B.Sc. PHYSICS

CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum and Syllabus

Students admitted from 2021 onwards

Enable | Enlighten | Enrich
KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

DEPARTMENT OF PHYSICS
KARPAGAM ACADEMY OF HIGHER EDUCATION
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PREAMPLE

The B.Sc. Physics course is conducted with the following objectives:

- **To update the knowledge of the students in one of the most important basic sciences, namely PHYSICS.**
- **To update the knowledge of a person in the latest fields of science like Atomic and Nuclear Physics, Laser Physics, Materials Science, Nano Technology, Astrophysics etc.**
- **To motivate and support young talented researchers in their research activities.**
- **To prepare the students to fit into National Laboratories like CSIR laboratories and National Physical Laboratories etc., as working personnel. Also to make them to work in Universities and colleges as teachers.**
- **To enhance the knowledge of the structure and evolution of the Universe, fundamental properties of matter and energy through the support of leading edge research.**
- **To provide efficient and resourceful hands to help in inter-disciplinary areas where basic and advanced knowledge in physics is utilized.**

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FACULTY OF ARTS, SCIENCE AND HUMANITIES
UNDER-GRADUATE PROGRAMMES
REGULAR MODE
REGULATIONS - 2021

The following Regulations are effective from the academic year 2021-2022 and are applicable to candidates admitted to Under Graduate Degree (UG) programmes in the Faculty of Arts, Science, and Humanities, Karpagam Academy of Higher Education (KAHE) from the academic year 2021-2022 onwards.

1 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

1.1 U.G. Programmes Offered

A candidate may undergo a programme in any one of the under graduate programme approved by the KAHE as given below.

S. No.	DEGREE	DISCIPLINE
1	B. Sc.	Biochemistry
2	B. Sc.	Biotechnology
3	B. Sc.	Computer Science
4	B.Sc.	Mathematics
5	B.Sc.	Physics
6	B. Sc.	Chemistry
7	B. Sc.	Microbiology
8	B. Sc.	Information Technology
9	B. Sc.	Computer Technology
10	B.Sc.	Computer Science with Cognitive Systems
11	BCA	Computer Application
14	B. Com.	Commerce
15	B.Com (CA)	Commerce with Computer Applications
16	B. Com. (PA)	Commerce with Professional Accounting
17	B. Com. (BPS)	Commerce with Business Process Services
18	B.B.A.	Business Administration

1.2 Mode of Study

Full-Time

All programs are offered under Full-Time Regular mode. Candidates admitted under '**Full-Time'** should be present in the KAHE during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

1.3 Admission Requirements (Eligibility)

A candidate for admission to the first year of the UG Degree programme shall be required to have passed the Higher Secondary Examination (10 + 2) [Academic or Vocational] prescribed by the Government of Tamil Nadu Board or any similar examination of any other Board accepted by the KAHE as equivalent thereto.(Annexure I)

2. DURATION OF THE PROGRAMMES

2.1 The minimum and maximum period for the completion of the U.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
B.Sc., B.Com, BCA, BBA	6	12

2.2 Each semester normally consists of 90 working days or 450 Instructional hours of study. Examination shall be conducted at the end of every semester for the respective courses.

3. CHOICE BASED CREDIT SYSTEM

3.1. All programmes are offered under Choice Based Credit System with a total credit of 140 for UG Programmes.

3.2. Credits

Credit means the weightage given to each course of study by the experts of the Board of Studies concerned. Total credits 140 as per UGC Guidelines for the UG programme (Three Years).

4. STRUCTURE OF THE PROGRAMME

4.1 Tamil or any one of the Indian / Foreign Languages *viz*, Malayalam, Hindi, French, Sanskrit are offered as an additional course for Science Programme. Four credits are awarded for each course and the examinations will be conducted at the end of the each semester.

For Arts programme, there are two additional courses (English III and IV) offered during the Second year - third and fourth semesters. Six credits are awarded for each course, and the examinations will be conducted at the end of the respective semester.

4.2. Core Course, Discipline Specific Elective, Generic Elective, Skill Enhancement Course, Project, Ability Enhancement Course are part of curricular structure.

4.2.1. Core Course

Core course consists of theory and practical for Department domains for which examinations shall be conducted at the end of each semester. The students have to study 12 Core Courses compulsorily.

4.2.2. Discipline Specific Electives (DSE)

DSE is offered in the fifth and sixth semesters of third year. The examination shall be conducted at the end of each semester. Final year students (V and VI Semesters) will have to choose the elective courses in V semester and VI Semester from the list of elective courses given in the curriculum, in addition to the project work.

