of the questions)

14. Discuss….
15. Summarize….

ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc. (Five Year) **Year: I/II** **Semester: I, II, III, IV**

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

Part-A (Level-K1) **Marks: (15x2=30)**

(Answer ALL of the questions)

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

Part-B (Level-K2) **Marks: (5x5=25)**

(Answer any FIVE of the questions)

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

Part-C (Level-K3/ Level-K4) **Marks: (5x7=35)**

(Answer any FIVE of the questions)

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

Part-D (Level-K5) **Marks: (1x10=10)**

(Answer any ONE of the questions)

29. Discuss….
30. Summarize….

ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc. (Five Year) **Year: III** **Semester: V, VI**

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

Part-A (Level-K1) **Marks: (10x2=20)**

(Answer ALL of the questions)

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

Part-B (Level-K2) **Marks: (5x3=15)**

(Answer any FIVE ofthe questions)

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

Part-C (Level-K3/Level-K4) **Marks: (9x5=45)**

(Answer any NINE of the questions)

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

Part-D (Level-K5/Level-K6) **Marks: (2x10=20)**

(Answer any TWO of the questions)

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

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ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc. (Five Year) **Year: IV** **Semester: VII, VIII**

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

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

(Answer ALL of the questions)

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

Part-B (Level-K3/ Level-K4) **Marks: (8x5=40)**

(Answer any EIGHT of the questions)

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

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

(Answer any THREE of the questions)

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

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

(Answer any ONE of the questions)

25. Design….
26. Develop…

*****

ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc. (Five Year) **Year: V** **Semester: IX, X**

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

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

(Answer ALL of the questions)

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

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

(Answer any SIX of the questions)

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

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

(Answer any THREE of the questions)

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

Part-D (Level-K6) **Marks: (2x10=20)**

(Answer any TWO of the questions)

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

*****

ANNAMALAI UNIVERSITY

All PG in the Faculties of Arts / Sci. / M. Sci. / Ind. Lan. / Edn. / Fine Arts. [2019-20]

[End Semester Examinations]

Bloom's Taxonomy - Questions Conforming to Levels K1 to K6

I Year (Five Year PG)			
Level	Part	Questions & Marks	Total Marks
K1	A	15 x 2	30
K2	B	5 x 5	25
K3	C	3 x 7	21
K4		2 x 7	14
K5	D	1 x 10	10
			100

II Year (Five Year PG)			
Level	Part	Questions & Marks	Total Marks
K1	A	15 x 2	30
K2	B	5 x 5	25
K3	C	3 x 7	21
K4		2 x 7	14
K5	D	1 x 10	10
			100

III Year (Five Year PG)			
Level	Part	Questions & Marks	Total Marks
K1	A	10 x 2	20
K2	B	5 x 3	15
K3	C	5 x 5	25
K4		4 x 5	20
K5	D	1 x 10	10
K6		1 x 10	10
			100

IV Year (Five Year PG) I Year (Two/Three year PG)			
Level	Part	Questions & Marks	Total Marks
K1	A	5 x 2	10
K2		5 x 2	10
K3	B	4 x5	20
K4		4 x5	20
K5	C	3 x 10	
K6	D	1 x 10	10
			100

V Year (Five Year PG) II/III Year (Two/Three Year PG)			
Level	Part	Questions & Marks	Total Marks
K1	A	5 x 2	10
K2		5 x 2	10
K3	B	2 x 5	10
K4		4 x 5	20
K5	C	3 x10	30
K6	D	2x 10	20
			100

PROGRAMME OUTCOMES (POs)

After the successful completion of the M.Sc.Physics (Five year) Degree Programme, the graduates will be able to

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

PROGRAMME SPECIFIC OUTCOMES (PSOs)

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

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

Semester	19ITAMC11: Language I	L	T	P	C
I	நவீன இலக்கியமும் நாடகமும்	3	0	0	3

Learning Objectives (LO):

கற்றலின்நோக்கம் :

LO1	தமிழில் தோன்றிய நவீன இலக்கியங்கள் குறித்து அறிமுகம் செய்தல். நவீன இலக்கியங்கள் குறித்த வரையறை.
LO2	தோற்றப்பின்னணி – நவீன இலக்கிய வகைகள் – உரை நடை – புதுக்கவிதை.
LO3	செய்தித்தாள் – நாடகம் போன்றவற்றின் வரலாற்றை விளக்குதல்.

Course Outcomes (CO):

கற்றல் வெளிப்பாடு:

இந்தப்பாட முடிவில் மாணவர்கள்

CO1	நவீன இலக்கியங்கள் நாடக இலக்கியங்கள் குறித்த அறிதலைப் பெறுவதோடு தமிழ் இலக்கியங்களில் நீட்சியைப்புரிந்து கொள்வர்
CO2	தற்கால இலக்கியங்கள் எவ்வாறு சமூகத்தை எடுத்துக்காட்டுகின்றன என்பதை விளங்கிகொள்வர்
CO3	நவீன இலக்கியங்களின் வழி வாழ்வியல் கருத்துக்களை அறிந்து வாழ்க்கையில் பின்பற்றுவார்கள்

அலகு - 1 சிறுகதை

1. புதுமைப்பித்தன் - பால்வண்ணம்பிள்ளை
2. .கி.ராஜநாராயணன் - கதவு
3. கு.அழகிரிசாமி - ராஜாவந்திருக்கிறார்
4. கண்மணிகுணசேகரன் - உயிர்த்தண்ணீர்
5. மேலாண்மைபொன்னுச்சாமி - தேசியமயில்

அலகு – 2 புதுக்கவிதை

1. பாரதியார் - புதுமைப்பெண்
2. பாரதிதாசன் - தமிழ்உணவு
3. உவமைக்கவிஞர் சுரதா - தமிழில்பெயரிடுங்கள் (துறைமுகம்)
4. தேவதேவன் - புகட்டல் (அமுதம்மாத்திரமேவெளிப்பட்டது)
5. அறிவுமதி - நட்புக்காலம் (முதல் 20- கவிதைகள்மட்டும்)
6. மித்ரா - ஹைகூஎன்தோழி (முதல் 20- கவிதைகள்மட்டும்)

அலகு - 3 புதினம்

1. டி.செல்வராசு - பொய்க்கால் குதிரை

அலகு - 4 நாடகம்

1. இன்குலாப் - ஒளவை

அலகு - 5 இக்கால இலக்கிய வரலாறு

ஐரோப்பியர் வருகை – நவீன இலக்கியங்கள் அறிமுகம் - புதுக்கவிதை - சிறுகதை – புதினம் ஆகியவற்றின் தோற்றமும் வளர்ச்சியும் – இலக்கிய முன்னோடிகள் – செய்தித்தாள் வருகை - நாடகம் – தோற்றமும் வளர்ச்சியும்.

(மாணவர்கள் அறிந்துகொள்வதற்கு மட்டும் – தேர்வுக்கானபகுதி அல்ல)

இலக்கியங்களையும் அவை தொடர்பான இலக்கிய வரலாற்றையும் இணைத்துப்படித்தல் – நவீன இலக்கியங்கள் சமூகத்தைப் படம்பிடித்துக்காட்டுவதை சமூகக்கண்ணோட்டத்தோடு அறிதல். நவீன இலக்கிய வடிவங்களின் வளர்ச்சி வாழ்வியலுக்குப்பயன்படும் முறையை விளக்குதல்.

பாடநூல்கள்

1. புதுமைப்பித்தன் - பால்வண்ணம்பிள்ளை
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
ஐந்தாம்பதிப்பு - 2015
2. கி.ராஜநாராயணன் - கதவு
அன்னம்வெளியீடு,
தஞ்சாவூர், ஏழாம்பதிப்பு - 2015
3. கு.அழகிரிசாமி - ராஜாவந்திருக்கிறார்
காலச்சுவடுபதிப்பகம், நாகர்கோயில்
முதற்பதிப்பு -2012
4. கண்மணிகுணசேகரன் - உயிர்த்தண்ணீர்
தாமரைச்செல்விபதிப்பகம்
சென்னை, முதற்பதிப்பு- 1997
5. மேலாண்மைபொன்னுச்சாமி - தேசிய மயில்
வானதிபதிப்பகம், சென்னை
முதற்பதிப்பு - 1997
6. பாரதியார் - பாரதியார்கவிதைகள்
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
முதற்பதிப்பு – 2014
இரண்டாம்பதிப்பு- செப்டம்பர்- 2017
7. பாரதிதாசன் - பாரதிதாசன்கவிதைகள்
மணிவாசகர்பதிப்பகம், சென்னை
ஏழாம்பதிப்பு -2016
8. உவமைக்கவிஞர்சுரதா - துறைமுகம்
சுவாதி பதிப்பகம்,
அம்பத்தூர், சென்னை, முதற்பதிப்பு 2010
9. தேவதேவன் - அமுதம் மாத்திரமே வெளிப்பட்டது
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
முதற்பதிப்பு – 2016
10. அறிவுமதி - நட்புக்காலம்
கவிதாபதிப்பகம், சென்னை
எட்டாம்பதிப்பு-2005
11. மித்ரா - மித்ராகவிதைகள்
சாரல்வெளியீடு, சென்னை
முதற்பதிப்பு, 1990
12. டி.செல்வராசு - பொய்க்கால்குதிரை
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
முதற்பதிப்பு – 2014
13. இன்குலாப் - ஔவை
அகரம்பதிப்பகம், தஞ்சாவூர்

ஐந்தாம்பதிப்பு - 2015
14. ச.வே.சுப்பிரமணியன் - தமிழ் இலக்கியவரலாறு
மணிவாசகர்பதிப்பகம்
சென்னை, ஏழாம்பதிப்பு- 2015
15. சோ.நா. கந்தசாமி - தமிழ் இலக்கியவரலாறு
மணிவாசகர்பதிப்பகம்
சென்னை, முதற்பதிப்பு- 2004

பார்வைநூல்கள் :

1. வல்லிகண்ணன் - புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்
பாரிநிலையம், சென்னை-108
முதற்பதிப்பு - 2008
2. க. கைலாசபதி - தமிழ்நாவல் இலக்கியம்
குமரன் பதிப்பகம்
வடபழனி சென்னை
முதற்பதிப்பு- 1968, மறுபதிப்பு 2010
3. கார்த்திகேசுசிவதம்பி - தமிழில்சிறுகதை தோற்றமும்
வளர்ச்சியும், நியூசெஞ்சரி, புத்தகநிலையம்,
சென்னை- 98, முதற்பதிப்பு - 2013
4. ஆறு. அழகப்பன் - தமிழ்நாடகத் தோற்றமும் வளர்ச்சியும்
பாரிநிலையம், சென்னை, மு.ப. 2011
5. சு. சக்திவேல் - இருபதாம் நூற்றாண்டுத் தமிழ் உரைநடை
மணிவாசகர்பதிப்பகம், சிதம்பரம்–2010

COURSE OUTCOME MAPPING:

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

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

Semester	19IHINC11: Language - I	L	T	P	C
I	BASIC HINDI-1	3	0	0	3

Learning Objectives (LO):

LO1	To know the Hindi terms for various professions
LO2	To gain knowledge of poem and prose
LO3	To help the student to learn the importance of the moral, spiritual and human values
LO4	To study short stories and imbibe morals
LO5	To know about national leaders

Course Outcomes (CO):

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

CO1	understand the basic structure of poems.
CO2	knowledge on various common hindi words.
CO3	describe the basic concepts of moral stories.
CO4	apply the concepts of in life.
CO5	analyse the difference between prose and poem.

Unit – I : Mathru vandana (poem) ,peshwar,chalo bazaar chalo, ahimsa ki vijay

Unit – II : Balwan bano, Gandhiji ke asheram me chor,

Unit – III : Vani ka theer, Bharth, daku se mahatma.

Unit – IV : Chandhini, samay ki pabandhi, vitamin.

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

Text Books:

1. Adharsha Hindi reader I-DBHPsabha-Chennai.17.
2. Parichya DBHPS**, Trichi** 17.

Supplementary Reading:

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

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		2	3	2	2	3	2	3	3	3	3	3						
CO2	3	3	2		3		2	2		3								
CO3	3	2			2	3		2	3				2					
CO4	3		3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

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

Learning Objectives (LO):

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

Course Outcomes (CO):

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

CO1	Greet people appropriately, ask how they are, tell them how I am and ask how others are
CO2	Obtain another different culture, the sound of the French language, certain words in French, some famous French symbols/landmarks.
CO3	Understand basic classroom instructions
CO4	Can use different forms of address to speak to friends, teachers and people, I do not know, using formal and informal modes of address and language.
CO5	Understand when the teacher is speaking to one or more persons in class and understand simple commands (mostly passive, receptive language with some active, productive language) and polite language. I can recognise 'tu' and 'vous' forms and help phrases such as ***'Pardon', 's'il vous plaît', 'excusez-moi', 'merci'.***

Unit I

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

Unit II

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

Dire s'excuser ; Affirmer et nier ; Epeler son nom

Unit III

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

Unit IV

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

Unit V

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

Text Books:

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

Supplementary Readings:

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

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		2	3	2	2	3	2	3	3	3	3	3						
CO2	3		2		3		2	2		3								
CO3	3	2			2	3		2	3				2					
CO4	3	3	3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

Semester	19IENGC12: Language - II	L	T	P	C
I	English through Literature - I: Prose	3	0	0	3

Learning Objectives (LO):

LO1	Develop the Language ability of the students
LO2	Enable students to understand the passage, to read fluently, to enrich their vocabulary, and to enjoy reading and writing
LO3	Make the students proficient in the four language skills
LO4	Make the students read with correct pronunciation, stress, intonation, pause, and articulation of voice
LO5	Develop their inquiry skill

Course Outcomes (CO)

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

CO1	competency in communication both in written and oral skills
CO2	fluency in the English language
CO3	knowledge about construction of sentence structures
CO4	English Vocabulary to use the English language effectively
CO5	proficiency in the four communication skills

Unit-I

Stephen Leacock "With the Photographer"

Winston S. Churchill "Examinations"

Grammar: Introduce the Parts of speech Nouns, Verbs, Adjectives, and Adverbs

Unit-II

G.B. Shaw "Spoken English and Broken English"
M.K. Gandhi "Voluntary Poverty"
Grammar: Articles

Unit-III

Robert Lynd "On Forgetting"
Virginia Woolf "Professions for Woman"
Grammar: Pronouns

Unit-IV

A. G. Gardiner " On Umbrella Morals"
R.K. Narayan "A Snake in the Grass"

Grammar: Prepositions

Unit-V

Martin Luther King (Jr.) “I Have a Dream”
George Orwell “The Sporting Spirit”
Grammar: Conjunctions & Interjections

TEXT BOOKS:

1. Ayyappa Raja. S., Deivasigamani. T., Saravana Prabhakar. N., Karthikeyan. B. *English through Literature: Prose.*
2. David Green: *Contemporary English Grammar: Structures and Composition*, Macmillan

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1				3			3	3		3	3	3			3			
CO2				3			3	3		3	3	3			3			
CO3	3			2			2	2		2	2	2			3			
CO4	3			3			3	3		3	3	3			3			
CO5	2			2			2	2		2	2	2			2			

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

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

Learning Objectives (LO):

LO1	To make the student aware of World Environmental System
LO2	To make the student aware of the fundamental Concepts and Principles of Eco-system and energy-flow

Course Outcomes (CO):

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

CO1	evaluate the present condition of environmental pollution
CO2	understand the nature of the atmosphere
CO3	be aware of causes of pollution and precautionary measures

Unit: I Environmental System

The Services provided by the Environmental System Ecosystems: Food Chains, Food Webs, Ecological Pyramids Biochemical Cycles: Hydrological Cycle, Carbon Cycle

Unit: II Environmental Damage –Pollution

Sources and impact ofAir Pollution,Water Pollution,Land Pollution,Municipal Solid Waste Noise Pollution

Unit: III Resource Depletion

Importance of Forests: Causes and Consequences of Deforestations,Bio Diversity: Meaning and Importance – Reasons and Consequences of Biodiversity Decline,Consequences of overdrawing Water Resources.

Unit: IV Global Climate Change

The Science of Climate Change The Green House Effect , Sources and Impact of Climate Change , Coping with Climate Change

Unit: V Sustainable Development

Concept and Definition of Sustainable Development (Brundtland Commission Definition), Poverty, Population Growth and Environmental Damage, Policies for Sustainable Development

Text books:

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

SUPPLEMENTARY READING:

1. Kumarasamy, K., A. Alagappa Moses and M. Vasanthy, (2004),*Environmental Studies*, Trichy: Bharathidasan University Publications
2. Rajamannar, *Environmental Studies*, Trichy: EVR College Publications, .
3. Kalavathy, S.(2004), (Ed), *Environmental Studies,* Trichy: Bishop Heber College Publication,

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC14 - Properties of Matter	L	T	P	C
I		4	2	0	4

Learning Objectives (LO):

LO1	To know about the gravity and the laws of gravitation.
LO2	To understand the concept of elasticity.
LO3	To understand the behaviour of fluids.

Course Outcomes (CO)

At 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 samein real life.
CO4	recall the principles and basic equations and apply them to unseen problems

UNIT– I: GRAVITY AND GRAVITATION

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

UNIT– II: ELASTICITY

Introduction – Hooke'slaw – Poisson's ratio – Relation between elastic moduli and Poisson's ratio – Torsion pendulum – Bending of beams – Uniform and Non-uniform bending – Theory and experiment – Work done in bending – Expression for the period of oscillation of a cantilever – Determination of Young's modulus of a cantilever – 'I' form of girders.

UNIT– III: SURFACE TENSION

Definition and dimensions of surface tension – Excess of pressure over curved surfaces – Variation of surface tension with temperature – Jaeger's experiment – Quincke's method– Vapour pressure over a liquid surface – Determination of surface tension by ripples method– Factors affecting surface tension.

UNIT– IV: VISCOSITY

Introduction to Stream line and turbulent motion – Coefficient of viscosity and its dimensions – Rate of flow of liquid in a capillary tube – Poiseuille's formula – Correction for Poiseuille's method – Poiseuille's method for determination of coefficient of viscosity of liquid – Searle's Viscometer – Viscosity of gas – Rankine's method – Comparison of viscosities – Ostwald's viscometer.

UNIT– V: DIFFUSION AND OSMOSIS

Diffusion – Graham's law of diffusion – Fick's law – Experimental measurement of diffusivity – Transpiration and transfusion – Osmosis – Osmotic pressure – Laws of Osmotic pressure – Van't Hoff law – Osmosis and vapour pressure of solution – Osmosis and boiling point of a solution – Osmosis and freezing point of a Solution.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Production and measurement of low pressure – Grades' molecular pump – Knudsen's absolute gauge – Detection of leakage.

TEXT BOOKS :

1 Brijlal and Subramanyam, (2014), *Properties of Matter*, S. Chand and Co Pvt. LTD.
2 Murugesan.R, (2016), *Properties of Matter*, S. Chand and Co Pvt. LTD.
3 Mathur, D.S, (2018), *Elements of Properties of Matter*, S.Chand& Co., New Delhi, 40th Revised Edition.

SUPPLEMENTARY READING:

1 Flowers, B.H, (1991), *Properties of Matter*, 1st ed., Wiley publishers, New Jersey.
2 Newman, F.H and Searle, V.H.L, (1961), *The General Properties of Matter*, Edward Arhold Publisher, London.
3 Galati, H.R, (2005), *Fundamentals of General Properties of Matter*, R. Chand and Co. (Fifth Edition).

COURSE OUTCOME MAPPING:

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

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

Semester	19IMATA01: ALLIED MATHEMATICS – I	L	T	P	C
I		5	0	0	5

Learning Objectives (LO):

LO1	To build the basic knowledge on series, matrices and differentiation.

Course Outcomes (CO):

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

CO1	study the series of number system.
CO2	understand the various the matrix operations and types.
CO3	study the trigonometric and hyperbolic functions.
CO4	understand the differentiations methods and applications.

Unit – I :

Series, Comparison test, Integral test, Comparison of ratios, D'Alembert's ratio test, Cauchy's root test, Alternating series, Convergence of exponential series, Uniform convergence.

Unit – II :

Matrix operations, Rank of a matrix, Normal form of a matrix, Inverse of a matrix, Eigen values and Eigen vectors, Caley-Hamilton theorem, Reduction to a diagonal form.

Unit – III :

Expansion of sin $n\theta$, cos $n\theta$, tan $n\theta$ in powers of sin θ, cos θ and tan θ, Exponential function of a complex variable, circular function of a complex variable, Hyperbolic functions, Inverse hyperbolic functions.

Unit – IV :

Differentiation, Successive differentiation, Meaning of derivative.

Unit – V :

Maxima and minima, Rolle's theorem and Mean value theorem, Expansions of functions, Partial differentiation.

Text Books:

1. Grewal, B.S. (2008), *Content and treatment as in the book "Higher Engineering Mathematics"* by Khanna Publishers,.
   - Unit I Chapter 9 Sections 9.3 to 9.17 except 9.14
   - Unit II Chapter 2 Sections 2.5 to 2.9 and 2.14 to 2.17
   - Unit III Chapter 19 Section 19.6 to 19.11
2. Narayanan S, and T.K. Manicavachogam Pillay, S.(2009), *Content and treatment as in the book "Calculus",* Vol. I Viswanathan Printers.
   - Unit IV Chapters 2, 3 and 4
   - Unit V Chapters 5, 6, 7 and 8 (Sections 1.1 to 1.7)

SUPPLEMENTARY READING:

1. Thomas G.B. and R.L.Finney. (1998), *Calculus and Analytic Geometry*, Addison Wesley (9 th Edn), Mass. (Indian Print).
2. Venkataraman, M.K, (1992), *Engineering Mathematics-Part B*, National Publishing Company, Chennai.

COURSE OUTCOME MAPPING:

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

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

Semester	19ITAMC21: Language - I	L	T	P	C
II	பக்தி இலக்கியமும் சிற்றிலக்கியமும்	3	0	0	3

Learning Objectives (LO):

கற்றலின் நோக்கம்

LO1	தமிழ்ப்பக்தி இலக்கியங்களையும் சிற்றிலக்கியங்களையும் அறிமுகம் செய்தல்.
LO2	பக்தி இலக்கியத்தின் செல்வாக்கு தோற்றம் வளர்ச்சி - பாகுபாடு
LO3	தமிழின் தனித்தன்மையை உணர்த்தியபாங்கு போன்றவற்றை வரலாற்றுடன் விளக்குதல்.

Course Outcomes (CO): கற்றல் வெளிப்பாடு

இந்தப்பாட முடிவில் மாணவர்கள்

CO1	பக்தி இலக்கியங்களால் தமிழ்மொழி அடைந்த சிறப்புத்தன்மையான நெகிழ்வுத்தன்மை அறிந்திருப்பர்
CO2	பக்தி இலக்கியங்களில் கூறப்பட்ட தத்துவங்களின் வழி வாழ்வியல் நெறிமுறைகளைப் பின்பற்றுவர்.
CO3	பக்தி இலக்கியங்களில கூறப்பட்டக்கருத்துக்களை சமூக மற்றும் உலக அமைதியை நிலைநாட்டப் பயன்படுத்துவர்.

அலகு- 1 பக்தி இலக்கியம்

1. திருஞானசம்பந்தர் - திருநள்ளாறு - பச்சைப்பதிகம் (முதல் 5 பாடல்கள்)

2. திருமூலர் - திருமந்திரம் (உடம்பினை முன்னை, யாவர்க்குமாம், ஒன்றேகுலமும், உள்ளம் பெருங்கோயில், ஆர்க்கும்எனத் தொடங்கும்பாடல்கள்)

3. சிவவாக்கியர் அறிவுநிலை (5 பாடல்கள்)

அலகு – 2 பக்தி இலக்கியம்

1. ஆண்டாள் - திருப்பாவை (முதல் 5 பாடல்கள்)

2. வள்ளலார் - திருவருட்பா - பிள்ளைச்சிறு விண்ணப்பம்

அலகு – 3 பக்தி இலக்கியம்

1.தேம்பாவணி - குழவிகள்வதைப்படலம்

2.சீறாப்புராணம் - மானுக்குப்பிணை நின்றபடலம்

அலகு – 4 சிற்றிலக்கியம்

1. குற்றாலக்குறவஞ்சி - மலைவளம் (வானரங்கள்... பாடல்முதல்)

2. முக்கூடற்பள்ளு - நாட்டுவளம்

அலகு - 5 இலக்கிய வரலாறு

பக்தி சிற்றிலக்கிய வரலாறு – இடைக்காலத் தமிழகச்சூழல் – சைவ வைண சமயங்களின் செல்வாக்கு – சமண பௌத்த சமய இலக்கியங்கள் – கிறித்துவ இசுலாம் இலக்கியங்கள் - நாயக்கர் காலச் சிற்றிலக்கியங்கள் தோற்றபின்னணி – சிற்றிலக்கிய வகை.

(மாணவர்கள் அறிந்துகொள்வதற்கு மட்டும் – தேர்வுக்கானபகுதி அல்ல)

இலக்கியங்களையும் அவைதொடர்பான இலக்கிய வரலாற்றையும் இணைத்துப்படித்தல். பக்தி இலக்கியவளர்ச்சியில் தமிழ்ப்பனுவல்களில் ஏற்பட்ட வளர்ச்சியைச் சுட்டிக்காட்டுதல். மனித மனத்தை பண்படுத்தவும், சமூக அமைதியை நிலைநாட்டவும், உலகநல்லிணக்கம் காணவும் பக்தி இலக்கியம் பயன்படுமாற்றை விளக்குதல்.

பாடநூல்கள்:

1. ச.வே.சுப்பிரமணியன்(ப.ஆ) - பன்னிரு திருமுறைகள்
மணிவாசகர் பதிப்பகம், சென்னை
மூன்றாம்பதிப்பு – 2010

2. ச.வே.சுப்பிரமணியன் (ப.ஆ) நாலாயிரத் திவ்யபிரபந்தங்கள்
முல்லை நிலையம்
சென்னை-17
முதற்பதிப்பு – 2000, இரண்டாம்பதிப்பு 1996

3. வள்ளலார் திருவருட்பா,
அண்ணாமலைப் பல்கலைக்கழகப்
பதிப்பு அண்ணாமலைநகர்

4. வீரமாமுனிவர் தேம்பாவணி
பாரி நிலையம்,
சென்னை - 8
முதற்பதிப்பு – 2010

5. உமறுப்புலவர் சீராப்புராணம்
நேஷ்னல்பதிப்பகம்
சென்னை
முதற்பதிப்பு – 2004

6. திரிகூடராசப்பக்கவிராயர் - குற்றாலக்குறவஞ்சி
பாவை பதிப்பகம்
சென்னை
இரண்டாம் பதிப்பு – 2014

பார்வைநூல்கள்

1. ந.வீ.செயராமன் சிற்றிலக்கியச்செல்வம்
மணிவாசகர் பதிப்பகம், சென்னை.
முதற்பதிப்பு- 1968.
2. ந.வீ. செயராமன் பள்ளு இலக்கியம்
மணிவாசகர் பதிப்பகம், சென்னை.
முதற்பதிப்பு- 1980.
3. கோ.கேசவன் - பள்ளு இலக்கியம் ஒருசமூகவியல்
பார்வை அன்னம் வெளியீடு, தஞ்சாவூர்- 1981.
முதற்பதிப்பு - 1981
4. ச.வே.சுப்பிரமணியன் - தமிழ் இலக்கிய வரலாறு
மணிவாசகர் பதிப்பகம், சென்னை.
ஏழாம் பதிப்பு - 2010
5. சோ.நா.கந்தசாமி - தமிழ் இலக்கிய வரலாறு
மணிவாசகர் பதிப்பகம், சென்ன

COURSE OUTCOME MAPPING :

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

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

Semester	19IHINC21: Language -I	L	T	P	C
II	BASIC HINDI-II	3	0	0	3

Learning Objectives (LO):

LO1	To know the life of National leaders
LO2	To know the life of National leaders.
LO3	To introduce the Gandhijji's thought.
LO4	To understand the concepts of teaching and learning from Dr.Sarvapalli Radhakrishnan's life.

Course Outcomes (CO):

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

CO1	understand the basic structure of poem and prose.
CO2	classify and compare various poems.
CO3	describe the basic concepts of moral stories.
CO4	apply the teachings of various national leaders.
CO5	understand the spirit of spirituality.

Unit - I: Introduction

man ki shakti dena ,prathighna palan, hamara Rajchinga,adhbhud maya..

Unit - II: Poem, Prose

Sarvapalli radhakrishnan,amedkar, mahaveer, sadak ke niyam,sanghi ka phal(poem),

Unit - III: Stories.

Tyog ka such,bhavan sabka ek hai,chirjivan ka jharna, , lob ka parinam.

Unit - IV:

Dadha ki moorkatha, kuthe ki poonch ande barabar dhana.

Unit - V:

Bakri do ghav kha gayi, , Dhan ki magima,

Text Books:

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

SUPPLEMENTARY READING:

1. Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.
2. Hindi prachar bodhini-DHBS, Chennai 17

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		3	3	2	2	3	2	3	3	3	3	3						
CO2	3		3		3		2	2		3								
CO3	3	3			2	3		2	3				2					
CO4	3	3	3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

Semester	19IFREC21: Language – I : French-II	L	T	P	C
II		3	0	0	3

Learning Objectives (LO):

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

Course Outcomes (CO):

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

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

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

TEXT BOOKS :

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

SUPPLEMENTARY READING:

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

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		2	3	2	2	3	2	3	3	3	3	3						
CO2	3		2		3		2	2		3								
CO3	3	2			2	3		2	3				2					
CO4	3	3	3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

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

Learning Objectives (LO):

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

Course Outcomes (CO):

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

CO1	become competent in communication, both in written and oral skills
CO2	gain fluency in English language
CO3	attain knowledge about construction of sentence structures
CO4	acquire the vocabulary to use the English language effectively
CO5	acquire the aesthetic sense for appreciating poetry

Unit - I

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

Unit - II

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

Unit - III

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

Unit - IV

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

Unit - V

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

Text books:

1. Jack.Hydes, (1985), *TouchedWith Fire.* London: Cambridge UP.
2. Narasimhaiah, C.D, (2006), *An Anthology of Common Wealth Literature*. New Delhi:

SUPPLEMENTARY READING:

1. Thomas, C.T. (2006), *Twentieth Century Verse: An Anglo-American Anthology*. Macmillan. New Delhi:
2. Henry Louis, and Y. NellieMcKay, (2004), *The Norton Anthology of African American Literature.* New York:
3. Ramachandran, C.N. and Radha Achar, (1998), *Five Centuries of Poetry.* New Delhi: Laxmi.

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3			3			3	3		3	3	3			3			
CO2	2			3			3	3		3	3	3			3			
CO3	3			2			2	2		2	2	2			2			
CO4	3			3			3	3		3	3	3			3			
CO5	2			2			2	2		2	2	2			2			

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

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

Learning Objectives (LO):

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

Course Outcomes (CO):

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

CO1	describe the usage of computers and why computers are essential components in business and society.
CO2	solve common business problems using appropriate information technology applications and systems.
CO3	identify categories of programs, system software and applications. organize and work with files and folders and utilize the internet web resources and evaluate on-line e-business system.
CO4	design a responsive web site using HTML5 and demonstrate Rich Internet Application.

Unit – I:

Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers. Input, output devices, data storage devices, software, the definition, the role of software, Housekeeping.

Unit – II:

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

Unit – III:

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

Unit – IV:

Issues involved in web site management, addressing, designing web sites with front page.

Unit – V:

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

Text Books:

1. Sanjay Saxena, (2015), *A first course in computers* , Vikas Publishing House, New Delhi.
2. Alexies Leon and Mathews Leon, (2016), *Internet in a nutshell,* Leon Press, Chennai and Vikas Publishing House, New Delhi.
3. Tay Vaughan, (1999), *Multimedia Making it work*, Osborne, Tata McGraw Hill.

SUPPLEMENTARY READING:

1. Ron Mansfield, (1997), *Windows 95 for Busy People"*, Obsorne, McGraw Hill.
2. *Krishnan, (2012), Computer fundamentals and Windows with Internet Technology*, Scitech Publications Pvt Ltd, Chennai, India.
3. *Krishnan, (2000), Windows and MS-Officewith database concepts*, Scitech Publications Pvt Ltd, Chennai, India.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC24 - HEAT AND THERMODYNAMICS	L	T	P	C
II		4	0	0	4

Learning Objectives (LO):

LO1	To provide a phenomenological introduction to thermodynamics through thermodynamics postulates, quantities and relations
LO2	To gain in depth knowledge regarding the effects of heat and its applications.
LO3	Studying the micro and macroscopic properties of the matter through the statistical probability laws and distribution of particles

Course Outcomes (CO)

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

CO1	gain in depth knowledge of heat and its effects.
CO2	understand the behaviour of thermal properties of materials.
CO3	know the theory of heat and thermodynamics with applications.
CO4	finding applications of the physical quantities.

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

Specific heat capacity of solids – Regnault's method of mixtures(solid) – Newton's law of cooling - specific heat capacity of liquids – Callendar and Barnes method – Specific heat capacity of gases – C_p and C_v – Meyer's relation – C_v by Joly's differential steam calorimeter method – C_p by Regnault's method.

UNIT– III: TRANSMISSION OF HEAT

Conduction – coefficient of thermal conductivity – Rectilinear flow of heat along a bar – convection – lapse rate – Stability of the atmosphere - Radiation - black body – Kirchhoff's law – Stefan – Boltzmann law - energy distribution in black body spectrum - Wien's law – Rayleigh Jean's law – Planck's law - solar constant – water flow pyrheliometer.

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

Kinetic Theory of gases - assumptions - Molecular collisions – mean free path – expression for mean free path – Transport phenomenon – Brownian motion and its features – expression for viscosity of gas.

Joule Thomson effect – porous plug experiment – temperature of inversion – Joule-Thomson Cooling – Joule-Kelvin effect - Liquefaction of Air-Linde's process – Liquefaction of Helium - K.Onnes method - Helium I and II – Properties of Helium I and II – super conductivity.

UNIT– V: THERMODYNAMICS

Zeroth and first law of thermodynamics – reversible and irreversible processes – second law of thermodynamics – Carnot's engine – its efficiency.

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.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

THERMODYNAMICAL APPLICATIONS

Steam Engine – Petrol Engine – Refrigeration- Ammonia ice plant - Air conditioning system - Weather – Ozone hole - Solar Energy – Green house effect – Global Warming

TEXT BOOKS:

1. Brij Lal, N. Subramaniyam and P.S.Hemne, (2010), *Heat, Thermodynamics and Statistical Physics*, Chand and Co.
2. Murugeshan R and Kiruthiga Sivaprasath, (2012), *Thermal Physics*, S. Chand and Co.
3. Mathur, D.S, (2002), *Heat and Thermodynamics*, S. Chand and Co.

SUPPLEMENTARY READING:

1. Saha and Srivasatava, (1967), *A Text book of Heat*, Science Book Agency.
2. Charles Kittel, and Herbert Kroemer, (1987), *Thermal Physics*, CBS Publishers.
3. Singhal, S.S, J.P.Agarwal and Satya Prakash, (2001), *Heat and Thermodynamics*, Pragati Prakashan,
4. Kamal Singh & S.P. Singh, (1999), *Elements of Statistical Mechanics*, S. Chand and Co.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYP25 - PRACTICAL – I	L	T	P	C
II		0	0	2	3

Learning Objectives (LO):

LO1	To gain in depth knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine variousproperties of the materials given
LO4	To provide hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat and electricity.

Course Outcomes (CO):

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

CO1	apply knowledge of physics fundamentals and an instrumentation to arrive olution 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.

(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. Calibration of Low range voltmeter - Potentiometer.
6. Internal resistance of a cell - Potentiometer.
7. Determination of g and k - Compound pendulum.
8. Coefficient of viscosities - Hare's apparatus.
9. Thermal conductivity of a bad conductor - Lee's disc.
10. Thermal conductivity - Forbe's method.
11. Specific heat capacity of liquid by method of mixtures.
12. Specific heat capacity of liquid by method of cooling.
13. Viscocity of a liquid by Poiseuille's flow method.
14. Surface tension of a liquid - Drop weight method.
15. Rigidity Modulus – Torsional pendulum.
16. Elastic constants of a wire - Searle's method.

COURSE OUTCOME MAPPING:

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

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

Semester	19IMATA02: ALLIED MATHEMATICS – II	L	T	P	C
II		5	0	0	5

Learning Objectives (LO):

LO1	In this paper the student is exposed to the idea of integration and different methods of integration.
LO2	The application of integration to the evaluation of areas and volumes is also introduced. The notion of vector and its derivative is also taught
LO3	The notion of line integral, surface integral and volume integral using vectors is also studied and the verification of three basic theorems of vector calculus namely Green's theorem, Gauss divergence theorem and Stoke's theorem are carried out.

Course Outcomes (CO):

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

CO1	basic mathematical concepts related to the science field
CO2	problem solving
CO3	applications of mathematics
CO4	understanding the application of vector calculus

Unit - I: Integration

Introduction, Definite integral, Methods of integration, Integrals of the form

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

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

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

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

$\int \frac{1}{\sqrt{ax^2+bx+c}}$

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

Unit - II: Integration

Properties of definite integrals, Integration by parts, Reduction formula for the following types

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

$I_n = \int \cos^n x \, dx$ n, positive integer

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

$I_{mn} = \int \sin^m x \cos^n x dx$ Bernoulli's formula.

Unit - III:

Area under plane curves, Area of a closed curves, Area between two intersecting curves, Areas in polar coordinates, Volume of the solid of revolution, Length of a curve, Area of surface of revolution.

Unit - IV:

Vector differentiation, Scalar functions, Vector functions, Differentiation of a vector, Differentaitions formulas, Differentation of dot and cross products, The Vector differential operator Del, Gradient of a scalar function, Directional derivatives, Divergence of a vector, Curl of a vector, Expansion formulae, Second order differential operators, Solenoidal and irrotational fields.

Unit - V:

Vector integration, The line integral, Green's theorem in two dimesions-verification, Gauss divergence theorem (without proof)-verification and evaluation of integrals, Stoke's theorem (without proof)-verification and evaluation of integrals.

Text Books:

1. Narayanan S and T.K. Manicavachogam Pillay, S, (2003), *Content and treatment as in the book "Calculus (Major*), *Vol. II*, S. Viswanathan Printers.

   Unit I Chapter 1 Sections 1 to 8

   Unit II Chapter 1 Sections 11 to 15.1

   Unit III Chapter 2 Sections 1.1 to 1.4, Sections 3 to 5
2. Venkataraman M.K. and Manorama Sridhar, (2002), *Content and treatment as in the book "Vector Calculus and Fourier Series*, The National Publishing Company.

   Unit IV Chapter 2 Sections 2.2 to 2.4, 2.6, 2.7.

   Chapter 3 Sections 3.2, 3.3, 3.4, 3.7, 3.9, 3.11, 3.12, 3.15.

   Unit V Chapter 4 Sections 4.1, 4.3, 4.9 and 4.12

SUPPLEMENTARY READING:

1. Thomas G.B and R.L.Finney, (1998), *Calculus and Analytic Geometry*, Addison Wesley (9th Edn), Mass. (Indian Print).
2. Venkataraman M.K, (1992), *Engineering Mathematics-Part B*, National Publishing Company, Chennai.
3. Vittal P.R, (2004), *Vector Calculus, Fourier series and Fourier Transform*, Margham Publications, Chennai.
4. Grewal B.S, (2008), Higher Engineering Mathematics, Khanna Publishers.

COURSE OUTCOME MAPPING:

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

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

Semester	19ITAMC31: Language I	L	T	P	C
III	அறஇலக்கியமும் காப்பியமும்	3	0	0	3

Learning Objectives (LO): கற்றலின் நோக்கம்

LO1	தமிழில் தோன்றிய அறஇலக்கியங்களையும் காப்பிய இலக்கியங்களையும் அறிமுகம் செய்தல். அவற்றின் வகைகளை வரலாற்றுடன் விளக்குதல்.
LO2	இலக்கியங்களையும் அவை தொடர்பான இலக்கிய வரலாற்றையும் இணைத்துப் படித்தல்.

Course Outcomes (CO): கற்றல் வெளிப்பாடு

இந்தப்பாடமுடிவில்மாணவர்கள்

CO1	அறஇலக்கியங்கள் எப்படி மனதை நெறிப்படுத்தவும் சமூக நடத்தையையும் கற்றுத்தருகின்றது என்பதை விளக்குவர்.
CO2	அறஇலக்கியங்களில் கூறப்பட்டுள்ள அறநெறிக்கருத்துக்களை வாழ்வியலில் கடைப்பிடிக்கமுயலுவர்.
CO3	நல்ல சமுதாயம் உருவாக்க அறஇலக்கியங்களில் கூறப்பட்டுள்ள அறக்கருத்துக்களை எடுத்துரைப்பர்.

அலகு – 1 அறஇலக்கியம்

1. திருக்குறள் - உழவு, ஒழுக்கமுடைமை, காலமறிதல், நட்பு, பிரிவாற்றாமை

அலகு – 2 அறஇலக்கியம்

1. நாலடியார் - பெரியாரைப் பிழையாமை
2. பழமொழிநானூறு - கல்வி

அலகு - 3 காப்பியம்

1. சிலப்பதிகாரம் - இந்திர விழவு ஊரெடுத்தகாதை
2. மணிமேகலை - ஆபுத்திரன் திறன் அறிவித்தகாதை

அலகு - 4 காப்பியம்

1. பெரியபுராணம் - அப்பூதி அடிகள் புராணம்
2. கம்பராமாயணம் - வாலி வதைப்படலம்

அலகு - 5 இலக்கிய வரலாறு

சங்க மருவிய கால அறஇலக்கியங்கள் – திருக்குறளின் பெருமை – அற இலக்கியங்களின் வளர்ச்சி – காப்பிய இலக்கணம் – பகுப்புகள் – காலந்தோறம் தோன்றியகாப்பியங்கள் - வரலாறு.

அலகு – 6 (மாணவர்கள் அறிந்துகொள்வதற்கு மட்டும் – தேர்வுக்கான பகுதி அல்ல)

அறஇலக்கியங்கள் மனதை நெறிப்படுத்துவதோடு சமூக நடத்தைகளையும் கற்றுத்தருகின்றன. அறஇலக்கியங்களின் தொடர்பால் மாணவர்கள் நல்லக் கருத்துகளைக் கற்றுக்கொள்வதோடு வாழ்விலும் கடைபிடிக்க எண்ணுதல் நல்லசமூகம் உருவாகும். சமூகத்திற்கு அறநெறிகளில் தேவையானவை எடுத்துரைத்தல்.

பாடநூல்கள்:

1.	பதிப்பாசிரியர் ச. மெய்யப்பன்	-	திருக்குறள் மணிவாசகர் பதிப்பகம், சென்னை- 08. இரண்டாம் பதிப்பு -2017
2.	ச.வே.சுப்பிரமணியன்	-	நாலடியார், பழமொழி நானூறு மணிவாசகர் பதிப்பகம், சென்னை- 08. இரண்டாம் பதிப்பு -2012
3.	இளங்கோவடிகள்	-	சிலப்பதிகாரம் டாக்டர்உ.வே.சா. பதிப்பு 2, அருண்மடல் கடற்கலை சாலை பெசன்ட்நகர், சென்னை பதினொன்றாம் பதிப்பு -2008
4.	சீத்தலைச்சாத்தனார்	-	மணிமேகலை டாக்டர் உ.வே.சா. பதிப்பு 2, அருண்மடல் கடற்கலை சாலை பெசன்ட்நகர், சென்னை எட்டாம்பதிப்பு -2008
5.	சேக்கிழார்	-	பெரியபுராணம் முல்லை நிலையம், சென்னை முதற்பதிப்பு -2010
6.	கம்பர்	-	கம்பராமாயணம் அண்ணாமலைப் பல்கலைக்கழகம் வெளியீடு,
7.	ச.வே.சுப்பிரமணியன்	-	தமிழ் இலக்கிய வரலாறு மணிவாசகர் பதிப்பகம், சென்னை. முதற்பதிப்பு- 1999
8.	சோ.ந.கந்தசாமி	-	தமிழ் இலக்கிய வரலாறு மணிவாசகர் பதிப்பகம், சென்னை. முதற்பதிப்பு - 2004

COURSE OUTCOME MAPPING:

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

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

Semester	19IHINC31: Language I	L	T	P	C
III	BASIC HINDI - III	3	0	0	3

Learning Objectives (LO):

LO1	To study various comedy stories.
LO2	To introduce Indian epics.
LO3	To understand the concepts of drama

Course Outcomes (CO):

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

CO1	understand the basic structure of short stories.
CO2	knowledge on Mahabharath.
CO3	describe the basic concepts of human feelings.
CO4	apply the concepts of comedy in stories.
CO5	describe the effects of western culture.

Unit - I: Introduction, ekanki.

Andher Nagari - Bharathendhoo Harishchandra

Unit - II: Mahabharath Ki Ek Sanj - Bharath Bhoosahn Agrwal [Full]

Unit - III: Drama.

Ladai - Sarveswar Dayal Saxeena [Full]

Unit - IV: stories, Tatava-vyanghya

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

Text Books:

1. Andher Nagari - Bharathendhoo Harishchandra, Vinodh Pustak Mandir, Agra-2
2. Prathinidhi Ekanaki - Dr. Dashrath Oojaa, Jawahar Pustakalya, Mathura
3. Ekanaki Manach - Dr.V.P. Abhithap, Jawahar Pustakalya, Mathura
4. Ladai - Sarveswar Dayal Saxeena, Rajkamal Prakashan, New Delhi

SUPPLEMENTARY READING:

1. Hindi natak uthbhav aur vikas-dashrath ojha-rajpal and saons, new Delhi.7.
2. Hindi natak aur rangmanch-pahachan aur parak - Dr.Indranath madan, newdelhi.7.

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		3	3	2	2	3	2	3	3	3	3	3						
CO2	3		3		3		2	2		3								
CO3	3	3			2	3		2	3				2					
CO4	3	3	3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

Semester	19IFREC31: Language – I : French - III	L	T	P	C
III		3	0	0	3

Learning Objectives (LO):

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

Course Outcomes (CO):

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

CO1	ask the price of the product, pay the product.
CO2	ask about their daily activities
CO3	to give and ask information about the climate
CO4	describe their family
CO5	describe their accommodation where they live.

Unit I

Demander des nouvelles de quelqu'un(les activités de la journée)

Choisir, acheter, payer un objet

Unit II

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

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

Le temps en France et parler du temps

Unit III

Evaluez-vous

Evasion dans la Poésie

Unit IV

Souvenez-vous (Les moments de la vie)

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

Unit V

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

Présenter sa famille.