4.2.3. Generic Elective

Generic elective is an elective course chosen generally from an unrelated discipline/subject, with an intention to provide exposure in other areas of interest also to students.

The students have to choose two Generic Electives- one each in the First year (3 or 4 courses) and second year (3 or 4 courses) of the programme from the list of elective courses given in the curriculum.

Note: A particular elective course will be offered only if at least one third of the students in a class opt that course. If less, the elective selected has to be studied as a self-study course only.

4.2.4. Skill Enhancement Courses

Skill Enhancement Courses are offered in the third and fourth semesters of second year programme and in the fifth and sixth semesters of the third year programme. Second year students (III and IV Semesters) will have to choose atleast one elective course each in both III and IV Semesters from the list of elective courses given in the curriculum. Similarly final year students (V and VI Semesters) will have to choose atleast one elective course each in both V and VI Semesters from the list of elective courses given in the curriculum. The examination shall be conducted at the end of each semester.

Note: A particular elective course will be offered only if at least one third of the students in a class opt that course. If less, the elective selected has to be studied as a self-study course only.

4.2.5. Project Work

The project work shall start at the beginning of sixth semester and the Project Report has to be submitted at the end of the sixth semester. The project may be an individual or group task**.** HoD of the department concerned shall assign a project supervisor who in turn shall monitor the project work of the student(s). A project/ dissertation work may be given *in lieu* of a discipline-specific elective paper.

4.2.6. Ability Enhancement Course

Ability Enhancement Course-1

The course (English for Science Programme / Business Communication for Arts Programme) shall be offered during the first and second semester for which examinations shall be conducted at the end of the semester. And Business Communication for Arts Programme shall be offered during the first semester for which examinations shall be conducted at the end of the semester.

Ability Enhancement Compulsory Course-2

Students shall study the course Environmental Studies in the First / Second Semester for which examinations shall be conducted at the end of the semester.

4.2.7. Internship

The student shall undergo 15 days internship in the end of II and IV semester.

5.0 Value Added Courses

Courses of varying durations but not less than 30 hours which are optional and offered outside the curriculum that add value and helping the students in getting placement. Students of all programmes are eligible to enroll for the value added course. The student can choose one Value-added course per semester from the list of Value-added courses available in KAHE. The examinations shall be conducted at the end of the value added course at the Department level and the student has to secure a minimum of 50% of marks to get a pass. The certificate for the value added course for the passed out students shall be issued duly signed by the HOD and Dean of the Faculty concerned.

6.0 Online Course

Student shall study at least one online course from SWAYAM / NPTEL / MOOC in any one of the first five semesters for which examination shall be conducted at the end of the course by the respective external agencies if any. The student can register to the courses which are approved by the Department. The student shall produce a Pass Certificate from the respective agencies before the end of the fifth semester. The credit(s) earned by the students will be considered as additional credit(s) over and above the credits minimum required to earn a particular degree.

7.0 Extension Activities

Every student is encouraged to participate in at least any one of the following Extension activities:

- NSS
- NCC
- Sports / Mass drill
- YRC
- Club activities
- Other Co-curricular and Extra curricular activities

The student's performance shall be examined by the staff in-charge of Extension Activities along with the faculty mentor and the Head of the respective department on the following parameters.

- 75 % weightage for active participation in Extension Activities in / out of the KAHE.
- 25 % weightage for Exemplary Awards / Honours / Prizes secured.

8.0 Marks for Co-curricular and Extra-curricular shall be sent to the CoE before the commencement of the Sixth End Semester Examinations.

The above activities shall be conducted outside the regular working hours of the KAHE.

5. MEDIUM OF INSTRUCTION

The medium of instruction and examinations for the courses under Language I – Tamil / Hindi / Malayalam / French / Sanskrit shall be in the language concerned. For all other courses, the medium of instruction and examination shall be in English.

6. MAXIMUM MARKS

Each of the theory and practical courses shall carry a maximum of 100 marks. Out of which 40 marks is awarded for Continuous Internal Assessment (CIA) and 60 marks for End Semester Examinations (ESE).

Evaluation: Evaluation in the courses comprises two parts, one is the Continuous Internal Assessment (CIA) and the other one is the End Semester Examination (ESE).