TEXT BOOKS:

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

SUPPLEMENTARY READING:

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

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		2	3	2	2	3	2	3	3	3	3	3						
CO2	3		2		3		2	2		3								
CO3	3	2			2	3		2	3				2					
CO4	3	3	3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

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

Learning Objectives (LO):

LO1	Enhance the conversational competence of the learners by introducing drama in English.
LO2	Make them learn the key elements of sentence structures
LO3	Make the students the understand characteristics of the Elizabethan Age.
LO4	Make them appreciate Shakespearean drama
LO5	Make the students master the mechanics of writing

Course Outcomes (CO) :

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

CO1	obtain a literary acumen to answer MCQs ofNET/SETexaminations and other competitive examination
CO2	appreciate conversational English
CO3	recognize the dramatic elements of Shakespearean dramas
CO4	use punctuations and capitals effectively in their composition
CO5	recognize the elements of the spoken discourses

Unit I

William Shakespeare — *The Tempest* (Act I)

Grammar — "Phrases and Clauses"

Unit II

William Shakespeare — *The Tempest* (Act II)

Grammar — "Simple, Compound, and Complex Sentences"

Unit III

William Shakespeare — *The Tempest* (Act III)

Grammar — "Transformation of Sentences"

Unit IV

William Shakespeare — *The Tempest* (Act IV)

Grammar — "Sequence of Tenses and Reported Speech"

Unit V

William Shakespeare — *The Tempest* (Act V)

Grammar — "Punctuation and Capitals"

TEXT BOOKS:

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

SUPPLEMENTARY READING:

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

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3			3			3	3		3	3	3			3			
CO2	2			3			3	3		3	3	3			3			
CO3	3			2			2	2		2	2	2			2			
CO4	3			3			3	3		3	3	3			3			
CO5	2			2			2	2		2	2	2			2			

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

Semester	19IPHYC33 - MECHANICS	L	T	P	C
III		4	0	0	4

Learning Objectives (LO):

LO1	To educate the students related to the various aspects of mechanics.
LO2	To understand the basic concepts of projectile motion, impulse, impact, rockets and satellites.
LO3	To provide the concepts of dynamics of rigid bodies.
LO4	To provide in depth knowledge about static, centre of gravity, hydrodynamics and basic concepts of classical mechanics.

Course Outcomes (CO):

At 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.

UNIT– I: PROJECTILE, IMPULSE AND IMPACT

Projectile – Range of a projectile in horizontal and inclined plane – Impulse – Impact – Impulsive force – Laws of impact – Impact of a smooth sphere on a smooth horizontal plane – Direct and oblique impacts –Loss in kinetic energy – Motion of two interacting bodies – Reduced mass.

UNIT – II: ROCKETS AND SATELLITES

Rockets and Satellites – Basic Principles of rocket motion – Rocket Equation, thrust and acceleration – Escape velocity, multistage rockets – liquid, solid and cryogenic – propellant rockets – space shuttle – Orbital velocity – launching of a satellite, types of satellite orbits.

UNIT–III: DYNAMICS OF RIGID BODIES

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

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.

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

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.

Current streams of Thought: (Not for Final Examinations)

Rigid body motion – Heavy symmetrical top with one point fixed on the axis – Fast and sleeping top - Deformable bodies - Strain and stress tensor – Energy of elastic deformation – Fluid dynamics - Permanency of vortices – Navier-Stokes theorem.

TEXT BOOKS:

1. Hans H S and Puri S P, (2003), *Mechanics*, Tata Mc Graw Hill.
2. Mathur DS, (2006), *Mechanics*, S.Chand.
3. Gupta, Kumar and Sharma, (2010), *Classical Mechanics*, Pragathi Prakashan.

SUPPLEMENTARY READING:

1. Takwale R G and Puranik P S, (1979), *Introduction to Classical Mechanics*, Tata Mc Graw Hill, New Delhi.
2. Gupta B D and Satya Prakash, (2004), *Classical Mechanics*, Keder Nath Publisher, Meerut.
3. Arora C L, (2006), *Mechanics and Properties of Matter*, S.Chand.
4. David Halliday, Robert Resnick and Jearl Walker, (2010), *Fundamentals of Physics*, John Wiley & Sons, 6 th edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC 34 - OSCILLATIONS, WAVES AND ACOUSTICS	L	T	P	C
III		4	0	0	4

Learning Objectives (LO):

LO1	To gain knowledge about the wave motion and wave propagation.
LO2	To know more about the basics of Acoustics.
LO3	To get more exposure to the ultrasonic sound and its applications.

Course Outcomes (CO):

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

CO1	thorough understanding about the terms such as frequency, wavelength and amplitud
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.

UNIT – I: OSCILLATIONS

Free, damped and forced vibrations – Expressions and derivations – Principle of resonance – Expression for resonance frequency – Expression for the velocity of longitudinal waves in a gaseous medium – Newton-Laplace's formula – Effect of temperature, pressure and humidity on the velocity of sound in air.

UNIT– II: WAVE PROPAGATION AND VIBRATING SYSTEMS

Equation of simple harmonic waves – Differential equation of wave motion – Progressive waves – Characteristics of progressive and stationary waves – Beats phenomenon – Expression for beats – Reflection & Refraction of sound waves - Expressions for velocity of transverse wave in a stretched string – Laws of transverse vibrations of string – Sonometer – Determination of AC frequency.

UNIT–III: ACOUSTICS

Characteristics of musical note – Intensity measurement – Pitch – Quality – Decibel – Sabine's empirical formula - Reverberation time – Measurement of absorption coefficient – Acoustic aspects for halls and auditoria – Acoustical Doppler effect

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 Squarewave and Saw tooth wave.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

ACOUSTIC APPLICATIONS

Typical acoustic applications include acoustic ranging, acoustic location, SONAR, seismology, acoustic emission, vibration analysis, engine testing, process control, ocean acoustic tomography and bio-acoustics, Acoustic Arrays and Transducers - Acoustic Electro-Magnetic and Piezo-Electric Transducers- Acoustic Hydrophones – Synthetic Aperture Sonar

TEXT BOOKS:

1. Lawrance E. Kinsler, Austin R. Frey and Alan B Coppens, (2009), *Fundamentals of Acoustics*, Fourth Edition, Wiley Student Edition.
2. Ghosh and D.Bhattacharya, (2006), *Oscillations, waves and Acoustics*, S.Chand and Company
3. Sathya Prakash, (2010), *Waves and Oscillations*, Pragati Prakashan.

SUPPLEMENTARY READING:

1. Robert D Finch, (2016), *Introduction to Acoustics*, First Edition, Pearson Edition, India.
2. Alton Everest F and Ken Pohlmann, (2015), *Master Handbook of Acoustics*, Sixth Edition Mcgraw Hill Education.
3. Mittal, P.K , (2010), *Oscillations, waves and Acoustics*, I.K International Pvt. Ltd,.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYP35 - PRACTICAL – II	L	T	P	C
III		0	0	2	3

Learning Objectives (LO):

LO1	To gain in depth knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine variousproperties of the materials given
LO4	To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

Course Outcomes (CO):

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

CO1	apply knowledge of physics fundamentals and an instrumentation to arrive olution for various problems.
CO2	understand the usage of basic laws and theories to determine various properties of the materials given.
CO3	understand the application side of the experiments
CO4	use of basic laws to study the spectral properties and optical properties of the given prism.

(Any **Twelve** experiments)

1. Viscosity – Stokes method.
2. Sonometer – Verification of laws.
3. Spectrometer – Refractive index of a solid prism.
4. Spectrometer – Dispersive power of a prism.
5. Spectrometer – Hollow Prism – Refractive index of a liquid.
6. Spectrometer – Grating – Normal incidence – λ determination.
7. Potentiometer – Low range voltmeter.
8. Potentiometer – Internal resistance of a cell.
9. Coefficient of viscosities - Ostwald's apparatus.

10. Rigidity modulus by torsional pendulum (with symmetric masses).
11. Potentiometer – Comparison of e.m.f of the cells.
12. Young's modulus – cantilever optical method.
13. Latent heat of Ice (Half time cooling correction)
14. Latent heat of Steam (Half time cooling correction)
15. Ultrasonic Interferrometer - Determination of velocity
16. Vibration Magetometer

COURSE OUTCOME MAPPING:

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

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

Semester	19ICHEA01: ALLIED CHEMISTRY - I	L	P	C
III		4	0	4

Learning Objectives (LO):

LO1	To develop knowledge in coordination chemistry.
LO2	To understand basics in chemical kinetics and photochemistry.

Course Outcomes (CO):

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

CO1	analyze the experimental data and present it systematically
CO2	appreciate, describe and adopt suitable separation techniques.
CO3	understand the role of metal ions in biological systems

Unit–I : Basic Organic Chemistry

Classification of organic compounds - Hybridization in methane, ethane, acetylene, benzene - Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution (nucleophilic & electrophilic) , elimination, condensation and polymerisation - Polar Effects - Inductive effect, resonance, hyper - conjugation, steric effect.

Unit–II : **Chemistry of Some Useful Organic Compounds**

Structure and uses of the following: Paracetamol, Penicillin, Morphine, Camphor, Thiopental Sodium, BHC, DDT, CF2Cl2. Synthesis, properties and uses of, PTFE, PVC, Bakelite, Nylon 6, 6.

Unit–III : Acid-Base Equilibria

Bronsted definition, Lewis definition, Ka Kb, pKa and pKb for Bronsted acids and bases. Relative strengths of Bronsted acids and bases.pH Buffer solution. Henderson's equation.Theory of acid-base indicators.

Unit–IV: Coordination Chemistry

Definition of terms - classification of ligands -chelation - Nomenclature of coordination compounds. Effective Atomic Number and its application to Ni(CO)4, [Ni(CN)4]2-, [Co(CN)]63- Role of metal ions in biological systems such as Hemoglobin, Vitamin B12.

Unit–V : Chemical Kinetics and Photochemistry

Rate of chemical reaction, Differential rate expression, order and molecularity, Integrated rate expressions for first, second, and zero order reactions, Half-life period. Effect of temperature on reaction rate - Activation energy.Arrhenius equation, Catalysis - Homogeneous and heterogeneous catalysis.

Introduction to photochemistry - Grothus - Draper Law, Stark-Einstein's Law. Quantum Yield. Fluorescence, Phosphorescence, Photsensitisation.

TEXT BOOKS :

1. VeeraiyanV, (2006), *Text book of Ancillary Chemistry*, Highmount Publishing house.
2. James E.Huheey, (1983), *Inorganic Chemistry*, 3rd edition, Harper &Row,Publishers, Asia, Pvt Ltd.,
3. Soni P.L, (2006), *Textbook of Organic chemistry*, S. Chand and Company,.New Dehi.
4. Soni P.L, (2006), *Text book of Inorganic Chemistry*, S. Chand and Company, New Dehi.
5. Puri B.R, Sharma and Pathania, (2006), *Text book of Physical Chemistry*, Vishal Publishing Co., Punjab.India.
6. Dara S.S, (2006), *Text book of Environmental chemistry and Pollution Control*. S.Chand and Co., New Dehi.

COURSE OUTCOME MAPPING:

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

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

Semester	19ITAMC41: Part-I Language I	L	T	P	C
IV	சங்கஇலக்கியமும் செம்மொழி வரலாறும்	3	0	0	3

Learning Objectives (LO):

கற்றலின்நோக்கம்

LO1	உலகச் செம்மொழியின் வரலாற்றைக் கூறுதல்.
LO2	தமிழ்ச் செம்மொழியின் தனிச்சிறப்புக்களையும் செம்மொழி இலக்கியங்களையும் விவரித்தல்.
LO3	தமிழ்ச் செம்மொழியின் தனிச்சிறப்புக்களையும் செம்மொழி இலக்கியங்களையும் விவரித்தல்
LO4	இலக்கியங்களையும் அவைதொடர்பான இலக்கியவரலாற்றையும் இணைத்துப் படித்தல்.

Course Outcomes (CO): கற்றல் வெளிப்பாடு

இந்தப்பாட முடிவில் மாணவர்கள்

CO1	பண்டையத் தமிழ்மரபுகளையும் சமூக அமைப்புகளையும் விளக்குவர்.
CO2	தமிழ்மொழியின் தனித்துவத்தைச் செம்மொழியின் இயல்புகள் மற்றும் சங்க இலக்கியங்களின் துணைக்கொண்டு விளக்குவர்.
CO3	இலக்கண இலக்கிய வகைமைகளை அறிந்து தன்னைப் படைபாளராக உருவாக்க முயலுவர்.

அலகு – 1 அகஇலக்கியங்கள்

1. குறுந்தொகை - 125, 129, 177, 302, 397 (நெய்தல்)
2. நற்றிணை - 206, 217, 304, 334, 382 (குறிஞ்சி)
3. ஐங்குறுநூறு - 17, 18, 71, 75, 96, (மருதம்)
4. அகநானூறு - 147, 303, 370 (பாலை)
5. கலித்தொகை - 104, 105(முல்லை)

அலகு - 2 புறஇலக்கியங்கள்

1. புறநானூறு -பெண்பாற்புலவர்கள் 76, 83, 133, 146, 178, 188, 227, 261, 264, 278

அலகு - 3 பத்துப்பாட்டு

1. நெடுநெல்வாடை

அலகு - 4 சங்கஇலக்கியவரலாறு

தொல்காப்பியம் - சங்ககாலம் - முற்சங்கங்கள் – பாட்டும் தொகையும் - தொகுப்புமுறை - தனித்தன்மைகள்.

அலகு - 5 பயன்பாட்டுத்தமிழும்செம்மொழிவரலாறும்

மொழிவிளக்கம் - மொழிக்குடும்பங்கள் - உலகச்செம்மொழிகள் – இந்தியச் செம்மொழிகள் – செம்மொழித் தகுதிகள் - வரையறைகள் – வாழும் செம்மொழித்தமிழ் – தமிழின் தொன்மை – தமிழின்

சிறப்புக்கள் – தமிழ்ச் செம்மொழிநூல்கள் – தமிழ் செம்மொழிஅறிந்தேற்பு – பரிதிமாற்கலைஞர் முதல் தற்கால அறிஞர்கள் வரை (அறிஞர்கள் - அமைப்புகள் – நிறுவனங்கள் – இயக்கங்கள் தொடர்முயற்சிகள் – அறப்பேராட்டங்கள் – உலகத் தமிழ்ச் செம்மொழிமாநாடு, கோவை-2010)

(மாணவர்கள் அறிந்துகொள்வதற்கு மட்டும் – தேர்வுக்கான பகுதி அல்ல)

பண்டைய தமிழ் மரபுகளையும் சமூக அமைப்புகளையும் விளக்குதல், தமிழ்மொழியில் தனித்துவத்தையும் செம்மொழி இயல்புகளையும் சங்க இலக்கியங்களின் துணைக்கொண்டு விளக்குதல். சங்கப்பனுவல்களில் பொதுமைத் தன்மையையும் அவற்றின் சிறப்பியல்புகளையும் விளக்குதல்.

பாடநூல்கள் :

1. ச.வே.சுப்பிரமணியன் (ப.ஆ) - குறுந்தொகை, நற்றினை, ஐங்குறுநூறு, “ அகநானூறு, கலித்தொகை, மணிவாசகர் பதிப்பகம், சென்னை இரண்டாம் பதிப்பு - 2011
2. ச.வே.சுப்பிரமணியன் (ப.ஆ) - புறநானூறு, மணிவாசகர் பதிப்பகம், சென்னை இரண்டாம்பதிப்பு - 2011
3. ச.வே.சுப்பிரமணியன்(ப.ஆ) - பத்துப்பாட்டு (நெடுநல்வாடை) மணிவாசகர் பதிப்பகம், சென்னை இரண்டாம் பதிப்பு - 2011
4. தெ.பொ.மீனாட்சிசுந்தரம் - சங்கமொழிவரலாறு நியூசெஞ்சரி, புத்தக நிலையம் முதற்பதிப்பு - 2018
5. மணவை முஸ்தபா - செம்மொழி உள்ளும் புறமும் சீதைபதிப்பகம், சென்னை முதற்பதிப்பு - 2010
6. ச.வே.சுப்பிரமணியன் - சங்க இலக்கியம் மணிவாசகர் பதிப்பகம், சென்னை இரண்டாம் பதிப்பு - 2011
7. மு.வரதராசன் - தமிழ் இலக்கிய வரலாறு, சாகித்திய அகாதெமி வெளியீடு, புதுதில்லி மூன்றாம் பதிப்பு - 2015

COURSE OUTCOME MAPPING:

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

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

Semester	19IHINC41: Language - I	L	T	P	C
1V	BASIC HINDI - IV	3	0	0	3

Learning Objectives (LO):

LO1	To learn the important poems of famous Hindi poets.
LO2	To imbibe the knowledge of writing in Premchand stories.
LO3	To understand the relation between poems and stories.
LO4	To gain knowledge on stories of Beeshma Sahin

Course Outcomes (CO):

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

CO1	understand the concepts of Hindi poems.
CO2	knowledge on stories of Premchand.
CO3	describe the basic concepts of hindi stories.
CO4	apply the concepts of writings of Jai sankar Prasad.
CO5	understand the writing style of Beeshma Sahini.

Unit - I: Introduction, Poem

. Kabeer - 1 To 10 Dohas Tulasi - 1 To 10 Dohas.

Unit - II: Rahim - 1 To 10 Dohas

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

Unit - IV: stories,

Chief Ki Daavat - Beeshma SahinI

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

TEXT BOOKS:

1. PADHYA MANJARI, T.NIRMALA& DR.S.MOHAN Rajkamal Prakashan, New Delhi
2. Pemchand ki pradhini kahaniya, Rajkamal prakshan, New Delhi.7.
3. Kahani:nayi kahani: namvirsingh, Rajkamal Prakashan, New Delhi.
4. Bihari-ompraksh.vani prakshan, New Delhi 110002.

SUPPLEMENTARY READING:

1. Nayi kahani:prakruti aur paat:surendra chowdari.
2. Naveen ekanki , D.B.H.P. SABHA, madras17.
3. Bihari ki kavya sruti:jaya praksh.

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		3	3	2	2	3	2	3	3	3	3	3						
CO2	3		3		3		2	2		3								
CO3	3	3			2	3		2	3				2					
CO4	3	3	3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

Semester	19IFREC41: Language – I : French - IV	L	T	P	C
IV		3	0	0	3

Learning Objectives (LO):

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

Course Outcomes (CO):

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

CO1	describe a country
CO2	take an appointment with a doctor or with friends, etc.
CO3	express in which part of the body they have pain.
CO4	describe a person physically and mentally
CO5	ask others about how they are feeling using expressions such as ‘Qu’est-ce que tu as? Où est-ce que tu as mal?’

Unit I

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

Unit II

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

Unit III

Donner un conseil
Téléphoner /Prendre rendez-vous

Unit IV

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

Unit V

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

TEXT BOOKS:

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

SUPPLEMENTARY READING:

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

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		2	3	2	2	3	2	3	3	3	3	3						
CO2	3		2		3		2	2		3								
CO3	3	2			2	3		2	3				2					
CO4	3	3	3	3	3		3		2	2	2			2				
CO5			3	3	3	3	3	2	2	2	2				3			

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

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

Learning Objectives (LO):

LO1	Develop the communicative competence of learners in the English Language through training them in the skills of listening, speaking, reading, and writing
LO2	Enable the students to know about the origin and development of short story
LO3	Write objectively, avoiding vagueness, prejudice, and exaggeration
LO4	Enable the learner to function through the written mode of English language in all situations including classroom, library, laboratory etc
LO5	Discover an author's purpose, and draw conclusions about certain events, evaluating cause and effect, and understanding point of view

Course Outcomes (CO):

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

CO1	use more vocabularies while writing
CO2	ensure about the history and development
CO3	develop a flow in writing
CO4	come up with new ideas while reading stories from different perspectives
CO5	write in a style appropriate for communicative purposes

Unit I

1. O' Henry — "The Gift of The Magi"
2. Ken Liu — "The Paper Menagerie"

Grammar — Synonyms and Antonyms

Unit II

1. Flora Annie Steel — "Valiant Vicky"
2. Oscar Wilde — "Happy Prince"

Grammar — Words often confused

Unit III

1. R. K. Narayan — "The Martyr's Corner"
2. Mahasweta Devi — "Draupati"

Grammar — Paragraph-Writing

Unit IV

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

Grammar — Letter-Writing

Unit V

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

Grammar Precis-Writing

TEXT BOOKS:

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

SUPPLEMENTARY READING:

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

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3			3			3	3		3	3	3			3			
CO2	2			3			3	3		3	3	3			3			
CO3	3			2			2	2		2	2	2			2			
CO4	3			3			3	3		3	3	3			3			
CO5	2			2			2	2		2	2	2			2			

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

Semester	19IPHYC43 - OPTICS AND SPECTROSCOPY	L	T	P	C
IV		4	0	0	4

Learning Objectives (LO):

LO1	To understand and acquire an in-depth knowledge regarding the behavior of light and also the essential concepts of geometrical optics.
LO2	To understand the theoretical explanation of the phenomenon of interference, diffraction and polarization.
LO3	To educate the students about the fundamental aspects of molecular spectroscopy.

Course Outcomes (CO):

At 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	useof tools needed to formulate problems in optics and spectroscopy.
CO4	understand the fundamental aspects of molecular spectroscopy

UNIT–I: GEOMETRICAL OPTICS

Lens – Spherical aberration in lenses – Methods of minimizing spherical aberration – chromatic aberration in lenses – condition for achromatism of two thin lenses (in and out of contact) – Aplanatic lens – Dispersion – Angular and Chromatic dispersion – combination of prisms to produce - dispersion without deviation and deviation without dispersion – Direct vision spectroscope – Eyepieces – Ramsden's and Huygens's eyepieces – simple microscope – compound microscope.

UNIT–II: INTERFERENCE

Conditions for interference – Theory of interference fringes – determination of thickness of thin transparent sheet - interference due to reflected light (thin films) – colours of thin films – wedge shaped thin film – theory – determination of diameter of a thin wire by Air wedge – test for optical flatness – Newton's rings by reflected light – Determination of wavelength of light – Michelson's Interferometer – theory and its Application (Measurement of wavelength).

UNIT – III: DIFFRACTION

Fresnel's diffraction – Rectilinear propagation of light – Zone plate – action of zone plate - diffraction at circular aperture – opaque circular disc – Fraunhofer diffraction at single slit – Double slit – Plane diffraction grating – theory of plane transmission grating - experiment to determine wavelength(Normal incidence method) – resolving power - Rayleigh's criterion for resolution – resolving power of a telescope – resolving power of a microscope – resolving power of a prism - resolving power of grating.

UNIT – IV: POLARISATION

Double refraction – Nicol Prism – Nicol Prism as polarizer and analyzer – Huygens's explanation of double refraction in uniaxial crystals – Plane, elliptically and circularly polarized light – Quarter wave plates and Half wave plates – Production and detection of plane, circularly and elliptically polarized light - Optical activity – Fresnel's explanation of optical activity – Specific rotatory power – Laurent's half shade polarimeter.

UNIT–V: SPECTROSCOPY

Infrared spectroscopy – sources and detector – uses – ultraviolet spectroscopy – sources – quartz spectrograph - applications - Raman Spectroscopy – Quantum theory of Raman effect – applications – Nuclear magnetic resonance – theory and its applications – Nuclear quadrupole resonance - instrumentation and application– Electron spin resonance spectroscopy theory and application.

CURRENT STREAMS OF THOUGHT: (Not for Final Examinations)

Holography - Principle of Holography - Recording and Reconstruction Method - Theory of Holography as Interference between two Plane Waves - Point source holograms.

TEXT BOOKS:

1. Subramanyam Brijlal. N and Avadhanulu. M.N, (2016), *A Text Book of Optics*, S. Chand & Co Ltd., 25th Revised Edition.
2. Murugesan .R and Kiruthiga Sivaprasath, (2016), *Optics and Spectroscopy*, S. Chand & Co Ltd., 9th Revised Edition.
3. Colin N. Banwell, Elaine M. McCash, (2017), *Fundamentals of Molecular Spectroscopy.* Tata McGraw-Hill Publishing Company Ltd, 4thEdition.

SUPPLEMENTARY READING:

1. Jerkins A. Francis and Harvey E. White, (2011), *Fundamentals of Optics*, Tata McGraw Hill Ltd.
2. Colin N. Banwell, Elaine M. McCash, (1995), *Fundamentals of Molecular Spectroscopy* (Fourth Edition), Tata McGraw-Hill Publishing Company Ltd.
3. Straughen. R.P, Walker. S, (1976), *Spectroscopy, Vols. I, II and III*, Chapman & Hall, London.

COURSE OUTCOME MAPPING:

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

Semester	19IPHYC44 - ELECTRICITY AND MAGNETISM	L	T	P	C
IV		4	0	0	4

Learning Objectives (LO):

LO1	Fundamental laws viz, Gauss's law in electro & magnetostatics, Faraday's law and Ampere's law are emphasized
LO2	Basics of electrostatics, magnetostatic and time varying fields from the fundamentals of electromagnetic theory.
LO3	Galvanometer, thermocouple, transformer principle are discussed.

Course Outcomes (CO):

At 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

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

Magnetic poles - Fundamental vectors-force on a magnet in a uniform magnetic field – magnetic dipole - magnetic vector and scalar potential - Electric field vector in scalar and vector potential – force on a moving charge - Lorentz force – force on a conductor carrying current - torque on a current loop - Ballistic galvanometer theory and uses - Biot and savarat's law - calculation of H in different conditions.

UNIT– IV : ELECTROMAGNETIC INDUCTION

Faraday's law of electromagnetic induction - expression for induced electromagnetic force - self and mutual induction - Co-efficient of coupling - determination of self and mutual inductance - A.C.bridges - Anderson's and Owen's bridges.

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.

CURRENT STREAMS OF THOUGHT: (Not for Final Examinations)

Spontaneous magnetic orders - Alignment of spins through Heisenberg exchange - Thermal variation of spontaneous magnetization - Spin waves - Magnon dispersion relation - Derivation of Bloch T3/2 Law - Magnon heat capacity.

TEXT BOOKS:

1. Sehagal and Chopra, (2013), *Electricity and Magnetism*, S.Chand and Sons.
2. Vasudeva. D.N, (2012), *Electricity and Magnetism*, S.Chand and Co.
3. Brijlal and Subramaniyam, (1966), *Electricity and Magnetism*, Ratan Prakashan Mandir, Agra.

SUPPLEMENTARY READING:

1. Resnic and Halliday, (1988), *Physics, Vol. III*, Willey Eastern Limited.
2. Murugesan. R, (2019), *Electricity and Magnetism*, S. Chand and Co.
3. Mahajan A.S.and A.A. Rangwala, (1988), *Electricity and Magnetism*, Tata- McGraw Hill.

COURSE OUTCOME MAPPING:

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

Semester		L	T	P	C
IV	**19IPHYP45 - PRACTICAL – III**	0	0	2	3

Learning Objectives (LO):

LO1	To gain in depth knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine variousproperties of the materials given
LO4	To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

Course Outcomes (CO):

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

CO1	apply knowledge of physics fundamentals and an instrumentation to arrivesolution 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.

(Any **Twelve** experiments)

1. Spectrometer – Determination of Cauchy's constant.
2. Air wedge – Determination of Diameter of a thin wire.
3. Newton's rings - Determination of radius of curvature of given lens
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 – Determination of Temperature co-efficient of resistance of a coil.
7. Potentiometer – Calibration of an Ammeter.
8. Internal resistance of a cell –using B.G.
9. Determination of Thermo e.m.f using B.G.
10. Series and parallel resonance circuits - Determination of self inductance of a coil
11. B.G. – Determination of comparison of mutual inductance.
12. B.G. – Absolute capacity of a condenser.
13. Potentiometer – High range voltmeter Calibration
14. Anderson's bridge - Determination of resistivity of the given coil
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 OUTCOME MAPPING:

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

Semester	19ICHEA02: ALLIED CHEMISTRY - II	L	P	C
IV		4	0	4

Learning Objectives (LO):

LO1	To develop knowledge in electrochemistry and industrial chemistry.
LO2	To understand Quantitative Analysis and separation techniques.

Course Outcomes (CO):

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

CO1	analyze the quality of water samples
CO2	appreciate , describe and adopt suitable separationtechniques.
CO3	identify compounds using spectral techniques.

Unit–I : Chemistry of Natural Products

Terpenoids: Structure and uses – Camphor, vetivones. Alkaloids – Structure and uses, papavarine, cocaine Structures and important biological properties

Unit–II: Electrochemistry

Galvanic cells – emf - standard electrode potential - reference electrodes - electrochemical series and its applications-glass electrode and pH determination - Electroplating process - Nickel and Chrome plating - Different types of cells - primary cell, secondary cell. Fuel cells. Corrosion and methods of prevention.

Unit–III: **Industrial Chemistry**

Production and uses of gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas and compressed natural gas - Fertilizers-manufacture and uses of urea, ammonium sulphate, superphosphate, Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - Zeolite process, Purification of water for domestic use: use of chlorine, Ozone and UV light - Definition and determinations of BOD and COD.

Unit–IV: **Analytical Chemistry**-I

Introduction to Quantitative Analysis and separation techniques - Principle of volumetric and gravimetric analysis-Estimation of hardness by EDTA method.Estimation of Ni, Ba and Cu by gravimetric methods.Electrogravimetry – theory of electrogravimetric analysis – determination of copper (by constant current procedure) - Separation techniques - extraction - distillation – crystallization.

Unit–V: Analytical Chemistry-II

Colorimetric methods, Beer's law and its validity, estimation of fluoride ion by photocolorimeter, flame photometry and atomic absorption spectroscopy - NMR spectroscopy: Nuclear spin and conditions for a molecule to give rise to NMR spectrum – theory of NMR spectra, number of NMR signals, equivalent and non-equivalent protons, position of NMR signals, shielding, de-shielding, chemical shift – δ and τ scales, peak area and number of protons – splitting of NMR signals – spin-spin coupling.

TEXTBOOKS :

1. Veeraiyan. V, (2006), *Text book of Ancillary Chemistry*, Highmount Publishing house, Chennai.
2. Vaithyanathan. S, (2006), *Textbook of Ancillary Chemistry*, Priya Publications, Chennai.
3. Soni. P. L, (2006), *Text book of Organic chemistry*, Sultan Chand &Company,New Delhi.
4. Puri, Sharma and Pathania, (2006), *Text book of Physical Chemistry*, Vishal Publishing Co., Jalandar.

SUPPLEMENTARY READING:

1. Dara. S.S, (2006), *Text book of Environmental chemistry and Pollution Control*, S.Chand and Co., New Delhi.
2. Day. R.A and Underwood.A.L, (1999), *Quantitative Analysis*, Prentice Hall,New Delhi.
3. Kemp.W, (1989), *Organic Spectroscopy*, Palgrave, USA
4. Silverstein R.M and F.X.Webster, (1998), *Spectrometric Identification of Organic Compounds*, John Wiley, New York.

COURSE OUTCOME MAPPING:

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

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

Semester	19ICHEP01: ALLIED CHEMISTRY PRACTICAL	L	P	C
IV		0	1	2

Learning Objectives (LO):

LO1	To develop knowledge in volumetric titrations.
LO2	To understand reactions involved in complexometric titrations..

Course Outcomes (CO) :

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

CO1	estimate commercial caustic soda for carbonate and hydroxide content.
CO2	estimation of metal ions using EDTA and EBT as indicator

Titrimetric Analysis

1. Estimation of sodium hydroxide with standard sodium carbonate using HCl as a link solution
2. Standardization of given sodium hydroxide solution using potassium hydrogenphthalate.
3. Estimation of commercial caustic soda for carbonate and hydroxide content.
4. Titration involving $KMnO_4$ and standard sodium oxalate.
5. Estimation of Mg^{2+} using EDTA and EBT as indicator.
6. Estimation of Zn^{2+} using EDTA and EBT as indicator.

TEXT BOOKS:

1. Vogel A. I, (2002), *Textbook of Quantitative Inorganic Analysis*, Pearson India Publishers, New Delhi.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYF40: Extension Activities	L	T	P	C
IV		0	0	2	1*

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

Semester	19IPHYC51 - ATOMIC PHYSICS	L	T	P	C
V		4	0	0	4

Learning Objectives (LO):

LO1	To study about the structure of basic matter and its response to radiation and impinging particles.
LO2	To study the principles, applications of photoelectric effect and various atomic models and their importance.
LO3	To understand the concepts of the production and characterization of X-rays.

Course Outcomes (CO) :

At 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 spectral lines.
CO3	understand the photoelectric effect and its important applications.
CO4	understand the concepts of X-ray production, properties and theory.

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 spectrograghs.

UNIT– II: STRUCTURE OF ATOM

Bohr atom model – Bohr's theory of Hydrogen atom - Bohr - Sommerfeld theory – Somerfield's relativistic atom model – Critical potentials- Experimental determination Davis and Goucher's experiment - Explanation for the fine structure of $H_\alpha$line - Relativistic variation of atomic mass – Vector atom model – Quantum numbers – coupling schemes – Pauli's exclusion principle – Arrangement of electrons in atoms - Magnetic dipole moment due to orbital motion of the electron – magnetic dipole moment due to electron spin - Stern and Gerlach experiment.

UNIT – III: FINE STRUCTURE OF SPECTRAL LINES

Optical spectra – spectral terms and notations – selection rules - Fine structure of sodium D-lines – Zeeman effect – theory and experiment – quantum theory of Zeeman effect – anomalous Zeeman effect – Stark effect.

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

Properties - production - Coolidge tube - absorption of X-rays - crystal lattice - Interplanar spacing – X-Ray spectra - Duane and Hunt law - Moseley's law - Bragg's law - Bragg's X-ray spectrometer - measurement of wave length - Laue's method - Rotating crystal method - Compton effect - theory and experimental verification.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)
LASERS IN SPECTROSCOPY

Broadening of spectral lines - Doppler-free spectroscopy - excitation spectroscopy - ionization spectroscopy - Tera Hertz spectroscopy with innovative applications.

TEXT BOOKS:

1. Murugeshan, R, Kiruthiga Sivaprasath, (2008), *Modern Physics*, S.Chand and Co,
2. Rajam, J. B, (2008), *Atomic Physics*, 20th Edition, S. Chand and Co.
3. Subrahmanyam N Brij Lal, (2009), *Atomic and Nuclear Physics*, Jivan Seshan S. Chand and Co. Ltd., New Delhi – 110055.

SUPPLEMENTARY READING:

1. Saxena, A.K, (2010), *Principales of Modern Physics*, Narosa Publishing House.
2. Theraja, B. L, (2008), *Modern Physics*, 16th Revised Edition, S.Chand.
3. Ghoshal S.N, (2010), *Atomic Physics [Modern Physics]*, S. Chand & Company Ltd., Ram Nagar, New Delhi.
4. Thyagarajan and Ghatak, (1986), *Laser theory and applications*, Macmillan, India.

COURSE OUTCOME MAPPING:

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

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

Semester		L	T	P	C
V	19IPHYC52 - LASERS AND FIBER OPTICS	4	0	0	4

Learning Objectives (LO):

LO1	To understand the operational principles and construction lasers.
LO2	To enable the student to explore the field of Holography and nonlinear optics
LO3	To gain knowledge in the applications of Lasers in Fibre optic communications.

Course Outcomes (CO) :

At 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.

UNIT– I: BASIC THEORY

Introduction to Laser – Basic principle of Laser - Absorption, Spontaneous emission and stimulated emission - Relation between Einstein's A and B coefficients - Population inversion - Pumping – Types of pumping – Main components of laser.

UNIT– II: LASER BEAM CHARACTERISTICS

Introduction – Directionality – Divergence - Intensity – Coherence – Temporal coherence – Spatial coherence - Monochromaticity – Polarization – Speckles – Active medium and active centre – Metastable state.

UNIT – III: TYPES OF LASERS

Solid State Lasers: Ruby Lasers - Nd : YAG laser – Gas lasers: Helium – Neon laser – CO_2 laser – Semiconductor lasers – Hetero junction laser - Liquid Dye laser – Excimer laser.

UNIT– IV: APPLICATIONS OF LASERS

Laser in material processing – Laser in electronic industry – Laser in nuclear energy – Medicine and surgery – Applications in dentistry – Laser angioplasty – Endoscopy - LIDAR - Holography – Optical communication using laser.

UNIT– V: FIBRE OPTICS

Basic characteristics of optical fibre – Acceptance angle – Numerical aperture – Propagation of light through optical fibre – Classification of fibres – Step index and graded index fibres – Single mode and multi mode fibres – Losses in fibres – Design consideration of a fibre optic communication system.

Current streams of Thought: (Not for Final Examinations)

Principle of generation of ultrafast pulses (mode locking), basic concepts for measurement of fast processes, Streak technique, Stroboscopy, sampling technique, nonlinear optical methods for measuring ultrashort pulses.

TEXT BOOKS:

1. Avadhanulu M N and Hemne P S, (2011), *An introduction to Lasers theory and applications*, S. Chand and Co. Ltd.
2. Thyagarajan K and Ajoy Ghatak, (1999), *Laser theory and applications*, Cambridge University Press.

SUPPLEMENTARY READING:

1. Silfvast W T, (2008), *Laser fundamentals*, Cambridge University Press.
2. Senior J M, (1996), *Optical Fiber Communication*s, Cambridge University Press.
3. Govind P and Agarwal, (2002), *Fiber-Optic Communication Systems,* John-Willey & Sons.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC53 - ANALOG ELECTRONICS	L	T	P	C
V		4	0	0	4

Learning Objectives (LO):

LO1	To impart knowledge about the linear circuit analysis.
LO2	To provide the basic ideas of semiconductor devices.
LO3	To enable the students to know about the basic ideas of analog operations for various analog circuit problems.

Course Outcomes (CO) :

At 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.

UNIT – I: LINEAR CIRCUIT ANALYSIS

Concept of voltage source - concept of 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

Transisters: Introduction – types - V-I characteristics (CE, CB and CC configuration) - RC coupled amplifier – Power amplifiers – classification - Class A and Class B amplifiers - Push pull amplifier.

UNIT– IV: OPERATIONAL AMPLIFIER AND OSCILLATORS

Operational Amplifier – characteristics – parameters – applications - Inverting amplifier - Non inverting amplifier - Voltage follower- Adder - Subtractor - Integrator – Differentiator - Low pass, High pass, Band pass filters and Band reject filter.

UNIT – V: OSCILLATORS AND WAVE SHAPING CIRCUITS

Feedback principle and Barkhausen criterion - Hartley, Colpitt's, and Phase shift oscillators using transistors – Astable - Monostable and Bistable multi vibrators using transistors - Schmitt trigger.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Introduction: Carrier frequency requirements of a radio transmitter - AM transmitter - FM transmitter – Comparison of AM and FM systems - Stereo FM transmitter - Broadcast receiving circuits - Stereo FM receiver.

BOOKS FOR STUDY:

1. Jacob Millman and Grabel, (2017), *Microelectronics*, McGraw Hill, 2nd Edn.
2. Jacob Millman and Halkias, (2017), *Integrated Electronics*, McGraw Hill, 2nd Edn.
3. Bapat, (2012), *Electronic Circuits-Linear and Digital*, Tata McGraw Hill.

SUPPLEMENTARY READING:

1. Sze, S.M, (1969), *Physics of Semiconductor Devices*, Wiley Interscience.
2. Satnam Mathur, P, (2010), Electronic Devices - Applications and Integrated Circuits, John Wiley and Son
3. Bhotkar, (2010), *Integrated Circuits*, Khanna Publishers.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC54 - ENERGY PHYSICS	L	T	P	C
V		4	0	0	4

Learning Objectives (LO):

LO1	To create an awareness among the students regarding the forms of energy and the availability of their resources
LO2	To educate regarding the utilization and conservation of energy
LO3	To impart a knowledge about the Sustainable forms of energy

Course Outcomes (CO):

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

CO1	identify various forms of energy and recognize the effective utilization of their resources.
CO2	evaluate the practical usage of solar energy.
CO3	describe the practical usage of thermal energy.
CO4	list out and use 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

Solar Energy: Thermal application and solar radiation – Energy alternatives – Devices for thermal collection and storage – Thermal applications – Water heating – Space heating – Power generation – Instruments for measuring solar radiation and sunshine.

UNIT – III: THERMAL ENERGY STORAGE

General characteristics - Definitions - Methods of classifications - Thermal energy storage - Sensible heat storage - Liquids - Solids – Latent heat storage - Thermochemical 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 applications.

CURRENT STREAMS OF THOUGHT: (Not for Final Examinations)

WAVE POWER

Introduction – Wave motion – wave energy and power – Real (irregular) sea waves: Patterns and power – Energy extraction using devices: wave power devices – social, economic and environmental aspects.

TEXT BOOKS :

1. Sukhatme Nayak, P, (2017), *Solar Energy*, 4th ed., Tata McGraw-Hill.
2. Kothari, D.P, et al., (2016), *Renewable Energy Sources and Emerging Technologies*, Prentice Hall of India.
3. Rai, G.D., (2011), *Non-conventional Energy Sources*, Khanna Publication.

SUPPLEMENTARY READING:

1. Kreith and Kreider, (2015), *Principles of Solar Engineering*, 3rded. McGraw Hill Publication.
2. Meinel, A.B and Meinal, A.P, (1976), *Applied Solar Energy*.
3. John Twidell and Tony Weir, (2016), *Renewable Energy Resources*, 3rd ed., BSP Books Pvt. Ltd.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC55 - SOLID STATE PHYSICS	L	T	P	C
V		4	0	0	4

Learning Objectives (LO):

LO1	This paper provides the elementary ideas about the crystalline solids and their physical properties.
LO2	To understand the basic concept of superconductors and their applications.
LO3	To know the basic facts of bond formation, ionic distribution and magnetic behavioural characters of solids.

Course Outcomes (CO):

At 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
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.

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 - cohesive energy of ionic solids - application to sodium chloride crystal - evaluation of Madelung constant for sodium chloride.

UNIT – II: CRYSTAL STRUCTURE AND CRYSTAL DIFFRACTION

Lattice planes and Miller Indices – Separation between lattice planes in simple FCC and BCC cubic lattice – Atomic Packing – Atomic radius – Lattice constant and density - Crystal Diffraction – Bragg's law – Reciprocal lattice – Properties – Diffraction of X-rays by a crystal – crystal structure - Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure - Sodium Chrloride, Zinc Blende and Diamond Structures.

UNIT – III: MAGNETIC PROPERTIES

Spontaneous Magnetization – Weiss Theory – Temperature dependence of Magnetization - classical Theory of Diamagnetism – Weiss theory of Para magnetism – Ferromagnetic domains – Bloch wall – Basic ideas of anti-ferromagnetism – Ferrimagnetisms – Ferrites in computer Memories.

UNIT – IV: DIELECTRIC PROPERTIES

Band theory of solids – classification of insulators, Semiconductors, conductors – intrinsic and extrinsic semiconductor – Carrier concentration for electron - Barrier Potential Calculation – Rectifier Equation.

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

UNIT – V: **SUPER CONDUCTIVITY**

Introduction - General Properties of Superconductors - effect of magnetic field - Meissner effect - effect of current - thermal properties - entropy - specific heat -energy gap - isotope effect - London equations - AC & DC Josephson effects - applications - Type–I and Type–II Superconductors - Explanation for the Occurrence of Super Conductivity - BCS theory - Application of Superconductors - High T_C superconductors.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Physics of linear crystals - Photonic crystals - origin of photonic band gap - periodic systems – cavities - waveguides, defects, micro-structured fibres, technology, materials, and fabrication of photonic crystals.

TEXT BOOKS:

1. Saxena B.S, Gupta R.C and Saxena P.N, (2017), Solid State Physics, Pragathi Prakashan.
2. Gupta S.L, Kumar V, (2013), *Solid State Physics*, 5th Edition, Kedar Nath and Ram Nath Co, Ltd.,
3. Kittel C, (2012), Introduction to Solid State *Physics*, 4th Edition, Wiley Eastern Ltd.,

SUPPLEMENTARY READING:

1. Pillai, S.O, (2018), *Solid State Physics*, 3rd Edition, New Age Internationals.
2. Singhal, L, (2018), *Solid State Physics*, Kedar Nath and Ram Nath Co, Ltd.
3. Kachhava, C.M, (2003), *Solid State Physics*, Tata McGraw Hill.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYP56 - PRACTICAL – IV	L	T	P	C
V		0	0	3	6

Learning Objectives (LO):

LO1	To gain in depth knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine variousproperties of the materials given
LO4	To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

Course Outcomes (CO):

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

CO1	apply knowledge of physics fundamentals and an instrumentation to arrive solution for various problems.
CO2	understand the usage of basic laws and theories to determine various properties of the materials given.
CO3	understand the application side of the experiments
CO4	use of these basic circuits to create amplifier circuits, oscillator, regulated power supplies etc.,

(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. Hartley oscillator - BJT.

6. Colpitt's oscillator - BJT.
7. Logic gates – Discrete components.
8. Half wave and full wave rectifier.
9. Bridge rectifier.
10. V-I Characteristics of Zener diode.
11. Regulated power supply - Zener diode.
12. Mathematical operations-I using IC 741.
13. Basic logic gates using ICs.
14. Universal Gates.
15. Half Adder and Full Adder.
16. Half Subtractor and Full Subtractor.

COURSE OUTCOME MAPPING:

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

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

Semester	19IVEC50: VALUE EDUCATION	L	T	P	C
V		2	0	0	2*

Learning Objectives (LO):

LO1	Understand the building of human beings with strength and power based upon India's ancient values.
LO2	Develop the qualities of peace and co-operation.
LO3	Promote the personality development and develop individual with sense of patriotism and international understanding.

Course Outcomes (CO):

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

CO1	gather and analyse a range of information about value education
CO2	develop a positive and responsible attitude to their own wellbeing, respect for the rights of other people, care and concern for their community and develop a sense of social justice.
CO3	acquire the knowledge about morality and freedom.
CO4	understand the social ethics, its dimensions and its importance and also know the ethical issues of present society.

Unit – I

Value education – Meaning – Nature and Purpose - Importance of Value Education

Unit – II

Basic Features of Rational Ethics - Moral Consciousness and Conscience - Love – the ultimate moral norm

Unit – III

Morality and Freedom - Human Freedom and Moral - Responsibility God, Religion and Morality - Sanction for Moral Life.

Unit – IV

Social Ethics: Value of Life and Human Beings - Liberty, Equality and Fraternity

Unit – V

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

Text Books :

1. YojanaYatin Patil, (2015), *Value Education: Need of the Hour*, California (USA), Pasaaydaan Foundation Publication.
2. Lovat, Terence, Toomey and Ron, Clement and Nevil, (2010), *International Research Hand book on Values Education and Student Wellbeing*, Germany, Springer Science & Business Media.