7. REQUIREMENTS TO APPEAR FOR THE END SEMESTER EXAMINATION

a. Ideally, every student is expected to attend all classes and secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to attend at least 75% of the classes and the conduct of the candidate has been satisfactory during the course.

b. A candidate who has secured attendance between 65% and 74% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) or due to participation in University / District / State / National / International level sports or due to participation in Seminar / Conference / Workshop / Training Programme / Voluntary Service / Extension activities or similar programmes with prior permission from the Registrar shall be given exemption from prescribed minimum attendance requirements and shall be permitted to appear for the examination on the recommendation of the Head of the Department concerned and Dean to condone the shortage of attendance. The Head of the Department has to verify and certify the genuineness of the case before recommending to the Dean concerned. However, the candidate has to pay the prescribed condonation fee to the KAHE.

c. However, a candidate who has secured attendance less than 64% in the current semester due to any reason shall not be permitted to appear for the current semester examinations. But he/she will be permitted to appear for his/her supplementary examinations, if any and he/she has to re-do the same semester with the approval of the "Students' Affairs Committee" and Registrar.

8. a. FACULTY MENTOR

To help students in planning their courses of study and for general advice on the academic programme, the HoD shall allot twenty students to a faculty who will function as faculty mentor throughout their period of study. Faculty mentor shall advise the students and monitor their behavior and academic performance. Problems if any shall be counseled by them periodically. The Faculty mentor is also responsible to inform the parents of their wards' progress. Faculty mentor shall display the cumulative attendance particulars of his / her ward students' periodically (once in 2 weeks) on the Notice Board to enable the students, know their attendance status and satisfy the **clause 7** of this regulation.

b. ONLINE COURSE COORDINATOR

To help students in planning their online courses and for general advice on online courses, the HOD shall nominate a coordinator for the online courses. The Online course coordinator shall identify the courses which students can select for their programme from the available online courses offered by the different agencies periodically and inform the same to the students. Further, the coordinators shall advice the students regarding the online courses and monitor their course.

9. CLASS COMMITTEE

Every class shall have a Class Committee consisting of the faculty members of the various courses of the class concerned, student representatives (Minimum 2 boys and 2 girls of various capabilities and Maximum of 6 members) and the concerned HoD / senior faculty as Chairperson. The objective of the Class Committee Meeting is all about the teaching – learning process. Class Committee shall be convened at least once in a month. The functions of the Class Committee shall include

- Analysing and solving problems experienced by students in the class room and in the laboratories.
- Analyzing the performance of the students of the class after each test and finding the ways and means to improve the performance.
- The Class Committee of a particular class of any department is normally constituted by the HoD / Chairperson of the Class Committee. However, if the students of different departments are mixed in a class, the Class Committee shall be constituted by the respective Dean of the Faculty.
- The class committee shall be constituted during the first week of each semester.
- The HoD / Chairperson of the Class committee is authorized to convene the meeting of the class committee.
- The respective Dean of the Faculty has the right to participate in any Class committee meeting.
- The Chairperson is required to prepare the minutes of every meeting, and submit the same to Dean concerned within two days after having convened the meeting. Serious issues if any shall be brought to the notice of the Registrar by the HoD / Chairperson immediately.

10. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or department shall have a "Course Committee" comprising all the teachers handling the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the respective Dean depending upon whether all the teachers handling the common course belong to a single department or to various other departments. The 'Course Committee' shall meet in order to arrive at a common scheme of evaluation for the tests to ensure a uniform evaluation of the tests. If feasible, the course committee shall prepare a common question paper for the Internal Assessment test(s).

11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

11.1 **Attendance and assessment:** Every Faculty is required to maintain an **Attendance and Assessment Record (Log book)** which consists of attendance of students marked for each lecture / practical / project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the HoD once in a fortnight for checking the syllabus coverage and the records of test marks and attendance. The HoD shall sign with date after due verification. The same shall be submitted to respective Dean once in a month. After the completion of the semester the HoD should keep this record in safe custody for five years. Because records of attendance and assessment shall be submitted for Inspection as and when required by the KAHE / any other approved body.

11.2 **Continuous Internal Assessment (CIA)**: The performance of students in each course will be continuously assessed by the respective faculty as per the guidelines given below:

Theory Courses

S. No.	Category	Maximum Marks
1.	Assignment*	5
2.	Attendance	5
3	Seminar	5
4.	Test – I (1 ½ units- Unit I and II)	8
5	Test – II (1 ½ units Unit II and III)	8
6	Test III (2 units Unit IV and V)	9
Continuous Internal Assessment : Total		40

* Two Assignments (Assignment I before Internal Test – I and assignment II before Internal Test – II).