SUPPLEMENTARY READING:

1. Ahuja. R, (2000), *Value Oriented Education in India, Jaipur*, Rawat Publications.
2. Bhat. R.K, (2000), *Towards Value based Education System, New Delhi*, Association of Indian Universities.
3. Bottery, (2004), *The Challenges of Education Leadership-Values in a Globalized Age*, London: Paul Chapman Publishing.
4. William K. Frankena, (1999), *Ethics,* Delhi: Prentice Hall of India Pvt. Ltd.

COURSE OUTCOME MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3					1					1		1			2		
CO2		3		1		1		2		2		1						
CO3		2			2					1		2			2			
CO4	1					1							2		3			
CO5	2			3			2		1		3		2			2		

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

Semester	19IPHYC61 - NUMERICAL METHODS OF ANALYSIS	L	T	P	C
VI		4	0	0	4

Learning Objectives (LO):

LO1	To acquire analytical ability in solving mathematical problems numerically as applied to the respective branches of Engineering.
LO2	To introduce the basic concepts of solving algebraic and transcendental equations.
LO3	To introduce the numerical techniques of interpolation in various intervals in real life situations.
LO4	To acquaint the student with understanding of numerical techniques ofdifferentiation and integration which plays an important role in engineering and technology disciplines.
LO5	To understand the knowledge of least –squares approximations of best fit curves

Course Outcomes (CO) :

At 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 order ordinary differential equations.
CO4	solve thel and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

UNIT– I: ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

Solutions of algebraic and transcendental equations – Bisection method – Regulafalsi method – Newton Raphson method – Gauss ellimination – Gauss-Jordan – Gauss-Seidel methods.

UNIT– II: INTERPOLATION

Gregory-Newton forward and backward interpolation formula – Theory and problems central difference interpolation formula – Stirling's and Bessel's formula – Theory and problems – relative accuracy of the interpolation formula – Lagrange's interpolation formula for unequal intervals.

UNIT– III: NUMERICAL DIFFERENTIATION AND INTEGRATION

Newton's forward difference formula – Newton's backward difference formula – Newton's divided difference formula – Theories and problems - Numerical Integration – trapezoidal rule – Romberg's method – Simpson's one third rule – Theory and Problems.

UNIT– IV: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Ordinary differential equations – Taylor series method – Merits and Demerits – Theory and Problems – Euler's method, improved Euler's method, modified Euler's method - Runge – Kutta methods - second and fourth order.

UNIT– V: CURVE FITTING

Empirical laws and curve fitting – The principle of least squares – fitting a straight line – parabola and power curve - normal equations - Errors and their types – Propagation of errors – approximations and residuals.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Fixed point iteration - Gauss Jacobi method – Cubic spline interpolation – Gauss quadrature formula – Evaluation of double integrals - Milne's Predictor-Corrector method – Power curves.

TEXT BOOKS:

1. Grewal, B.S, (2012), *Numerical methods in Engineering and Science*, Khanna Publishers, 42nd Edition.
2. Venkataraman, M.K, (2005), Numerical methods in science and Engineering, National Publishing co.
3. Conte, S.D. and de Boor, C. (2005), Elementary Numerical Analysis, McGraw Hill Publisher 3rd Edition.

SUPPLEMENTARY READING:

1. Sastry, S.S, (2005), *Introductory Methods of Numerical Analysis*, 4th edition.
2. Jain, M.K, Iyengar, S.R.K and Jain, R.L, (2003*), Numerical methods for scientific and engineering computation,* Wiley Eastern Ltd, 4th Edition.
3. Kandasamy, P, et al, (2003), *Numerical methods*, S.Chand & Co, New Delhi.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC62 - DIGITAL ELECTRONICS	L	T	P	C
VI		4	0	0	4

Learning Objectives (LO):

LO1	To provide the students a sound understanding of Number system, coding, and Boolean algebra for designing the digital circuits.
LO2	To make the students understand the characteristics of basic logic gates, flip flops, Registers and counters.
LO3	To give exposure in understanding digital instruments with the help of logic gates.
LO4	To highlights the concept of digital electronics and functioning of various digital devices.

Course Outcomes (CO) :

At the end of the course, the 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
CO3	understand the working of various flip flops, registers and counters.
CO4	apply the principles of electronics in day to life

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

Introduction - Design procedure - Half and Full adders - Half and Full Subtractors - Code conversion, BCD-to-Excess-3 code - Universal gates - Ex-OR gate - BCD adder - Magnitude comparator - Decoders - Demultiplexers - Encoders – Multiplexers.

UNIT–IV: FLIP FLOPS AND REGISTERS

Flip flops - Basic flip flop circuit - Clocked RS flip flop - D flip flop –race around condition - JK flip flop – T-Flip flop - Timing diagram - Master slave flip flops - Registers - Shift registers - Serial transfer - Serial addition.

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.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Semiconductor memories – Classification - Read only memory (ROM) - Read and write memory (RAM) and classification.

TEXT BOOKS:

1. Jain, R.P, (2010), *Modern Digital Electronics*, Tata McGraw Hill.
2. Herbert Taub, Donald Schilling, (2017), *Digital integrated Electronics*, McGraw Hill.
3. Gothmann, W.H, (2002), *Digital Electronics*, Prentice Hall of India, 2nd Edn.
4. Bhargava, N.N, Kulshreshtha D.C and Gupta SC, (2013), Basic Electronics & Linear Circuits, Tata McGraw Hill.

SUPPLEMENTARY READING:

1. Floyd, Pearson, T.L, (2017), *Electronic Devices (Conventional Current Version)*, 10th Edition.
2. Thomas Floyd, L, and David Buchla M, (2009), *Electronics Fundamentals: Circuits, Devices and Applications*, Prentice Hall, 8th Edition.
3. Malvino, A.P, and Bates, D.J, (2015), *Electronic Principles*, McGraw-Hill, 8th Edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC63 - NUCLEAR PHYSICS	L	T	P	C
VI		4	0	0	4

Learning Objectives (LO):

LO1	To grasp the knowledge and understanding on the general properties of nucleus, nuclear force and nuclear models.
LO2	To study the phenomena of radioactivity, nuclear fission and fusion reactions.
LO3	To impart the basic knowledge about various detectors and cosmic rays.

Course Outcomes (CO):

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

CO1	acquire knowledge on the fundamental concept of nuclear physics.
CO2	understand the nuclear structure, radioactivity and its applications.
CO3	understand the fission and fusion reactors and how these are used for energy production

UNIT– I : PROPERTIES AND STRUCTURE OF NUCLEI

General properties of nucleus - average binding energy verus mass number curve - proton electron theory - proton neutron theory - Nuclear forces - characteristics - Meson theory of nuclear forces - Yukava Potential - Nuclear models - liquid drop and shell model.

UNIT– II: RADIO ACTIVITY

Fundamental laws of radio activity - properties of alpha, beta and gamma rays - theory of α, β and ϒ decay - neutrino and its properties - electron capture - nuclear isomerism - Radio carbon dating - radio isotopes uses.

UNIT–III: NUCLEAR REACTIONS

Nuclear reaction – types of reaction – conservation laws – Nuclear reaction Kinematics - Q-value and its significance - Nuclear fission - cahin reaction – four factor formula - Nuclear reactor features – Nuclear fusion - thermonuclear reaction in sun and stars.

UNIT–IV: NUCLEAR DETECTORS AND PARTICLE ACCELERATORS

Detectors - G.M.Counter - Scintillation counter - bubble chamber – Wilson-Cloud chamber – Accelerators – Cyclotron – synchrocyclotron – Betatron - Synchrotrons.

UNIT–V: **COSMIC RAYS AND ELEMENTARY PARTICLES**

Cosmic rays – introduction – discovery - origin of cosmic radiation - lattitude, altitude and azimuthal 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.

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

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

NUCLEAR MEASUREMENT TECHNIQUES

Detectors and electronics for high resolution gamma and charge particle spectroscopy - Fast neutron, detection - Neutrino detection - Drift chambers, RICH, calorimeter

TEXT BOOKS:

1. Tayal, D.C, (2018), Nuclear Physics, Himalaya Publishing House Pvt. Ltd., V Edition.
2. Srivatsava, B.N, (2016), *Basic Nuclear Physics and Cosmic Rays*, Pragati Prakashan publications, Meerut, XVII Edition:
3. Pandya, L and Yadav, P.R.S, (2016), *Elements of Nuclear Physics*, Kedar Nath Ram Nath publications, Meerut.

SUPPLEMENTARY READING:

1. Ghoshal, S.N, (1994), *Nuclear Physics*, S.Chand and Co, II Edition.
2. Yatramohan Jana, S, (2015), *An Introduction to Nuclear Physics*, Narosa Publishing House.
3. Irving Kaplan, (1977), *Nuclear Physics*, Addsion-Wesley Publising company, II Edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC64 - RELATIVITY AND QUANTUM MECHANICS	L	T	P	C
VI		4	0	0	4

Learning Objectives (LO):

LO1	To understand relativity and its consequences
LO2	To classify the velocities associated with wave packets
LO3	To formulate the Schrodinger's equation for the given problem
LO4	To solve the simple quantum mechanical problems

Course Outcomes (CO):

At 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.

UNIT–I: RELATIVITY

Frames of reference - Galilean transformation - Michelson - Morley experiment - Postulates of special theory of relativity - Lorentz transformation - length Contraction – time dilation - Relativity of simultaneity - addition of velocities - variation of mass with velocity– Mass energy relation - Elementary ideas of general relativity.

UNIT–II: WAVE NATURE OF MATTER

Phase and group velocity - wave packet - expression of De Brogile's wave length - Davisson and Germer's experiment - G.P.Thompson's experiment - Heisenberg's uncertainty principle and its consequences.

UNIT–III: SCHRODINGER EQUATION

Inadequacy of classical mechanics - Basic postulates of quantum mechanics - Schrodinger equation - Properties of wave function - Probability interpretation of wavefunction - linear operators - self-adjoint operators - expectation value – eigen values and eigen functions - 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.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Approximation methods for exactly not solvable problems – Relativistic quantum mechanical equations – Quantization of Field

TEXT BOOKS:

1. Murugeshan, R, and Kiruthiga Sivaprasath, (2008), *Modern Physics*, Chand S. and Co.
2. Saxena, A.K, (2010), *Principles of Modern Physics*, Narosa Publishing House.
3. Aruldas, G, (2016), *Quantum Mechanics*, Prentice Hall of India Pvt. Ltd.

SUPPLEMENTARY READING:

1. Devanathan, V, (2015), *Quantum Mechanics*, Wiley Eastern.
2. Thankappan, V.K, (2011), *Quantum Mechanics*, New Age International (P) Ltd.
3. Claude Cohen-Tannoudji, Bernard Diu, FranckLaloë, (2001), *Quantum Mechanics (Vol.I),* John Wiley Interscience Publications.

COURSE OUTCOME MAPPING:

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

Semester	19IPHYC65 – ASTROPHYSICS	L	T	P	C
VI		4	0	0	4

Learning Objectives (LO):

LO1	To understand the basics of Astrophysics with respect to our universe.
LO2	To furnish knowledge regarding the structure of sun and other stars of our Galaxy.
LO3	To provide an in-depth knowledge about various theories of evolution of universe.

Course Outcomes (CO) :

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

CO1	ecplain the basics of astrophysics.
CO2	describe the the structure of sun and other stars of our Galaxy
CO3	evaluate the merits and demerits of various theories of evolution of universe.

UNIT – I: UNIVERSE

Planets – interior planets – exterior planets - crust, mantle and core of the earth - different region of earth's atmosphere – rotation of the earth – Magnetosphere - Van Allen belts – Aurora.

UNIT – II: SUN

Structure of photosphere, chromospheres, corona - sunspots - solar flares - solar prominences - solar piages - satellites of planets – structure, phases and features of their moon.

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

Equations of stellar structure – Solution to Equations of Stellar Structure, Toy Stellar Models: Homologous Stellar Models, the Radiative Stellar Envelope, Fully Convective Stars with H-Opacity - Observational Aspects of Stellar Atmospheres - Continuum Radiation - Lines.

UNIT– V: ORIGIN OF UNIVERSE

Big bang theory – pulsating theory - steady state theory - composition of universe expansion.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Instrumentation space technology: Space technology – Multiwavelength Astronomy – Infrared Astronomy – UV Astronomy Earths Atmosphere effect – Evolution of Earth Atmosphere - The Greenhouse effect - Atmosphere effect on incoming solar Radiations

TEXT BOOKS:

1. Abyankar, K.D, (2012), *Astrophysics of the Solar system*, University Press, India.
2. Baidyanath Basu, (2010), *An Introduction to Astrophysics*, Prentice Hall of India, New Delhi.
3. Ajit Kumar Sharma, (2014), *Astrophysics*, DPH Pvt, LTD, 1st Edition.

SUPPLEMENTARY READING:

1. Devadas, P, (2010), *The Fascinating Astronomy*, Devadas Telescopies, Chennai.
2. Frank Shu, (1982), *The Physical Universe*. University of California.
3. Abhyankar, K.D, (1992), *Astrophysics (Stars and Galaxies),* Tata McGraw Hill.

COURSE OUTCOME MAPPING:

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

Note : 3 – Strong, 2 – Medium, 1- Low

Semester	19IPHYP66 - PRACTICAL – V	L	T	P	C
VI		0	0	3	6

Learning Objectives (LO):

LO1	To gain in depth knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine various properties of the materials given
LO4	To providing a hands-on learning experience such as in measuring the basic concepts in Electronic circuits.

Course Outcomes (CO) :

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

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, convereters and flip flops etc.,

(Any **Twelve** experiments)

1. RC coupled amplifier – Two stages - BJT.
2. Feedback amplifier – BJT.
3. Mathematical operations – II using IC 741.
4. Solving Simultaneous equations using IC 741.
5. BCD counter – Seven Segment Display.
6. Schmitt Trigger.
7. Astable Multivibrator – Using transister.
8. Astable Multivibrator - IC 741.
9. Astable Multivibrator– IC 555.
10. D/A Converter (Two methods).
11. Arithmetic Logic Unit - IC 74181.

12. Study of Flip-flops.
13. Synchronous and Asynchronous counter - IC 7473.
14. Multiplexers and Demultiplexers.
15. Shift Registers - IC 7474.
16. Ring counter and Ripple counter – IC 7474.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYF60 : Experiential Learning	L	T	P	C
VI		0	0	3	2*

Experiential learning provides opportunities to students to connect principles of the discipline with real-life situations. In-plant training/internships/laboratory visits fall under this category. Experiential Learning is a process of learning through experience. It is specifically defined as “learning through reflection on doing”.

Semester	19IPHYC71 - CLASSICAL AND STATISTICAL MECHANICS	L	T	P	C
VII		4	0	0	4

Learning Objectives (LO):

LO1	To develop familiarity with the physical concepts and facility with the mathematical methods of classical mechanics
LO2	To demonstrate and apply the classical mechanics towards the solution of motion of rigid bodies
LO3	To Construct a bridge between macroscopic thermodynamics and microscopic statistical mechanics by using mathematical methods and fundamental physics for individual particles.

Course Outcomes (CO) :

At the end of the course, the students will be 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 and thermodynamics.

UNIT– I: MECHANICS OF A PARTICLE AND SYSTEM OF PARTICLES

Mechanics of a Particle and System of particles – Constraints – Degrees of freedom – Generalized coordinates and its advantages – Hamilton's variational principle – Lagrange's equation of motion – D'Alembert's principle – Applications of Lagrange's equation of motion – Linear harmonic oscillator and simple pendulum. Cyclic co-ordinates – Equivalence of Lagrange's and Newton's equations – Principle of least action.

UNIT– II: CANONICAL TRANSFORMATIONS

Canonical transformation and Conditions for transformation to be canonical with examples – Hamilton-Jacobi method. Hamilton's principal function – Solution of harmonic oscillator problem by Hamilton-Jacobi method – Poisson brackets, Properties and Invariance of Poisson brackets, Equation of motion in Poisson bracket – Small oscillations – Normal modes and Normal Coordinates – Free vibrations of a linear triatomic molecule.

UNIT– III: MAXWELL-BOLTZMANN STATISTICS

Postulates of kinetic theory of gases – Maxwell-Boltzmann distribution of velocities – Derivation of Maxwell – Boltzmann distribution equation – Significance of Maxwell-Boltzmann equation – Phase Space – Ensembles and their types – Liouville's theorem – Statement and Proof.

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 distribution law – Gibb's paradox – Explanation and proof for occurrence of paradox – Sackur – Tetrode equation and its significance.

UNIT– V: QUANTUM STATISTICS

Differentiation of B-E and F-D particles – Derivations of B-E and F-D distributions – Comparison of M-B,B-E and F-D statistics – Black body radiation and the Planck radiation law – Derivation with explanation – Ideal Bose gas – Gas degeneracy – Derivation - Bose Einstein Condensation – Derivation with explanation (Example: Liquid Helium)

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Black body radiation: Planck's distribution - Pressure and Energy relationship of Photons - Black body radiation-Rayleigh Jeans formula - Wein's law - Wein's displacement formula - Absorption and Emission of Radiation - Stefan's law - High temperature measurements.

TEXT BOOKS:

1. Gupta, Kumar, Sharma, (2012), *Classical Mechanics*, A Pragati Edition
2. Gupta B.D, and Satya Prakash, (2012), *Classical Mechanics*, Keder Nath publisher, Meerut.
3. Gupta Kumar, (2017), *Elementary Statitiscal Mechanics*, Pragati Prakashan Publisher, Meerut.

SUPPLEMENTARY READING:

1. Kiran C.Guta, (1997), *Classical mechanics of Rigid Bodies*, New Age Publication.
2. Agarwal R.K and Melvin Eisner, (2011), *Statistical Mechanics*, New Age publisher.
3. Gopal, E.S.R, (1976), *Statistical Mechanics and Properties of Matter*, The McMillan Company of India Ltd.
4. Herbert Goldstein, Charles P Poole, John Safko, (2011), *Classical Mechanics*, Pearson Education, Third edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC72 – ELECTRONICS	L	T	P	C
VII		4	0	0	4

Learning Objectives (LO):

LO1	To acquire in-depth knowledge about semiconductor devices.
LO2	To know about amplifiers, oscillators using transistors.
LO3	To study the applications of operational amplifiers.
LO4	To use with various semiconductor memories
LO5	Turn about the fabrication concepts of Integrated circuits.

Course Outcomes (CO) :

At 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 familiarize with applications of operational amplifiers.
CO3	understand the classifications of semiconductor memories.
CO4	understand the concepts of Integrated circuits.

UNIT– I: SEMICONDUCTOR DEVICES

Semiconductor – introduction – types - 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

Transistors: 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

Operational Amplifier - Characteristics – parameters – applications - Instrumentation amplifier - Differential input and differential output amplifier - V to I and I to V converter - Sample and Hold circuits - Solving simultaneous and differential equation. Applications of IC 741: monostable, bistable Multivibrators, Oscillators - Wein bridge, voltage controlled oscillators, wave form generators - square wave, triangular wave, saw tooth wave.

UNIT– IV: SEMICONDUCTOR MEMORIES

Classification of memories: ROM - RAM. Sampling theorem. DAC - weighted resistor network, binary ladder network. ADC - successive approximation, dual slope, counter method, voltage to frequency conversion method. Programmable Logic Array. Charge Coupled Device memory.

UNIT– V: INTEGRATED CIRCUITS

Classification of ICs - advantages - fabrication of basic monolithic ICs - epitaxial growth - masking and etching - diffusion of impurities. Transistors for monolithic circuit, monolithic diodes, resistors, capacitors and Inductors. Monolithic circuit layout. Logic families - RTL, TTL, CMOS, interfacing CMOS and TTL.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

ELECTRONIC MEASUREMENTS

Introduction – Evolution and growth of communication satellites – Assignable satellite frequencies – Equipment on satellite – Propagation of signal - The ground station – Special purpose satellite – Space centres and satellite systems.

TEXT BOOKS:

1. Bhotkar, (2013), *Integrated Circuits*, Khanna Publishers, 10th Edition.
2. Jain, R.P, (2017), *Modern Digital Electronics*, Tata McGraw Hill, 4th Edition.
3. Allen Mottershead, (1991), Electronic Devices And Circuits; An introduction, PHI, 4th edition.

SUPPLEMENTARY READING:

1. Jacob Millman and Grabel, (2017), *Microelectronics*, McGraw Hill, 2nd Edn.
2. Jacob Millman and Halkias, (2017), *Integrated Electronics*, McGraw Hill, 2nd Edn.
3. Gayakwad, (2002), *OP-AMPs and Linear Integrated Circuits*, PHI, India.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC73 - MATHEMATICAL PHYSICS – I	L	T	P	C
VII		4	0	0	4

Learning Objectives (LO):

LO1	To develop knowledgeinmathematical physics and its applications.
LO2	To develop expertise in mathematical techniquesrequired in physics.
LO3	To enhanceproblem solvingskills.
LO4	To enable students to formulate, interpret and draw inferences from mathematical solutions.

Course Outcomes (CO) :

At 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 branches of Physics.
CO4	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

Definition of Tensors – Contravariant, covariant and mixed tensors – addition and subtraction of Tensors – Summation convention- Symmetry and Anti-symmetry Tensor – Contraction and Direct product – Quotient rule- Pseudo tensors, Levi-Civita Symbol - Dual tensors, irreducible tensors-Metric tensors-Christoffel symbols – Geodesics.

UNIT–IV: COMPLEX VARIABLE

Functions of complex variable - Analytic functions - Cauchy-Riemann equations – integration in the Complex plane - Cauchy's theorem - Cauchy's integral formula – Taylor and Laurent expansions - Singular Points - Cauchy's residue theorem – poles - evaluation of residues - evaluationof definite integrals.

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_{2v} and C_{3v} point group molecules).

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Mathematical probability - compound probability - total probability - sample space - random variables - expectation value, averages, mean, standard deviation, binomial distribution - normal distribution - variance, covariance and correlation - theory of errors, central limit - random process - random variables to random process, statistical averages, stationary processes.

TEXT BOOKS:

1. Satya Prakash, (2017), *Mathematical Physics*, Sultan Chand & Sons, 6th Edition.
2. Gupta, B.D, (2010), *Mathematical Physics*, Vikas Publishing House Private Limited.
3. Rajput, B.S, (2008), *Mathematical Physics*, Pragati Prakashan, 20th Edition.

SUPPLEMENTARY READING:

1. Charlie Harper, (1993), *Introduction to Mathematical Physic*s, Prentice Hall of India Private Limited.
2. Pipes L.A. and Havevill, L.R, (2014), *Applied Mathematics for Engineers and Physicists*, McGraw Hill Publications Company, 3rd Edition.
3. Spigel, Murray, R, (1986), *Theory and Problems of Laplace Transforms,* Schaum's outline series, McGraw Hill.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYP74 - PRACTICAL – VI	L	T	P	C
VII		0	0	3	6

Learning Objectives (LO):

LO1	To gain depth of knowledge regarding the physics fundamentals and instrumentation to arrive solution for various problems.
LO2	To utilize the applications of the experiments
LO3	To understand the usage of basic laws and theories to determine various properties of the materials given
LO4	To providing a hands-on learning experience such as the basic concepts and applications of microprocessor.

Course Outcomes (CO)

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

CO1	understand the laws and theories regarding the various properties of the materials.
CO2	understand the physical significance of the experiments
CO3	apply the theory to design electronic circuits
CO4	provide a hands-on learning experience and understand the basic concepts and applications of microprocessor.