Practical Courses

S. No.	Category	Maximum Marks
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Model Examination	20
5.	*Viva – voce* [Comprehensive]*	5
Continuous Internal Assessment: Total		**40**

* Includes *Viva- voce* conducted during the model Exam practical.

Every practical Exercise / Experiment shall be evaluated based on the conduct of Exercise/ Experiment and records maintained.

11.3 Pattern of Test Question Paper

Portions for Internal Test – I : First 1 ½ Units(Unit I and II)

Portions for Internal Test – II : Second 1 ½ Units (Unit II and III)

Portions for Internal Test – III : Two units (Unit IV and V)

Instruction	Remarks
Maximum Marks	50 marks
Duration	2 Hours
Part – A	Objective type (20x1=20)
Part - B	Short Answer Type (3 x 2 = 6)
Part - C	3 Eight mark questions 'either – or' choice (3 x 8 = 24 Marks)

11.4 Attendance

Marks Distribution for Attendance

S. No.	Attendance (%)	Maximum Marks
1	91 and above	5.0
2	81 – 90	4.0
3	76 – 80	3.0
4	Less than 75	0

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12. ESE EXAMINATIONS

12.1 End Semester Examination (ESE): End Semester Examination will be held at the end of each semester for each course. The question paper is for a maximum 60 marks.

Pattern of ESE Question Paper:

Instruction	Remarks
Maximum Marks	60 marks for ESE.
Duration	3 hours (½ Hr for Part – A Online & 2 ½ Hours for Part – B and C
Part - A	20 Questions of 1 mark each (20 x 1 = 20 Marks) Question No. 1 to 20 Online Multiple Choice Questions
Part- B	5 Questions of 2 marks each(5 x 2 = 10 Marks) Covering all the five units of the syllabus Question No. 21 to 25
Part- C	5 six mark Questions of 6 marks each (5 x 6 = 30 Marks.) Question No. 26 to 30 will be 'either-or' type, covering all five units of the syllabus; i.e., Question No. 26: Unit - I, either 26 (a) or 26 (b), Question No. 27: Unit - II, either 27 (a) or 27 (b), Question No. 28: Unit - III, either 28 (a) or 28 (b), Question No. 29: Unit - IV, either 29 (a) or 29 (b), Question No. 30: Unit - V, either 30 (a) or 30 (b)

12.2 Practical: There shall be combined valuation. The pattern of distribution of marks shall be as given below.

Experiments	: 40 Marks
Record	: 10 Marks
Viva-voce	: 10 Marks
Total	**: 60 Marks**

Record Notebooks for Practical Examination

Candidate taking the practical examination should submit Bonafide Record Notebook prescribed for the practical examination; failing which the candidate will not be permitted to take the practical examination.

In case of failures in Practical Examination, the marks awarded for the Record at the time of first appearance of the Practical Examination shall remain the same at the subsequent appearance also by the candidate.

12.3. **Evaluation of Project Work**

12.3.1 The project work shall carry a maximum of 100 marks. (CIA - 40 and ESE – 60*)

*Combined valuation of Internal and External Examiners.

12.3.2 The project report prepared according to the approved guidelines and duly signed by the supervisor(s) shall be submitted to HoD.

12.3.3 The evaluation of the project will be based on the project report submitted and a *viva-voce* Examination by a team consisting of the supervisor, who will be the Internal Examiner

and an External Examiner who shall be appointed by the COE. In case the guide is not available, the HoD shall act as an Internal Examiner for the same.

12.3.4 If a candidate fails to submit the project report on or before the specified date given by the Examination Section, the candidate is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

If a candidate fails in the respective viva-voce examinations he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. For this purpose the same Internal and External examiner shall evaluate the resubmitted report.

12.3.5 Copy of the approved project report after the successful completion of *viva-voce* examinations shall be kept in the KAHE library.

13. PASSING REQUIREMENTS

13.1 Passing minimum: There is a passing minimum 20 marks out of 40 marks for CIA and the passing minimum is 30 marks out of 60 marks in ESE. The overall passing in each course is 50 out of 100 marks (Sum of the marks in CIA and ESE examination).

13.2 If a candidate fails to secure a pass in a particular course (either CIA or ESE or Both) as per clause 13.1, it is mandatory that the candidate has to register and reappear for the examination in that course during the subsequent semester when examination is conducted for the same till he / she receives a pass both in CIA and ESE (vide Clause 2.1).

13.3 Candidate failed in CIA will be permitted to improve CIA marks in the subsequent semesters by writing tests and by re-submitting Assignments.

13.4 CIA marks (if it is pass) obtained by the candidate in the first appearance shall be retained by the Office of the Controller of Examinations and considered valid for all subsequent attempts till the candidate secures a pass in ESE

13.5 Candidate who is absent in ESE in a Course / Practical / Project Work after having enrolled for the same shall be considered to have **failed** in that examination.

14. IMPROVEMENT OF MARKS IN THE COURSES ALREADY PASSED

Candidates desirous to improve the marks secured in a passed course in their first attempt shall reappear once (**only in ESE**) in the subsequent semester. **The improved marks shall be considered for classification but not for ranking.** If there is no improvement there shall be no change in the marks awarded earlier.

15. AWARD OF LETTER GRADES

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

Letter grade	Marks Range	Grade Point	Description
O	91 - 100	10	OUTSTANDING
A+	81- 90	9	EXCELLENT
A	71-80	8	VERY GOOD
B+	66- 70	7	GOOD
B	61 – 65	6	ABOVE AVERAGE
C	55 - 60	5	AVERAGE
D	50 - 54	4	PASS
RA	<50	-	REAPPEARANCE
AAA	-	-	ABSENT

16. GRADE SHEET

After the declaration of the results, Grade Sheets will be issued to each student which will contain the following details:

i. The list of courses enrolled during the semester and the grade scored.
ii. The Grade Point Average (**GPA**) for the semester and
iii. The Cumulative Grade Point Average (**CGPA**) of all courses enrolled from first semester onwards.
iv. Remark on Extension Activities (only in the 6th Semester Grade Sheet)
v. GPA of a Semester and CGPA of a programme will be calculated as follows.

GPA of a Semester = (Sum of the product of the GP by the corresponding credits of the courses offered in that Semester) / (Sum of the credits of the courses of that Semester)

i.e. **GPA** of a Semester = $\frac{\sum_i CiGPi}{\sum_i Ci}$

CGPA of the entire programme = (Sum of the product of the GPs by the corresponding credits of the courses offered for the entire programme) / (Sum of the credits of the courses of the entire programme)

i.e. **CGPA** of the entire programme = $\frac{\sum_n \sum_i CniGPni}{\sum_n \sum_i Cni}$

where,

Ci is the credit fixed for the course 'i' in any semester
GPi is the grade point obtained for the course 'i' in any semester

'n' refers to the Semester in which such courses are credited.

Note: RA grade will be excluded for calculating **GPA** and **CGPA**.

17. REVALUATION

A candidate can apply for revaluation and retotalling of his / her semester examination answer script (**theory courses only**), within 2 weeks from the date of declaration of results, on payment of a prescribed fee. For the same, the prescribed application has to be sent to the Controller of Examinations through the HoD. **A candidate can apply for revaluation of answer scripts not exceeding 5 courses at a time.** The Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate through the HoD concerned**.** Revaluation is not permitted for supplementary theory courses.

18. TRANSPARENCY AND GRIEVANCE COMMITTEE

Revaluation and Re-totaling is allowed on representation (clause 17). Student may get the Xerox copy of the answer script on payment of prescribed fee, if he / she wishes. The student may represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HoD, the Dean of another Faculty nominated by the KAHE), HoD of the Department concerned, the faculty of the course and Dean from other discipline nominated by the KAHE and the CoE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External examiner will be final. The student has to pay the prescribed fee for the same.

19. ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the conferment of the Degree if he / she has

- Successfully completed all the components prescribed under Parts I to Part IV in the CBCS pattern to earn the minimum required credits as specified in the curriculum corresponding to his / her programme within the stipulated period vide class 2.1.
- Not any disciplinary action pending against him / her.
- The award of the degree must be approved by the Board of Management.

20. CLASSIFICATION OF THE DEGREE AWARDED

20.1 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses in his / her first appearance, within the specified minimum number of semesters and securing a **CGPA not less than 8** shall be declared to have passed the examination in **First Class with Distinction.**

20.2 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses within the specified maximum number of semesters (vide clause 2.1), securing a **CGPA not less than 6.5** shall be declared to have passed the examination in **First Class**.

20.3 All other candidates (not covered in clauses 20.1 and 20.2) who qualify for the award of the degree (vide Clause 19) shall be declared to have passed the examination in **Second Class**.

21. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

21.1 Candidate, may for valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

21.2 Such withdrawal shall be permitted only once during the entire period of study of the degree programme.

21.3 Withdrawal of application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the HoD / Dean concerned and approved by the Registrar.