(Any <u>Sixteen</u> 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
10. Krishnan Torsion Balance.
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 OUTCOME MAPPING:

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

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

Semester	19IPHYC81- MATHEMATICAL PHYSICS – II	L	T	P	C
VIII		4	0	0	4

Learning Objectives (LO):

LO1	To develop knowledgeinmathematical physics and its applications.
LO2	To develop expertise in mathematical techniquesrequired in physics.
LO3	To enhanceproblem solvingskills.
LO4	To enable students to formulate, interpret and draw inferences from mathematical solutions.

Course Outcomes (CO) :

At 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.

UNIT–I: DIFFERENTIAL EQUATIONS

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

UNIT–II: SPECIALFUNCTIONS – 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: SPECIALFUNCTIONS – II

Hermite differential equation – Generating functions – Hermite polynomials - Recurrence relations – Orthogonality. Rodrigue's formula – Laguerre differential equations – Generating functions - Laguerre polynomials - Recurrence relation - Rodrigue's formula – Orthogonality.

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

Fourier transforms - cosine and sine transforms - Linearity theorem - Parseval's theorem - solution of differential equation. Laplace transforms - Definition - Linearity, shifting and change of scale properties. Inverse Laplace transforms – Definition - Problems - Solution of differential equation (problems using the above methods).

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Green's function – Definition - Green's function for one – Dimensional case – Properties of Green's function – Solution of inhomogeneous differential equations $\psi'' = f(x)$ – Subject to the homogeneous boundary conditions and subject to the inhomogeneous boundary conditions (without involving derivatives) - Subject to the homogeneous boundary conditions and subject to the inhomogeneous boundary conditions (with involving derivatives).

TEXT BOOKS:

1. Satya Prakash, (2017), *Mathematical Physics*, Sultan Chand & Sons, 6th Edition.
2. Gupta, B.D, (2010), *Mathematical Physics*, Vikas Publishing House Private Limited.
3. Rajput, B.S, (2008), *Mathematical Physics*, Pragati Prakashan, 20th Edition.

SUPPLEMENTARY READING:

1. Charlie Harper, (1993), *Introduction to Mathematical Physics,* Prentice Hall of India Private Limited.
2. Pipes L.A and Havevill, L.R, (2014), *Applied Mathematics for Engineers and Physicists*, McGraw Hill Publications Company, 3rd Edition.
3. Spigel Murray R, (1986), *Theory and Problems of Laplace Transforms*, Schaum's outline series, McGraw Hill.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC82 - QUANTUM MECHANICS – I	L	T	P	C
VIII		4	0	0	4

Learning Objectives (LO):

LO1	To study the fundamentals of wave mechanics.
LO2	To study the stationary state and eigen spectrum of systems using time dependent Schrodinger equation
LO3	To solve the exactly solvable eigenvalue problems.
LO4	To know the matrix formulation of quantum theory and how it can be used to understand the equation of motion.
LO5	To understand the kinematics of scattering process and partial wave analysis.

Course Outcomes (CO) :

At 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 solvable eigenvalue 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 kinematics of scattering process and partial wave analysis.

UNIT– I: FOUNDATIONS OFWAVE MECHANICS

Postulates of wave mechanics – adjoint and self – adjoint operators – degeneracy - eigenvalue, eigen functions - Hermitian operator - parity – observables – Physical interpretation – expansion coefficients - momentum eigen functions – Uncertainty principle – states with minimum value – commuting observables.

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

UNIT– II: STATIONARY STATE AND EIGEN SPECTRUM

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

Identical Particles – symmetry and antisymmetric wave functions – exchange degeneracy – Spin and statistics: Pauli's exclusion principle - Slater determinant - spin and Pauli's matrices.

UNIT– III: EXACTLY SOLVABLE EIGENVALUE PROBLEMS

One dimensional linear harmonic oscillator – properties of stationary states - abstract operator method - Angular momentum operators - commutation relation - spherical symmetry systems – Particle in a central potential – radial wave function – Hydrogen atom: solution of the radial equation – stationary state wave functions – bound states - the rigid rotator: with free axis-in a fixed plane - 3-Dimentional harmonic oscillator.

UNIT– IV: MATRIX FORMULATIONOFQUANTUM THEORY, EQUATION OF MOTION & ANGULAR MOMENTUM

Quantum state vectors and functions – Hilbert space - Dirac's Bra-Ket notation - matrix theory of Harmonic oscillator – Equation of motions - Schrodinger, Heisenberg and Interaction representation.

Angular momentum - commutation relation of J_Z, J_+, J_- - eigenvalues and matrix representation of J^2, J_Z, J_+, J_- – Spin angular momentum – spin-½, 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 – screened columbic potential scattering from Born approximation.

Partial wave Analysis: Asymptotic behaviour – phase shift – scattering amplitude in terms of phase shifts – differential and total cross sections – optical theorem – low energy scattering –resonant scattering – non-resonant scattering - scattering length and effective range – Ramsauer-Townsend effect – scattering by square well potential.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Renormalizability, Counter terms and Physical Perturbation Theory, Vacuum Polarization. Symmetry and Symmetry Breaking: Gauge Symmetry, Global symmetry, Symmetry Breaking, Monopoles, Anderson–Higgs Mechanism, Anomalies.

TEXT BOOKS:

1. Aruldhas, G, (2012), *A Textbook of Quantum Mechanics*, Prentice Hall of India Pvt., Ltd.
2. Satya Prakash, (2018), *Quantum Mechanics*, Kedar Nath Ram Nath and Co. Publications.
3. Thankappan, V.K, (2017), *Quantum Mechanics*, New Age International (P) Ltd. Publication, Second Edition.

SUPPLEMENTARY READING:

1. Ghatak A. K. and Lokanathan, (2015), *Quantum Mechanics –Theory and applications*, Macmillan India Ltd Publication, Fifth Edition.
2. Leonard I. Schiff, (2011), *Quantum Mechanics*, McGraw-Hill International Publication, Third Edition.
3. Merzbacher, E, (2015), *Quantum Mechanics*, John Wiley Interscience Publications, Third Edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC83 - ELECTROMAGNETIC THEORY	L	T	P	C
VIII		4	0	0	4

Learning Objectives (LO):

LO1	To understand the nature of electric and magnetic fields and the intricate connection between them.
LO2	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.
LO3	To develop skills on solving analytical problems in electromagnetism.

Course Outcomes (CO):

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

CO1	apply vector calculus operations and developing knowledge of vector fields and scalar fields
CO2	describ the fundamental nature of static fields, including steady current, static electric and magnetic fields
CO3	formulate potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media etc.,
CO4	apply Maxwell's equations and their application to boundary conditions, wave equations, and Poynting's power-balance theorem.

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

Lorentz force – magnetic fields – magnetic forces – currents – Biot-Savart Law – divergence and curl of B – Ampere's Law – Electromagnetic induction - comparison of magnetostatics and electrostatics – Magnetic vector potential. Magnetization: effect of magnetic field on atomic orbit – Ampere's Law in magnetized materials – ferromagnetism.

UNIT– III: ELECTROMOTIVE FORCE

Ohm's Law – electromotive force – motional emf – Faraday's Law – induced electric field – inductance – energy in magnetic field – Maxwell's equation in free space and linear isotropic media – continuity equation – Poynting theorem.

Electromagnetic waves in vacuum: Waves in one dimension – wave equation – sinusoidal waves – reflection and transmission – Polarization.

UNIT– IV: ELECTROMAGNETIC WAVES

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

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

CLASSICAL ELECTRODYNAMICS

Special theory of relativity, Minkowski space and four vectors, concept of four-velocity, four acceleration and higher rank tensors, relativistic formulation of electrodynamics, Maxwell equations in covariant form, gauge invariance and four-potential, the action principle and electromagnetic energy momentum tensor.

TEXT BOOKS:

1. Sathya Prakash, (2019), *Electromagnetic Theory and Electrodynamics*, Kedarnath Ramnath and Co.
2. Laud, B.B, (2011) , *Electromagnetics*, New Age Internatioanal Publisher.
3. Wazed Miah, (1992), *Fundamentals of Electromagnetics*, Tata McGraw Hill.

SUPPLEMENTARY READING:

1. Jackson, J.D, (1993), *Classical Electrodynamics*, Wiley Eastern Limited, II Edition.
2. Narayana Rao, (1997), *Basic Electromagnetics with Application*, (EEE) Prentice Hall.
3. David J. Griffths, (2000), Introduction *to Electrodynamics*, Pearson, 4th Edn.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYP84 - PRACTICAL – VII	L	T	P	C
VIII		0	0	3	6

Learning Objectives (LO):

LO1	To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine various properties of the materials given.
LO4	To providing a hands-on learning experience such as in measuring the basic concepts and applications of laser and microprocessor.

Course Outcomes (CO):

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

CO1	understand the basic laws and theories regarding the various properties of the materials
CO2	understand the given concepts and its physical significance
CO3	apply the theory to design electronic circuits
CO4	provide a hands-on learning experience and understand 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
8. Determination of wavelength – laser source.
9. Particle size analyzer using Laser
10. Magnetostriction
11. Numerical Aperture and Acceptance Angle - Fibre Optics
12. Microprocessor 8086 – Addition and Subtraction (16 & 32 bits)
13. Microprocessor 8086 – Multiplication and Division (16 & 32 bits)

14. Microprocessor 8086 - Biggest and Smallest Number
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 generation using 8086.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC91 - CONDENSED MATTER PHYSICS – I	L	T	P	C
IX		4	0	0	4

Learning Objectives (LO):

LO1	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.
LO2	To develop a deep understanding of how condensed matter is characterized on the atomic scale.
LO3	Understanding of Lattice vibrations, approximations, phonons and heat capacity to know the correlation between the structure and thermal properties of the materials.

Course Outcomes (CO) :

At 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 crystals.
CO4	understand the band-structure of the solid.

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.

Crystal Binding*:* Interactions in inert gas crystals and cohesive energy – Lennard – Jones potential - Interactions in ionic crystals and Madelung energy - Covalent bonding – Heitler – London Theory – Hydrogen bonding – metallic bonding.

UNIT– II: DIFFRACTION OF WAVES AND PARTICLES BY CRYSTALS

X-rays and their generation - Moseley's law – Absorption of X-rays (Classical theory) – Absorption Edge – X-ray diffraction – The Laue equations – Equivalence of Bragg and Laue equations – Interpretation of Bragg equation – Ewald construction - Reciprocal lattice – Reciprocal lattice to SC, BCC and FCC crystals - Important properties of the Reciprocal lattice – Diffraction Intensity - The Powder method – Powder Diffractometer - The Laue method -The Rotating Crystal method - Neutron Diffraction - Electron diffraction.

UNIT– III: CRYSTAL IMPERFECTIONS AND ORDERED PHASES OF MATTER

Point imperfections – Concentrations of Vacancy, Frenkel and Schottky imperfections – Line Imperfections – Burgers Vector – Presence of dislocation – surface imperfections - Polarons – Excitons. 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-Dirac 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.

Nearly free electron model and the origin and magnitude of energy gap – Bloch functions - Bloch theorem - Motion of an electron in a periodic potential – Kronig – Penney model - Approximate solution near a zone boundary – Metals, semiconductors and insulators – effective mass – Limitations of K-P model – Tight binding approach - Construction of Fermi surface - Reduced and periodic zone schemes of construction - de Haas – van Alphen effect.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)
CONTEMPORARY TOPICS

Quasi electrons and Plasmons – Magnons – Super fluidity - Disordered system of various levels.

TEXT BOOKS:

1. Wahab, M.A, (1999), *Solid State Physics, Structure and Properties of the Materials*, Narosa, New Delhi.
2. Saxena, Gupta, Saxena, (2016), *Fundamentals of Solid State Physics*, Pragati Prakhasan,
3. Dekker, A.J, (2008), *Solid State Physics*, Macmillan Publishers India Pvt. Ltd.

SUPPLEMENTARY READING:

1. Charles Kittle, (2004), *Introduction to Solid State Physics*, Wiley India Pvt. Ltd., New Delhi, 7th Edition.
2. Pillai, S.O, (1994), *Problems and Solutions in Solid State Physics*, New Age International Publishers, New Delhi.
3. Patterson, J.D., B.C. Bailey, (2007), *Solid State Physics: Introduction to the Theory*, Springer Publication.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC92 - QUANTUM MECHANICS – II	L	T	P	C
IX		4	0	0	4

Learning Objectives (LO):

LO1	To learn about the approximation methods for time independent and time dependent perturbation theory.
LO2	To understand the concept and applications of variation and WKB methods.
LO3	To study the theory of relativistic quantum mechanics and field quantization.
LO4	To study the quantum theory of atomic and molecular structures.

Course Outcomes (CO) :

At the end of the course, the students 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

UNIT– I: TIME INDEPENDENT QUANTUM APPROXIMATION METHODS

Time independent perturbation theory – Stationary theory - Non-degenerate case - first and second order – Normal Helium atom – Zeeman effect without electron spin – perturbed harmonic oscillator - Degenerate case - Energy correction - Stark effect in hydrogen atom.

UNIT– II: TIME DEPENDENT QUANTUM APPROXIMATION METHODS

Time dependent Perturbation theory – first order transitions – constant perturbation - transition probability - Fermi Golden Rule – harmonic perturbation – adiabatic and sudden approximation – charged particle in a electromagnetic field.

Semiclassical theory of radiation: Application of the time dependent perturbation theory to semi-classical theory of radiation – Einstein's coefficients – absorption - induced emission - spontaneous emission - Einstein's transition probabilities - dipole transition - selection rules – for bidden transitions.

UNIT– III: VARIATION METHOD

Variation method: Variation Principle - ground state of Helium atom – Hydrogen molecule - Heitlor-London model - WKB approximation - Schrodinger equation - Asymptotic solution - validity of WKB approximation - solution near a turning point – connection formula for penetration barrier – Bohr-Sommerfeld quantization condition - tunneling through a potential barrier.

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.

Born-Oppenheimer approximation – An application: the hydrogen molecule on (H_2^+) – Molecular orbital theory: LCAO.

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

Schrodinger relativistic equation - Klein-Gordan equation - charge and current densities – interaction with electromagnetic field - Hydrogen like atom – non relativistic limit - Dirac relativistic equation: Dirac relativistic – Hamiltonian – probability density - Dirac matrices - plane wave solution – eigen spectrum – spin of Dirac particle – significance of negative eigen states – electron in a magnetic field – spin magnetic moment.

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

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

QUANTUM FIELD THEORY

Field Theory and Collective Phenomena: Superfluids, Finite Temperature, Critical Phenomena, Superconductivity, Vortices, Monopoles, Instantons. Field Theory and Condensed Matter: Fractional Statistics, Chern–Simons Terms, Quantum Hall Fluids, Renormalization Group. Topics in Gauge Theory: Yang–Mills, Lattice Gauge Theory, Quantum Chromodynamics, Large N Expansions, Electroweak Unification - Grand Unification theory.

TEXT BOOKS:

1. Mathews P. M. and K. Venkatesan, (2010), *A Text book of Quantum Mechanics*, Tata McGraw – Hill Publications, 2nd Edition.
2. Satya Prakash, (2018), *Quantum Mechanics*, Kedar Nath Ram Nath and Co.

Publications.
3. Claude Cohen-Tannoudji, Bernard Diu, Franck Laloë, (2011) *Quantum Mechanics (Vol. II),* John Wiley Publications.

SUPPLEMENTARY READING:

1. Thankappan, V.K, (2014), *Quantum Mechanics*, New Academic Science Ltd. Publication, 4th Edition.
2. Ghatak A.K and Lokanathan, (2015), *Quantum Mechanics–Theory and Applications*, Macmillan India Ltd. Publication, 5th Edition.
3. Merzbacher, E, (2011), *Quantum Mechanics*, John Wiley Interscience Publications, 3rd Edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYC93 - NUCLEAR AND ELEMENTARY PARTICLE PHYSICS	L	T	P	C
IX		4	0	0	4

Learning Objectives (LO):

LO1	To understand the force that binds the nucleons in detail and the perspective of various models proposed with dipole and quadropole moments of the nucleus
LO2	To make them realize the cause of various nuclear particles in the strong short range interaction among the nucleons.
LO3	To understand the concepts of elementary particles.

Course Outcomes (CO):

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

CO1	understand the properties of nucleus and nuclear forces and their dependence on various parameters.
CO2	compare various nuclear models and picture a good model.
CO3	understand the nuclear energy sources through various nuclear reactions.
CO4	know the causes for short range interaction inside the nucleons with mathematical formulations.

UNIT– I: NUCLEAR FORCES

Characteristics of nuclear forces – Exchange forces and tensor forces – saturation of nuclear forces - charge independence - Ground state of deuteron – properties – theory - Nucleon-Nucleon scattering: types of cross-section – neutron-proton scattering at low energies - Effective range theory of n-p scattering at low energies.

UNIT– II: NUCLEAR MODELS

Binding energy & mass defect - Weizacker's mass formula - mass parabola – Nuclear models: Liquid drop model – Shell model - spin–orbit coupling - spins of nuclei - Magnetic moments - Schmidt lines- Electric quadrupole moments - Collective model - Nuclear vibrational-rotational states – Nilsson model.

UNIT– III: NUCLEAR REACTIONS

Introduction to Nuclear reaction - Nuclear reaction cross section - Direct Nuclear reactions theory - Knock out reaction, Pick-up reaction, Stripping reaction - Compound nucleus theory - Reciprocity theorem - Formation - Disintegration energy levels - Resonance scattering and Reaction cross-section – Breit-Wigner dispersion formula.

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 reactors – Classification of reactors - Critical size of a reactor - Reactor materials.

Nuclear fusion - 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.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

EFFECTS OF NUCLEAR RADIATION

Radiation therapy for cancer – Cancer therapy with protons, neutrons and heavy ions.

TEXT BOOKS:

1. Tayal, D.C, (2018), *Nuclear* Physics, Himalaya Publishing House Pvt. Ltd., fifth edition.
2. Pandya, L and Yadav, P.R.S, (2016), *Elements of Nuclear Physics*, Kedar Nath Ram Nath publications, Meerut.
3. Kuila, S.P, (2015), *Concepts of Nuclear Physics*, New Central Book Agency Pvt. Ltd., Kolkatta.

SUPPLEMENTARY READING:

1. Griffiths, D, (2008), *Introduction to Elementary Particles*, Wiley-Vch, II-Edition.
2. Srivatsava, B.N, (2016), *Basic Nuclear Physics and Cosmic Rays*, Pragati Prakashan publications, Meerut, XVII-Edition:
3. Irving Kaplan, (1977), *Nuclear Physics*, Addsion-Wesley Publising company, II Edition

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYP94 - PRACTICAL – VIII	L	T	P	C
IX		0	0	3	6

Learning Objectives (LO):

LO1	To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine various properties of the materials given.
LO4	To providing a hands-on learning experience such as in measuring the basic concepts and applications of microcontroller.

Course Outcomes (CO):

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

CO1	understand basic laws and theories regarding the various properties of the materials
CO2	understand the given concepts and its physical significance
CO3	apply the theory to design electronic circuits
CO4	provide a hands-on learning experience and understand the basic concepts and applications of microcontroller.

(Any <u>Sixteen</u> 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
9. R.F.Oscillator- determination of dielectric constant.

10. Ultrasonic velocity of liquid mixtures - Interferometer
11. Phase diagram of single component - using Potentiometer.
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 OUTCOME MAPPING:

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

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

Semester	19IPSC090- CONSTITUTION OF INDIA	L	T	P	C
IX		2	0	0	2*

Learning Objectives (LO):

CO1	To understand the basic features of Indian Constitution
CO2	To grasp about the basic Rights and Duties of Indian Citizenry.
CO3	To ponder over the form of Indian Political System.
CO4	To have broad understanding about the pivotal provisions related with liberty, equality and fraternity.

Course Outcomes (CO):

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

CO1	imbibe with the basic features of Indian Political System
CO2	enlighten themselves with the rights and duties of Indian citizens.
CO3	understand the significance of rule of law.
CO4	inculcate with basic liberties.

Unit I:

Constitution of India – Basic Features and Fundamental Principles - Making of Indian Constitutional Law and Constitutionalism - Historical Perspective of the Constitution of India – Salient features and Characteristics of the Constitution of India.

Unit II:

Fundamental Rights and Duties - Scheme of Fundamental Rights -The Scheme of Fundamental Duties and its legal status - The Directive Principles of State Policy – Its Importance and Implementation.

Unit III:

Legislative and Financial Powers of States - Federal Structure and Distribution of Legislative and Financial powers between the Union and the States - Parliamentary form of Government of India - The Constitution powers and States of the President of India.

Unit IV:

Constitutional Amendments in India - The Historical Perspectives of the Constitutional Amendments in India – Emergency Provisions - National Emergency, President Rule - Financial Emergency.

Unit V:

Fundamental Rights - Schemes of the Fundamental Right to Equality – Scheme of the Fundamental Rights to certain Freedom under Article 19 – Scope of the Right to Life and PersonalLiberty under Article 21.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Recent Ammendments in Constitution of India

Faculty member will impart the knowledge on Recent Ammendments in Constitution of India to the students.

TEXT BOOKS:

1. Bipan Chandra, Mridula Mukherjee, Adility Makherjee (2016), *India After Independence 1947- 2000,* Penguin Publishers, New Delhi.
2. Durga Das Basu, (2018), *Introduction to the Constitution of India*, Prentice Hall, New Delhi.
3. JogendraYadav, (2000), *Transforming India: Dynamics of Democracy*, Oxford University Press, New Delhi.

SUPPLEMENTARY READING:

1. *The Constitution of India,* (1950), (Bare Act), Government of India Publications.
2. Busi S.N Ambedkar B.R, (2015), *Framing of Indian Constitution.*
3. Jain M.P, (2014*), Indian Constitution Law*, Lexis Nexis.
4. Paul R.Brass, (1999), *The Politics of India Since Independence*, Cambridge University Press, UK.
5. Granvila Austin, (2006), *The Indian Constitution :Cornerstone of a Nation*, Oxford University Press, New Delhi.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYCX1 - CONDENSED MATTER PHYSICS – II	L	T	P	C
X		4	0	0	4

Learning Objectives (LO):

LO1	This course develops analytical thinking to understand the phenomenon that decide various properties of solids.
LO2	Provides a valuable theoretical introduction and overview of the fundamental application of physics of solids.
LO3	To impart the basic knowledge about superconductors and high temperature super conductors.

Course Outcomes (CO):

At 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.

UNIT– I: THEORY OF DIELECTRICS

Dipole moment – Polarization – The electric field of a dipole – Local electric field at an atom – Clausius –Mosotti equation - Dielectric constants and its measurements - Polarizability – The Classical theory of electronic polarizability – Ionic polarizabilities - Orientational polarizabilities - The polarizability catastrophe - Dipole orientation in solids - Dipole relaxation and dielectric losses – Debye Relaxation time - Relaxation in solids - Complex dielectric constants and the loss angle - Frequency and temperature effects on Polarization – Dielectric breakdown and dielectric loss.

UNIT– II: THEORY OF FERROELECTRICS AND PIEZO ELECTRICS

Ferroelectric Crystals – Classifications of Ferroelectric crystals - Dipole theory of ferroelectricity – Landau Theory of the phase transition – Second order Transition – First Order Transition - Ferroelectric Transition - One-Dimensional Model of the Soft Mode of Ferroelectric Transitions – Antiferroelectricity - Ferroelectric domains – Ferroelectric domain wall motion – Piezoelectricity - Phenomenological Approach to Piezoelectric Effects -Piezoelectric Parameters and Their Measurements -Piezoelectric Materials

UNIT– III: MAGNETIC PROPERTIES OF MATERIALS

Terms and definitions used in magnetism – Classification of magnetic materials – Atomic theory of magnetism – The quantum numbers- The origin of permanent magnetic moments – Langevin's classical theory of diamagnetism – Sources of paramagnetism – Langevin's classical theory of paramagnetism – Quantum theory of paramagnetism – Paramagnetism of free electrons - Ferromagnetism – The Weiss molecular field theory – Temperature dependence of Spontaneous magnetization – The physical origin of Weiss Molecular field - Ferromagnetic domains - Domain theory – Antiferromagnetism – Ferrimagnetism – Structure of Ferrite.

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

Definition of nanoscience and nanotechnology – Preparation of nanomaterials – Surface to volume ratio – Quantum confinement – Qualitative and Quantitative description – Density of states of nanostructures – Excitons in Nano semiconductors – Carbon in nanotechnology – Buckminsterfullerene – Carbon nanotubes – Nano diamond – BN nano tubes – Nanoelectronics – Single electron transistor – Molecular machine – nano biometrics.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

CONTEMPORARY TOPICS

Density functional theory – latest experimental techniques in condensed matter physics – Advanced optical and electronic properties.

TEXT BOOKS:

1 Wahab, M.A, (1999), *Solid State Physics, Structure and Properties of the Materials*. Narosa, New Delhi.
2 Saxena, Gupta, Saxena, (2016), *Fundamentals of Solid State Physics*, Pragati Prakhasan.
3 Dekker, A, (2008), Solid State Physics, Macmillan Publishers India Pvt. Ltd.

SUPPLEMENTARY READING:

1 Charles Kittle, (2004), *Introduction to solid state physics*, Wiley India Pvt. Ltd., New Delhi, 7th Edition.
2 Pillai, S.O, (1994), *Problems and Solutions in Solid State Physics*, New Age International Publishers, New Delhi.
3 Patterson, J.D and B.C Bailey, (2007), *Solid-State Physics: Introduction to the Theory*, Springer Publication.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYCX2 - SPECTROSCOPY	L	T	P	C
X		4	0	0	4

Learning Objectives (LO):

LO1	To educate the students about the fundamental aspects of Vibrational and Vibration-Rotational Spectroscopy.
LO2	To impart knowledge regarding the fundamental aspects of Resonance Spectroscopy.
LO3	To expose the students to the effective applications of various Molecular Spectroscopic techniques to study the chemical and structural properties of materials.

Course Outcomes (CO):

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

CO1	outline the fundamental principles of Vibrational and Vibration-rotational spectroscopy
CO2	describe the fundamental principles of Resonance Spectroscopy.
CO3	identify the applications of appropriate spectral technique for the characterisation of materials.
CO4	assess and recommend suitable solution to interdisciplinary problems.

UNIT– I: INFRARED SPECTROSCOPY

Vibrational energy of a diatomic molecule – IR 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 - Fourier Transform Infrared spectroscopy – Applications.

UNIT– II: RAMAN SPECTROSCOPY

Introduction - Theory of Raman scattering - Rotational Raman spectra - Vibrational Raman spectra - Mutual exclusion principle - Raman spectrometer - Sample handling techniques - Polarization of Raman scattered light - Structure determination using IR and Raman spectroscopy - Raman investigation of phase transitions - Resonance Raman scattering - Nonlinear Raman phenomena – Preliminaries: Hyper Raman effect - Stimulated Raman scattering – Inverse Raman effect - Coherent Anti-Stokes Raman scattering.

UNIT– III: ELECTRON SPIN RESONANCE SPECTROSCOPY

Basic principle – Quantum theory - g-factor – Nuclear Interaction and Hyperfine structure – Line width - Relaxation effects – Hyperfine interaction - ESR spectrometer – Instrumentation – applications.

UNIT– IV: NMR AND NQR SPECTROSCOPY

NMR : Basic principle – Quantum theory of NMR – magnetic resonance - relaxation processes – Chemical shift – spin-spin coupling – NMR instrumentation - FTNMR – applications.

NQR : Nuclear Electric quadrupole interaction – Basic theory - Energy levels and selection rules – fundamental requirements - Instrumentation – applications.

UNIT – V : MOSSBAUER SPECTROSCOPY

Mossbauer effect - recoilless emission and absorption - hyperfine interaction - chemical isomer shift – Quadrupole effects – Instrumentation – applications.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

SOME ASPECTS OF SPECTROSCOPIC TECHNIQUES

Principle, Instrumentation and Application: Nuclear Magnetic Double Resonance (NDMR) and INDOR spectroscopy - Electron Nuclear Double Resonance (ENDOR) - ELDOR spectroscopy - Femtosecond spectroscopy.

TEXT BOOKS:

1. Colin N. Banwell and Elaine M. Mc Cash, (2016), *Fundamentals of Molecular Spectroscopy*, McGraw-Hill Education (India) Pvt. Ltd.,New Delhi, (5th edition).
2. Straughen R.P and S. Walker, (1976), *Spectroscopy (vol.I, II, III),* Chapman & Hall , London.
3. Gurdeep R. Chatwal and Sham.K.Anand, (2016), *Spectroscopy (Atomic and Molecular),* Himalaya Publishing House, 5th edition.

SUPPLEMENTARY READING:

1. Michael Hollas, (2015), *Modern Spectroscopy*, John Wiley, New York, (4th edition), Reprint.
2. Walter S. Struve, (1989), *Fundamentals of Molecular Spectroscopy*, John Wiley and Sons, Ames, Iowa.
3. Aruldhas, G, (2007), *Molecular Structure and Spectroscopy*, PHI Learning Private Limited – Hall of India, 2nd edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYCX3 - PHYSICS OF NANOMATERIALS	L	T	P	C
X		4	0	0	4

Learning Objectives (LO):

LO1	To dinstinguish nanomaterials from bulk materials.
LO2	To apply their acquired knowledge in research level to synthesis and characterize the nanomaterials.
LO3	To identify the various techniques to investigate the different properties such as optical, structural and morphology of nanoparticles.
LO4	To select the nanomaterials for various applications.

Course Outcomes (CO):

At 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.

UNIT– I: INTRODUCTION

Introduction – History of nanotechnology - Classification of nanomaterials: Definition of – zero, one and two dimension nano structures – examples - Surface energy – Chemical potential as a function of surface curvature – Electrostatic stabilization - Steric stabilization – DLVO theory.

UNIT– II: SPECIAL NANOMATERIALS

Carbon Fullerenes and Nanotubes: Carbon fullerenes, Fullerene derived crystals, Carbon nanotubes. Micro and mesoporous materials: Ordered mesoporous structures, Random mesoporous structures, and crystalline microporous materials. Core-shell structures: Metal - oxide structures, Metal-polymer structures, Oxide-polymer structures.

UNIT – III: PROPERTIES

Physical properties of nanomaterials: Melting points, Lattice constants – Mechanical properties – Optical properties: Surface plasmon resonance – Quantum size effects – Electrical property: Surface scattering, charge of electronic structure - Ferroelectrics and dielectrics: Variation of magnetism with size - Super para magnetism - Diluted magnetic semi conductor.

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

Structural characterization: X-Ray diffraction – Scanning electron microscopy (SEM) – Transmission electron microscopy (TEM) – Chemical characterization: Optical spectroscopy: UV-Visible and Phototluminescence spectroscopy.

Applications: Molecular electronics and Nano electronics, Nano electromechanical systems - Colorants and pigments – DNA chips – DNA array devices – Drug delivery systems.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Nanotechnology: Magnetic sensors and its applications – Bio sensors and its applications - Photonic crystals – Plasmon wave guides.

TEXT BOOKS:

1. Viswanathan B, (2014), *Nano Materials*, Narosa publishing House Pvt Ltd.
2. Pradeep T, (2012), *Nano: The Essentials*, Tata MCGraw-Hill Publishing Company limited.
3. Christof M. Niemeyer, Chad A. Mirkin, (2004), *Nanobiotechnology: Concepts, Applications and Perspectives*, Wiley-VCH Verlag GmbH & Co.
4. Kalantar–Zadeh, Kourosh, Fry, Benjamin, (2008), *Nanotechnology–Enabled Sensors*,Springer.

SUPPLEMENTARY READING:

1. Kenneth F. Klablunde, (2009), *Nanoscale Materials in Chemistry*, John Wiley and sons, Inc.,
2. Bandyopadhyay A K, (2016), *Nano Materials*, New Age International Publisher(P) Ltd.
3. Maria Benelmekki, (2019), *Nanomaterials: The Origional Product of Nanotechnology*, Morgan & Claypool.
4. Vijay, K, Varadhan, Linfeng Chen and Sivathanupillai, (2010), *Nanotechnology Engineering in Nano and Biomedicine*, John Wiley & sons.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYPX4 - PRACTICAL – IX	L	T	P	C
X		0	0	3	6

Learning Objectives (LO):

LO1	To gain knowledge regarding the fundamentals of physics and instrumentation to arrive at solution for various problems.
LO2	To study the application aspects of the experiments
LO3	To understand the usage of basic laws and theories to determine various physical properties of the given materials.
LO4	To provide hands-on learning experience and applications of microcontroller.

Course Outcomes (CO):

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

CO1	understand the basic laws and theories regarding the various physical properties of the materials
CO2	understand the given concepts and its physical significance
CO3	apply the theory to design the basic electronic circuits
CO4	provide hands-on learning experience and applications of microcontroller.

(**Any Sixteen experiments**)

1. Spectrophotometer
2. Co-effeicient of linear expansion-Interference Method.
3. Dipole moment of Liquids - R.F. Oscillator
4. Susceptibility of Salt solutions/Solids-Guoy method
5. Susceptibility of liquid mixture - Calculation of Bohr magneton using Quincke's method.
6. Phase diagram - Two component system.
7. Molecular constants – AlO Band
8. Molecular constants - CN Band.
9. Cu-Salt spectrum - ultra violet region.
10. Optical rotation of quartz.
11. Absorption co-efficient of a Al foil - G.M. Counter
12. F.P. Etalon.
13. Dielectric of Solids
14. Determination of pH for liquids – various concentration / temperature.
15. Stark Effect
16. ESR experiment
17. Micro hardness of a Crystal
18. Micro controller 8051 - Setting and Masking bits in an 8-bit number.
19. Microcontroller 8051 - Generate a delay.
20. Microcontroller 8051 - DAC interfacing.
21. Microcontroller 8051 – Display and Rolling of messages.

COURSE OUTCOME MAPPING:

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

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

DEPARTMENT ELECTIVE COURSES

Semester	19IPHYE 15 - ELECTRICAL APPLIANCES	L	T	P	C
I		3	0	0	3

Learning Objectives (LO):

LO1	To impart knowledge about the basic electrical devices
LO2	To make the students understand the working of transformers.
LO3	To give exposure in understanding the functioning of various house hold appliances
LO4	To highlights the concept of electrical switches, inverters and motors.

Course Outcomes (CO):

At the end of the course, the 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.

UNIT–I:

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–II:

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–III:

Electric bulbs – Fluorescent lamps - Street Lighting - Electric fans - Wet Grinder - Mixer - Water heater - storage and instant types - electric iron box - microwave oven - Washing machine - stabilizer, Fridge and Air conditioner.

UNIT– IV:

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– V:

Electrical protection - relays - fuses - electrical switches - Circuit breakers - ELCB - overload devices - ground fault protection - Inverter - UPS - generator and motor.

Current streams of Thought: (Not for Final Examinations)

Computer - DVD player - Remote Control - Digital camera - vacuum cleaner - Hair dryer - Telephone - Toaster and toaster ovens - Microwave oven - Water purifier

TEXT BOOKS:

1. Theraja, B L, (2007), *A text book in Electrical Technology*, S Chand & Co.
2. Theraja, A K, (2003), *A text book of Electrical Technology,* S Chand & Co.
3. Theraja, B L, (2008), *Basic Electronics*, S Chand & Co.

SUPPLEMENTARY READING:

1. Say, M G, (2000), *Performance and design of AC machines*, ELBS Edn.
2. Palanichamy, P K, (2005), *Semi conductor physics and opto electronics*.
3. Arokh Singh and A K Chhabra, (2008), *Principles of Communication Engineering*, S Chand & Co
4. Bhatia K.B, (2001), *All Electronics and Electrical Books* by Khanna Publishers, VII th Edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE 16 - PHYSICS OF HUMAN ANATOMY	L	T	P	C
I		3	0	0	3

Learning Objectives (LO):

LO1	To provide an understanding of the physics of human anatomy and body systems.
LO2	To understand the medical applications of light to human body.
LO3	To understand the law of physics to explain several bodily functions including the mechanics of breathing, acoustic properties of the ears and vision optics.
LO4	To know the basic ideas in understanding the heat and work and energy of human body

Course Outcomes (CO):

At 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.

UNIT–I: PHYSICS OF LIGHT AND ITS MEDICAL APPLICATION TO HUMAN BODY

Properties of light – Measurement of Light – Energy of light – medical Application of Visible light, UV, IR and Laser in Human body.

UNIT–II: PHYSICS OF BREATHING:

Pressure –Typical pressure in Normal body – Gas transport in respiratory system – Definition of pressure - Volume in Lung - Thorax system – Resistance of air passage – Timing of breathing process – Work required for Breathing.

UNIT–III: 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–IV: THE ACOUSTICS OF BODY

Sound – unit – wave equation – Unit of sound intensities for auditory system – production of speech – Physics of ear – outer ear – inner ear – ear drum – middle ear.

UNIT–V: PHYSICS OF EYE

Optical system of the body structure of Eye – Refraction focusing of the eye system – Geometrical optics of the Eye – Structure of receptor system – Diffraction effects of Eye – Eye defects.

Current streams of Thought: (Not for Final Examinations)

MECHANICAL PROPERTIES OF THE BONE

Material Components of the Body – Bone - Ligaments and Tendons – Cartilage - Bone Fracture - Common sports injuries - Avoiding Fractures and other injuries

TEXT BOOKS:

1. Arumugam, M, (2000), *Biomedical Instrumentation*, Anuradha Agencies, Fourth reprint .
2. Dominique Placko, (2007), *Fundamentals of Instrumentation and Measurement*, ISTE Ltd.
3. Vasantha Pattabhi, N, Gautham, (2009), *Biophysics*, Narosa Publishing.

SUPPLEMENTARY READING:

1. web.khu.ac.kr/~bil/lecture/MedicalPhysics/Ch14.PDF
2. http://www.edb.utexas.edu/petrosino/Legacy_Cycle/mf_jm/Challenge2/physicsbreathing.pdf
3. http://web.khu.ac.kr/~bil/lecture/MedicalPhysics/Ch8.PDF

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE 36 - BASIC ELECTRONIC DEVICES	L	T	P	C
III		3	0	0	3

Learning Objectives (LO):

LO1	To impart knowledge about the passive and active devices.
LO2	To provide the basic ideas of semiconductors.
LO3	To enable the students to know about the ideas of transistors and working operations for various diodes

Course Outcomes (CO) :

At 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.

UNIT–I: PASSIVE DEVICES

Resistors – classification - specification - color code – Construction of various types of resistors - carbon composition - carbon film - wire-wound - Capacitors - fabrication of capacitors - ceramic - mica - polystyrene – electrolytic capacitors – Fixed and variable capacitors – Inductors – types of inductors.

UNIT–II: ATOMIC STRUCTURE

Atomic structure: Bohr's atom model – energy levels - energy bands – important energy band in solids - classification of solids and energy bands – Semiconductors – intrinsic and extrinsic semiconductors – P-type and N-type semiconductors – majority and minority carriers.

UNIT–III: PN JUNCTION

PN junction - Biasing a PN junction – forward and reverse biasing – PN junction diode: Characteristics - resistance of a diode - Diode Rectifiers – half and full wave rectifires - clippers and clampers - Zener diode – Characteristics - voltage regulation using Zener diode.

UNIT–IV: TRANSISTORS

Bipolar junction transistor – Common base, Common emitter & Common collector configurations and their characteristics – transistor as amplifier - load line – operating point – cut off and saturation regions – SCR and UJT - working and its characteristics.

UNIT–V: FET

FET - Construction - working principle – characteristics and parameters of JFET - MSFET - characteristics – Enhancement and depletion type – LED - photodiode.

Current streams of Thought: (Not for Final Examinations)

Integrated circuit - advantages – limitation of IC - classification of IC scale of integration – fabrication of monolithic IC

TEXT BOOKS:

1. Mehta, V.K, (2020), *Principles of Electronics*, S.Chand & Co, Revised Edition.
2. Theraja, B.L, (2020), *Basic solid state Electronics*, S.Chand & Co,Revised Edition
3. Bapat, (1991), *Electronic Circuits*, Linear and Digital,Tata McGraw Hill.
4. Senthilsivakumar, M, (2013), *Linear Integrated Circuits*, S.Chand.

SUPPLEMENTARY READING:

1. Sze, S.M, (1969), *Physics of Semiconductor Devices*, Wiley Interscience.
2. Grob, B, (2016), *Basic Electronics*, 12th edition, Tata McGraw Hill.
3. Bhargava, N.N, Kulshreshtha D & Gupta S.C, (2006), *Basic Electronics & Linear Circuits*, Tata McGrawHill.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE 37 - ENVIRONMENTAL PHYSICS	L	T	P	C
III		3	0	0	3

Learning Objectives (LO):

LO1	To provide the basic ideas regarding the atmosphere.
LO2	To impart knowledge regarding weather and climate.
LO3	To familiarize the concept of distribution of temperature and temperature inversion.
LO4	To enable the students to understand atmospheric and wind pressure.
LO5	To highlight the concept of energy in Biology.

Course Outcomes (CO):

At 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	analyze the factors affecting atmospheric and wind pressure.
CO4	interpret the concept of energy in biology

UNIT –I: 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 –II: 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– III: TEMPERATURE MEASUREMENTS AND CONTROLS

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

UNIT–IV: ATMOSPHERIC PRESSURE AND WINDS

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

UNIT -V:

Chemical Energy - Energy in Biology - Photosynthesis-Respiration - Energy use in the human body - Energy content of food.

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

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

ENERGY AND CLIMATE CHANGE

Energy balance of the earth - Green house effect-Climate Feedbacks - Global Climate Models - Evidence of Climate change - Climate change impacts - Climate mitigation - Target CO_2 Levels

TEXT BOOKS:

1. Kesavamoorthy R.N. and N Sankar Rao, (1992), *The Physics of Monsoon*, Allied Publication.
2. Houghton, J.T, (2002), *The Physics of Atmosphere*, Cambridge University.
3. Twidell J. and J Weir, (2015), *Renewal Energy Resources*, ELBS.

SUPPLEMENTARY READING:

1. Bharucha. E, (2004), *A textbook of Environmental Studies*, University Grants Commission.
2. Das R.C. and D.K. Behera, (2014), *Environmental Science: Principles and Practice*, PHI Learning Pvt. Ltd

3. Satyanarayan S, and S.Zade, S.Sitre and P.Meshram, (2009), *A textbook of Environmental Studies*, Allied Publishers, New Delhi.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE 57 - COMMUNICATION SYSTEMS	L	T	P	C
V		3	0	0	3

Learning Objectives (LO):

LO1	To provide the basic ideas regarding the various aspects of communication system.
LO2	To impart knowledge about analog and Pulse communication.
LO3	To enable the students to understand digital and fiber optical communication.
LO4	To highlight the concept of fiber optic communication system.

Course Outcomes (CO):

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

CO1	acquire knowledge on the fundamental concepts of communication systems.
CO2	understand the pulse communication systems and its applications.
CO3	knowledge updates on recent discoveries of fiber optic communications
CO4	understand the fundamental concepts of WPAN, mobile technology generations and GPS

UNIT - I: 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 -II: 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 - III: **PULSE COMMUNICATION**

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

UNIT - IV: DATA COMMUNICATION

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

UNIT - V: 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.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Latest Trends in Mobile Communication - Generations - Wireless Personal Area Networks (WPANs) - Global Positioning Systems (GPS).

TEXT BOOKS:

1. Sanjay Sharma, (2015), *Principle of Communication Systems*, S.K.Kataria & Sons Publications, India.
2. Frenzel Louis, E, (2015), *Communication Electronics Principles and Applications*, McGraw Hill Education Pvt. Ltd., India
3. Jose Robin, G and Ubald Raj, (2002), *A communication electronics*, Indira publications, Martandam.

SUPPLEMENTARY READING:

1. George Kennedy, (1987), *Electronic communication system*, Mc-Graw Hill international publications
2. Gerd Keiser, (2000), *Optical fiber communications*, McGrw Hill, Singapore.
3. Joseph C.Palais, (2001), *Fiber Optic Communications*, Prentice Hall International, USA.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE 58 - AUDIO AND VIDEO SYSTEMS	L	T	P	C
V		3	0	0	3

Learning Objectives (LO):

LO1	To know the characteristics of sound.
LO2	To understand the working principles and main features of audio and video devices

Course Outcomes (CO)

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

CO1	describe the various aspects of sound.
CO2	acquire knowledge regarding Audios and Video system.
CO3	appraise the concept of Digital and LCD Television.
CO4	highlight the concept of LED and LCD

UNIT – I: CHARACTERISTICS OF SOUND

Nature of sound – Pressure and intensities of sound waves – Sensitivity of human ear for sound – Loudness and Phon – Frequency of sound waves – Pitch – Production of audio waveforms.

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. Loudspeakers: Characteristics of loudspeakers – Types of loudspeakers – Moving coil cone loudspeaker – Electrodynamic loudspeaker – Horn type loudspeaker – Multi – Way speaker system (Woofers and Tweeters).

UNIT- III: TELEVISION MONOCHROME TELEVISION

Introduction to television – Basic monochrome television system – Transmitter – Receiver – Television systems and standards – Television camera tubes – Videocon camera tube. Colour Television - Colour Transmission and Reception – Colour combination – Three colour theory – Colour TV transmitter and receiver – Colour picture tube – CCTV.

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: LED and LCD TELEVISION

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

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

AUDIO AND VIDEO COMPRESSION

AUDIO COMPRESSION : Fundamental concepts of digital audio - Audio compression techniques – μ Law and A - Law companding - PCM, DPCM, DM, ADM - sub-band coding – Application to speech coding.

VIDEO COMPRESSION: Fundamental concepts of video – digital video signal - video formats – AVI, FLV, MP4, Real media - Motion estimation and compensation Techniques, Full search motion estimation methods.

TEXT BOOKS:

1. Gupta, R G, (2002), *Audio and Video Systems (Principles, maintenance and troubleshooting)*, Tata McGraw – Hill Publishing Company Limited, New Delhi.
2. George Kennedy, Bernard Davis, S R M Prasanna, (2012), *Electronic Communication Systems*, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Gulati, R.R, (2007), *Modern Television Practice (Fourth revised edition),* New Age International Publishers.

SUPPLEMENTARY READING:

1. Dhake, A.M, (1999), *Television & Video Engineering (Second edition),* McGraw Hill education Limited.
2. Bali & Bali, (2010), *Audio Video Systems Principles, Practices and Troubleshooting*, Khanna Publishing Company.
3. Bali, S.P, (2005), *Consumer Electronics*, Pearson Education, India.

COURSE OUTCOME MAPPING:

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

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

Semester		L	T	P	C
VIII	19IPHYE85 - MICROPROCESSORS AND MICROCONTROLLER	3	0	0	3

Learning Objectives (LO):

LO1	To learn the architecture of 8085 microprocessor and its programming.
LO2	To study the architecture of 8086 microprocessor.
LO3	To familiarize the architecture of 8051 microcontroller and its programming
LO4	To study the interfacing devices of microprocessor 8085.

Course Outcomes (CO)

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

CO1	describe basic concept and architecture of 8085 microprocessor and implement programs in 8085.
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.

UNIT– I: MICROPROCESSORS 8085 ARCHITECTURE

Intel 8085 microprocessor: Introduction – Pin configuration - Architecture and its operations - Machine cycles of 8085. Interfacing of memory and I/O devices. Instruction classification: number of bytes, nature of operations - Instruction format. Vectored and non - vectored interrupts.

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

Intel 8086 microprocessor: Introduction – Architecture - Pin configuration - Operating modes: Minimum mode, Maximum mode. Memory addressing: 8-bit data from even and odd address bank, 16-bit data from even and odd address bank. Addressing modes. Interrupts: Hardware interrupts – Software interrupts –Interrupt priorities. Simple programs

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 – Logical instructions- Branching instructions- Single bit instructions. Addressing modes. Simple programs using 8051 instruction set.

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)

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

GENERATION OF PROCESSORS

Introduction to core i5, core i7 and core i9 processors - salient features - comparison of 7^{th} and 8^{th} generation processors – introduction to mobile processors (single, dual, quad and hexa core).

TEXT BOOKS:

1. Ramesh S. Gaonkar, (2013), *Microprocessor Architecture, Programming and Applications with 8085/8080*, New Age International 6^{th} edition.
2. Kenneth J. Ayala, (2000), *The 8051 Microcontroller Architecture, Programming and Applications*, Penram International publishing Pvt. Ltd., second edition.
3. Muhammad Ali Mazidi and Janice Mazidi, (2000), *The 8051 Microcontroller and Embedded systems*, Pearson Education.

SUPPLEMENTARY READING:

1. Godse A.P and D.A.Godse, (2009), *Microprocessors and Microcontrollers*, Technical Publications, Pune.
2. Badri Ram, (2001), *Advanced Microprocessors and Interfacing*, Tata McGraw Hill.
3. Douglas, V, (1993), *Microprocessors and Interfacing-Programming and Hardware*, Hall, Tata McGraw Hill.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE86 - PHYSICS OF THE EARTH	L	T	P	C
VIII		3	0	0	3

Learning Objectives (LO):

LO1	To highlight the concept of solar system and behaviour of planets in this system.
LO2	To study the elastic behaviour in earth by applying various theories and hypothesis.
LO3	To understand the physical structure and behaviour of the earth as well as geomagnetic properties of rocks in the Earth's crust.

Course Outcomes (CO)

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

CO1	think and analyse the concept of the earth and its properties.
CO2	accumulate the various concepts proposed by theories and laws.
CO3	enlighten the concept solar system.
CO4	acquire basic knowledge about geomagnetism and palaeomagnetism.

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

Rotation of the Earth - Gravitational attraction, Gravitational Theory, Measurements of Gravity, Gravity meters - Principles and method of measuring gravity - Gravity anomalies-Local and regional variations.

UNIT – III: THERMAL HISTORY OF EARTH

Thermal history of the Earth. Temperature in the Primitive Earth and the Earth's surface and interior. Thermal conductivity. Generation of heat in the Earth. Heat flow measurements, methods and results.

UNIT – IV: ELASTIC PROPERTIES

Elastic constants and Elastic process in the earth. Earth's free rotation. Latitude variation. Tides of the Solid earth. Numerical values of Love's numbers. Rigidity of the Earth. Bulk modules in the earth. Poisson's ratio in the Earth, Young's modulus and Lame's constant.

UNIT – V: GEOMAGNETISM AND PALAEOMAGNETISM

Geomagnetism and palaeomagnetism - Earth's magnetic field. Origin - Theory of earth's magnetic field. Magnetohydrodymics of the Earth. Magnetic reversals. Polar wandering. Tectonic movements and its relation to palaeomagnetism - Measurement of magnetic properties of rocks.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Hydrological cycle - origin of groundwater, subsurface distribution of water, springs - Hydrological Properties of Water Bearing Materials - Porosity, void ratio, permeability, transmissivity, storativity, specific yield, specific retention, diffusivity - Mode of occurrence of groundwater, classification of rocks with respect to their water bearing characteristics, aquifers, aquicludes, aquitards - classification of aquifers and groundwater provinces - Physical and chemical characteristics of groundwater, classification of groundwater in respect to domestic, irrigation and industrial use, pollution of groundwater.

BOOKS FOR STUDY:

1. Jacobs, J.A, Russel, R. D, and Wilson J. T, (1974), *Physics and Geology*.
2. Eve, A.S, and Keys, D. A, (2011), *Applied Geophysics*, Cambridge University.
3. William Lowrie, (2007), *Fundamentals of Geophysics*, Cambridge University.

SUPPLEMENTARY READING:

1. Wyllie, P.J, (2019), *The dynamic Earth, John Wiley and Sons*, International Student Edition.
2. Fowler, C.M.R, (1996), *The Solid Earth, An Introduction to Global Geophysics*, Cambridge University press.
3. Alan Cox, (1973), *Geomagnetic Reversals and Plate Tectonics*, Freeman and company.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE95 – INSTRUMENTATION	L	T	P	C
IX		3	0	0	3

Learning Objectives (LO):

LO1	To create an awareness about the different types of transducer and their applications
LO2	To impart knowledgeaboutDigital, Analytical and Biomedical instrumentation.
LO3	To educate regarding the functioning of medical imaging instruments.

Course Outcomes (CO) :

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

CO1	select the appropriate type of transducer for measurement of a specific physical parameter.
CO2	test and use the digital instruments for different applications.
CO3	evaluate the potential applications of various analytical and biomedical instruments.
CO4	describe the functioning of medical imaging instruments.

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UNIT – I: TRANSDUCERS

Basic functional elements of measuring system –Transducers: Definition – Parts

– Classification – Types of primary sensing element.

LVDT: Principle – Working – Measurement of displacement.

Electrical Strain Gauge: Principle – Theory-Types – Working – Measurement of Force (or) Pressure.

Capacitive Transducers: Principle – Types – Working – Measurement of linear and angular displacement.

Thermistor: Principle – Working – Measurement of temperature.

Piezo electric transducers: Principle – theory – operation.

UNIT – II: DIGITAL INSTRUMENTATION

Principle, block diagram and operation: Digital Multimeter, Digital Frequency counter, Digital pHmeter, Digital Conductivity meter, Digital Storage Oscilloscope and Q-meter.

UNIT – III: ANALYTICAL INSTRUMENTATION

Principle, working, Instrumentation and applications: UV-VIS Spectrophotometer, ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectrometer), SEM (Scanning Electron Microscope) and AFM (Atomic Force Microscope).

UNIT – IV: BIO-MEDICAL INSTRUMENTATION

Origin of Bio-potentials – Measurements – Resting and Action potentials - Characteristics of resting potential l– Bio electric potentials –Types of bioelectric signal and their characteristics.

Components of the Bio-medical instrument system – Electrodes : Equivalent circuit – theory – types.

Principle, block diagram and functioning of ECG, EEG and EMG.

UNIT – V: MEDICAL IMAGING INSTRUMENTATION

Magnetic Resonance Imaging: Principle – Magnetic resonance phenomena – Magnetic resonance imaging process – Instrumentation.

Ultrasonic Imaging System: Principle – Construction of an ultrasonic transducer - Ultrasonic propagation through tissues – Display: A-mode, B-mode, M-mode or TM mode – Doppler mode – Recording devices.

Computed Tomography: Principle – CAT scanning – Instrumentation – Contrast scale

– Scanning components.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

MEASUREMENT OF PHYSIOLOGICAL PARAMETERS

Blood Pressure Measurement: Introduction – Direct measurement using Catheters

– Advancement of Direct Method - Indirect Method: Oscillometric measurement method.

Electromagnetic Blood Flow Meters – Ultrasonic Blood Flow Meter – transit time method – Doppler effect based ultrasonic blood flow meter – Laser Doppler Blood Flow Meter – NMR Blood Flow Meter.

Digital Thermometer – Digital Thermal Scanner – Digital Pulse Oximeter.

TEXT BOOKS:

1. Sawhney, A.K, (2000), *Electrical and Electronics Measurement and Instrumentation*, Dhanpath Rai and Company Pvt. Ltd.
2. Rajendra Prasad, (2002), *Electronic Measurements and Instrumentation*, Khanna Publishers.
3. Arumugam, M, (2001), *Biomedical Instrumentation*, Anuradha Publishers.

REFERENCE BOOKS :

1. Willard, D. Merrit, et.al, (2004), *Instrumental methods of analysis*, CBS Publishers.
2. Khandpur, R.S, (2007), *Hand Book of Biomedical Instrumentation*, TMH.
3. Venkata Ram, S.K, (2001), *Biomedical Electronics and Instrumentation*, Galgotia Publications Pvt. Ltd.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE96- BIO-MEDICAL INSTRUMENTATION	L	T	P	C
IX		3	0	0	3

Learning Objectives (LO):

LO1	To gain the knowledge about the bio medical instruments used for measuring bio-electric potentials and the electrodes used for sensing the bio-potentials.
LO2	To understand the working principles of imaging equipments and bio medical instruments used for determining the physiological parameters.
LO3	To update the knowledge of various lasers used for medical applications for the students.

Course Outcomes (CO)

At the end of the course, the students 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 bodyparts.
CO4	solve the health issues from the bio-medical instruments and applicability in physics concepts may give the clear idea about the health issues.

UNIT – I: BIO-ELECTRIC POTENTIALS

Resting and action potentials – Propagation of action potentials – Bioelectric potentials - Electrocardiogram (ECG) – Electroencephalogram (EEG) – Electromyogram (EMG) – Electroretinography (ERG) - Electrooculography (EOG).

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 - TM mode display - Ultrasonic imaging instrumentation - Biomedical applications - Magnetic Resonance Imaging (MRI) – Principle – Instrumentation - Advantages of MRI over other medical imaging techniques – Thermograph – Endoscopy.

UNIT – IV: MEASUREMENT OF PHYSIOLOGICAL PARAMETERS

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

Electromagnetic Blood Flow Meters - Ultrasonic Blood Flow Meter - transit time method - Doppler effect based ultrasonic blood flow meter - laser Doppler Blood Flow Meter - NMR Blood Flow Meter

UNIT – V: LASER IN MEDICINE

Introduction - Characteristics of laser ligh t- Generation of laser - Components of laser - Types of laser - Nd-YAG laser - Helium-Neon laser - CO_2 laser - Semiconductor laser - Applications of laser in Medical field.

Current streams of Thought (Not for Final Examinations)

BIOTELEMETRY, TELEMEDICINE AND SAFETY MEASUREMENTS

Elements of Biotelemetry system - Design of a biotelemetry system, Implantable Units - Problems, Application of Telemetry in Patient Care - Fundamentals of Telemedicine, Block diagram of Telemedicine - Scope & Benefits and Limitation of Telemedicine.

TEXT BOOKS

1. Rajalakshmi, T, (2008), *Bio Medical Instrumentation*, First Edition, Sams. Publishers.
2. Arumugam, M, (2000), *Biomedical Instrumentation*, Fourth reprint, Anuradha Agencies.
3. Khandpur, R.S, (2007), *Hand book of Biomedical Instrumentation*, Tata McGraw Hill.

SUPPLEMENTARY READING:

1. Robert B Northrop, (2005), *Introduction to Biomedical Instrumentation and Measurements* 2nd edition, LLCCRC Press is an imprint of Taylor & Francis Group.
2. Khandpur, R.S, (2016), *Hand Book of Bio medical Instrumentation*, 3 rd Edn, Access Eng.Tata McGraw Hill
3. Dominique Placko, (2010), *Fundamentals of Instrumentation and Measurement*, by ISTE Ltd. Tata McGraw Hill

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE97 - PETRO PHYSICS	L	T	P	C
IX		3	0	0	3

Learning Objectives (LO):

LO1	To understand the various magnetites and behaviour of the remanance properties.
LO2	To study the geomagnetic elements of the earth and various magnetometer instruments.
LO3	To understand the classification and properties of of rock forming minerals
LO4	To highlight the concept of seismic waves and various dating methods.

Course Outcomes (CO):

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

CO1	understand the various magnetites and behaviour of the remanance properties.
CO2	study the geomagnetic elements of the earth and various magnetometer instruments.
CO3	understand the classification and properties of of rock forming minerals
CO4	highlight the concept of seismic waves and various dating methods.

UNIT – I:

Magneto crystalline anisotropy – Dipolar anisotropy – Single ion anisotropy – Anisotropic exchange – Constants. Magnetic properties of mineral systems – Solid-Solid – Solution of oxides of iron – magnetite, haematite magnemites, titano magnetites, titono magneites, haematite – illmenite solid solution and pyrhotites – Intrinsic properties, magnetization process, weak field remanance.

Remanance properties - NRM, TRM, CRM, DRM, VRM, PRM – their mechanisms – Thermal demagnetization technique – partial TRM – additive law – Neel's theory of TRM. Primary and Secondary magnetization – Testing for stability of remanance.

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.

Geophysical prospecting – different methods – Geophysical properties of rocks and minerals – Resistivity methods – Two current electrode method - different electrode layouts – measuring equipment – application to ground water survey.

UNIT – IV:

Seismic waves – S waves & P waves – elastic, plastic behavior of rocks – modulus of elasticity in rocks – Time distance curves and the location of epicenters – Derivation properties from the velocities – the recent developments.

UNIT – V:

Geochronology – the geological time scale – archaeo-magnetic dating – Radio active methods of dating – Rubidium, Strontium method – Potassium Argon method – Thermo-luminescence dating and interpretation of data.

Current streams of Thought (Not for Final Examinations)

Principles and limitations of geophysical exploration methods - Elements of seismic surveying - Electrical surveying - Gravity surveying - Magnetic surveying- Electromagnetic surveying - Radiometric surveying.

TEXT BOOKS:

1. Singhal, RL, (2014), *Solid State Physics,* Kedar Nath Ram Nath & Co. Meerut.
2. Dekker, A.J, (2015), *Solid State Physics*, Prentice Hall.
3. Semana and Gupta and Sexana, (2016), *Solid State Physics*, Pragati Prakash, Meerut.

SUPPLEMENTARY READING:

1. Howell, (2012), *Introduction to Geophysics*, McGraw Hill Book Co.
2. Garland, G.D, (1981), *Introduction to Geophysics*, Saunder's Book Co., 2nd Edn.
3. Dobrin, (2014), *Introduction to Geophysical prospecting*, McGraw Hill Book Co.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE98 - MEDICAL PHYSICS	L	T	P	C
IX		3	0	0	3

Learning Objectives (LO):

LO1	To gain the knowledge about the bio medical instruments used for measuring bio-electric potentials and the electrodes used for sensing the bio potentials.
LO2	To understand the working principles of imaging equipments and bio medical instruments used for determining the physiological parameters.
LO3	To update the knowledge of various nuclear medicine and biological effects of radiation.

Course Outcomes (CO):

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

CO1	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

UNIT – I: Bio-Electric Potentials

Resting and action potentials - Propagation of action potentials – Bioelectric potentials – Electrocardiogram (ECG) – electroencephalogram (EEG) – Electromyogram (EMG) – Electroetinography – Electrooculography (EOG).

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

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

Production of X-rays – Types of X-ray tubes – Generators – Interaction of X-ray and Gamma rays with matter – Image formation and image quality – CR and DR – the image intensifier – fluoroscopy – Equipment for computed tomography scanning – Image reconstruction – Helical and multi-slice scanning – Image quality and artifacts – CT dose index.

UNIT – III: Imaging with Ultrasound and MRI

Piezoelectric effect – Interference – Different types of transducers – Modes of scanning – Image quality and artifacts – Doppler methods – Hemodynamic data – Spin echo sequence – Spatial encoding – functional MRI – Magnets and coils – Hazards and safe practice – Thermograph – endoscopy.

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

Radioactivity - Radioactive transformation – Radiopharmaceuticals – Hot lab – Gamma camera – Planner imaging – tomography with radionuclide – PET scanner – Characteristics and quality assurance of images – Precautions necessary in handling open radioactive sources – Ionizing radiation interactions with tissues – Radiation dose and units – Effects of radiation – Principles of radiation protection – ICRP, BARC and AERB – eLORA – Practical aspects of radiation protection.

UNIT – V: Medical Imaging Instrumentation

Radiation therapy – Surgery – Chemotherapy – Hormone therapy – Immunotherpy and Radionuclide therapy – Begin and malignant disease – Methods of spread of malignant disease – Staging and grading systems – Teletherapy and Brachy therapy – Co-60 and other radioactive sources used in the treatment of cancer – Modern treatment techniques – Treatment planning – Non-Photon ionizing radiation treatments and challenges.

Current streams of Thought (Not for Final Examinations)

RADIO NUCLIDE IMAGING

Interaction of nuclear particles and matter, nuclear sources, nuclear radiation detectors, rectilinear scanner, scintillation camera, SPECT, PET, and Gamma ray camera, medical LINAC.

TEXT BOOKS:

1. Rajalakshmi, T, (2012), *Bio Medical Instrumentation*, Second Edition.
2. Arumugam, M, (2014), *Bio Medical Instrumentation*, Anuradha Agencies, Fifth reprint.
3. Khandpur, R.S, (2007, *Handbook of Biomedical Instrumentation*, Tata McGraw Hill.

SUPPLEMENTARY READING:

1. Penelope Allsiy, Rpberts, Jerry R.Villiams, Saunders,Farr's, (2013), *Physics for Medical Imaging*, Elsevier, Third Edition.
2. Fiaz M.Khan, (2006), *The Physics of Radiation Therapy*, Second Edition, Springer.
3. Ramesh Chandra, (2008), *Nuclear Medicine Physics*, Lea and Febiger. 5th Edition.

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYE99 – BIOPHYSICS	L	T	P	C
IX		3	0	0	3

Learning Objectives (LO):

LO1	To understand the applications of various microscopic tools in cell biology.
LO2	To understand the fundamentals of macromolecular structure.
LO3	To understand the analytical techniques in characterizing biomolecular interactions and its structure

Course Outcomes (CO):

At 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.

UNIT – I: CELL ORGANIZATION

Cell as the basic structural unit - Origin & organization of Prokaryotic and Eukaryotic cell - Cell size & shape - Fine structure of Prokaryotic & Eukaryotic cell organization (Bacteria, Cyanobacteria, plant & Animal cell) - Internal architecture of cells - cell organelles - compartment & assemblies membrane system – Ribosome – Polysomes – Lysosomes – Peroxisomes - Connection between cell & its environment - Extracellular Matrix.

UNIT – II: TOOLS IN CELL BIOLOGY

Light microscope - Resolving Power - Phase contrast microscope - Detection of small differences in refractive indices - Interference microscope -Dark field microscope - Polarization microscope - Fluorescence microscope - Cytophotometry methods - Flowcytometry & cell sorting - Electron microscopy - specimen preparation - Scanning Electron Microscopy (SEM) - Transmission Electron Microscopy (TEM - Applications.

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.

Proteins structure: Amino acids and the primary structures of proteins – Secondary – Tertiary - Quaternary structure and virus structure.

UNIT – IV: SEPERATION TECHNIQUES

Centrifugation**:** Principle of centrifugation – Analytical ultracentrifugation – Differential centrifugation – Density gradient centrifugation.

Chromatography**:** Principles of chromatography – Paper chromatography – Thin layer chromatography (TLC) – Gas liquid chromatography (GLC) – High performance liquid chromatography (HPLC).

Electrophoresis: Principles – Factors affecting the migration of substances – Supporting media in electrophoresis – Gel electrophoresis – Polyacrylamide gel electrophoresis (PAGE) – Sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE).

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 disperson (ORD) - Relation between CD and ORD - Application of ORD in conformation and interactions of biomolecules.

Crystallization of proteins - preparation of heavy metal derivatives - Patterson synthesis - isomorphous replacement methods - structure factors of centro-symmetric and non-centrosymmetric crystals - General remarks on Protein-Structure determination from X-ray diffraction data - Neutron diffraction - Electron diffraction - Synchrotron diffraction, Application in Biomolecular structural studies.

Current streams of Thought (Not for Final Examinations)

SOME ASPECTS OF NANOTECHNOLOGY

Introduction to Protein-based Nanostructures - Nanomotors - Bacterial (E. coli) and Mammalian (Myosin family) Nanobiosensors - Science of Self assembly - Natural to Artificial Structures - Nanoparticles in Biological Labeling and Cellular Imaging

TEXT BOOKS:

1. Subramanian, M.A, (2015), *Biophysics*, MJP Publishers.
2. Veerakumari, L, (2017), *Bioinstrumentation*, MJP Publishers.
3. Deb, A.C, (2018), *Fundamentals of Biochemistry*, New central book agency.

SUPPLEMENTARY READING:

1. Geoffrey M. Cooper, (2019), *The Cell: A Molecular Approach*, ASM Press.
2. Gautham, N, (2013), *Biophysics*, Vasantha Pattabhi, Narosa Publishing.
3. Mishra, P.S, (2010), *Biophysics*, VK Enterprises.

COURSE OUTCOME MAPPING:

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

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

ALLIED COURSES OFFERED TO OTHER DEPARTMENTS

Semester	19IPHYA01 - ALLIED PHYSICS - I	L	T	P	C
		4	0	0	4

Learning Objectives (LO):

LO1	To educate and motivate the interdisciplinary students to understand the elementary concepts of various topics of physics.
LO2	To understand the centre of gravity and behavior of fluid motion.
LO3	To understand how the principle of relativity leads to time dilation and length contraction.
LO4	To understand the principle,theory, operations and applications of laser.

Course Outcomes (CO)

At the end of the course, the student 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.

UNIT - I: MECHANICS

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

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

UNIT - II: RELATIVITY

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

UNIT-III: LASER PHYSICS

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

UNIT- IV: NUCLEAR PHYSICS

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

UNIT- V: BASIC ELECTRONICS

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

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Experimental determination of viscosity of a liquid – Black hole- Holography and their applications – semiconductor detectors – Fabrication of integrated circuits .

TEXT BOOKS:

1. Murugesan, R, (2005) , Allied *Physics*, S .Chand & Co, Ltd.
2. Murugesen & Kiruthiga Sivaprasath, (2016), *Modern Physics*, S.Chand & Co Ltd.
3. Pandya , M. L. and Yadav ,P.R.S, (1993*), Elements of Nuclear Physics*, Kedarnath Ramnath, .

SUPPLEMENTARY READING:

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

COURSE OUTCOME MAPPING:

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

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

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

Learning Objectives (LO):

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

Course Outcomes (CO)

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

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

UNIT - I: ATOMIC PHYSICS

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

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

UNIT – II: MODERN PHYSICS

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

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

UNIT – III: NUCLEAR PHYSICS

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

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

UNIT – IV: POLARIZATION

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

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

UNIT- V: DIGITAL ELECTRONICS:

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

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

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

TEXT BOOKS :

1. Murugasen, R, & KiruthigaSivaprasath, (2016), Modern Physics,S.Chand& Co Ltd.
2. Murugesan, R, (2005), Allied Physics, S.Chand& Co, Ltd.
3. SubramaniyamBrijlal, N, and Avadhanulu, M.N, (2018), A Text Book of Optics , S. Chand & Co Ltd.

SUPPLEMENTARY READING:

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

COURSE OUTCOME MAPPING:

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

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

Semester	19IPHYAP01 - ALLIED PHYSICS PRACTICAL	L	T	P	C
		3	0	0	3

Learning Objectives (LO):

LO1	To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine various properties of the materials given.
LO4	To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

Course Outcomes (CO)

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

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

Any Ten Experiments

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

COURSE OUTCOME MAPPING:

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

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