21.3.1 Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

21.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during **VI semester**.

21.5 Withdrawal from the End semester examination is **NOT** applicable to arrears courses of previous semesters.

21.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.

22. PROVISION FOR AUTHORISED BREAK OF STUDY

22.1 **Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme.** However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Registrar, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Department stating the reasons therefore and the probable date of rejoining the programme.

22.2 The candidate thus permitted to rejoin the Programme after the break shall be governed by the Curriculum and Regulations in force at the time of rejoining. Such candidates may have to do additional courses as per the Regulations in force at that period of time.

22.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. (Vide Clause 20). However, additional break of study granted will be counted for the purpose of classification.

22.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 2.1 irrespective of the period of break of study (vide clause 22.1) in order that he/she may be eligible for the award of the degree.

22.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Break of Study' or 'Withdrawal' (Clause 21 and 22) is not applicable for this case.

23. RANKING

A candidate who qualifies for the UG Degree programme passing all the Examinations in the first attempt, within the minimum period prescribed for the programme of study from

Semester I through Semester VI to the programme shall be eligible for ranking. Such ranking will be confined to 10% of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

24. SUPPLEMENTARY EXAMINATION

Supplementary Examination will be conducted only for the final semester students within ten days from the date of publication of results for students who have failed in one theory course only. Such students shall apply with prescribed fee to the Controller of Examinations within the stipulated time.

25. DISCIPLINE

25.1. If a student indulges in malpractice in any of the Internal / External Examination he / she shall be liable for punitive action as prescribed by the KAHE from time to time.

25.2. Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the KAHE. The erring students will be referred to the disciplinary committee constituted by the KAHE, to enquire into acts of indiscipline and recommend the disciplinary action to be taken.

26. REVISION OF REGULATION AND CURRICULUM

The KAHE may from time to time revise, amend or change the Regulations, Scheme of Examinations and syllabi if found necessary.

DEPARTMENT OF PHYSICS
FACULTY OF ARTS, SCIENCE AND HUMANITIES
UG PROGRAM (CBCS) – B.Sc. Physics
(2021–2022 Batch and onwards)

Course code	Name of the course	Category	Objectives and outcomes		Instruction hours / week			Credit(s)	Maximum Marks			P.No.
			PEOs	POs	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER – I												
21LSU101	Language – I	AEC	1	a, f	4	0	0	4	40	60	100	25
21ENU101	English-I	AEC	1	a, f	4	0	0	4	40	60	100	28
21PHU101	Mechanics	CC	3	b	4	0	0	4	40	60	100	30
21PHU102	Properties of Matter	CC	3	b	4	0	0	4	40	60	100	32
21PHU103	Mathematics –I	Allied	8	e	4	0	0	4	40	60	100	34
21PHU111	Mechanics Practical	CC	6	d	0	0	3	2	40	60	100	36
21PHU112	Properties of Matter Practical	CC	6	d	0	0	3	2	40	60	100	37
21PHU113	Mathematics Practical-I	Allied	7	e	0	0	4	2	40	60	100	39
Semester Total					**21**		**10**	**26**	**321**	**480**	**800**	
SEMESTER – II												
21LSU211	Language –II	AEC	1	a,f	4	0	0	4	40	60	100	40
21ENU201	English-II	AEC	1	a,f	4	0	0	4	40	60	100	43
21PHU201	Electricity and Magnetism	CC	4	b	6	0	0	5	40	60	100	45
21PHU202	Principles of Electronics	CC	9	b	5	0	0	4	40	60	100	47
21PHU203	Mathematics – II	Allied	8	e	4	0	0	4	40	60	100	50
21PHU211	Electricity and Magnetism Practical	CC	6	d	0	0	2	1	40	60	100	52
21PHU212	Principles of Electronics Practicals	CC	6	d	0	0	2	1	40	60	100	54
21AEC201	Environmental Studies	AEC	2	l	3	0	-	3	40	60	100	56
Semester Total					**26**		**04**	**26**	**320**	**480**	**800**	
SEMESTER – III												
21PHU301	Waves and optics	CC	3	b	4	0	0	4	40	60	100	59
21PHU302	Physics of Electronic Devices and Circuits	CC	4	b	4	0	0	4	40	60	100	61
21PHU303A	Renewable Energy and Energy harvesting	SEC	5	i	03	0	0	3	40	60	100	63
21PHU303B	Physics Workshop Skill	SEC	5	i								65
21PHU304	Chemistry –I	Allied	2	b	4	0	0	4	40	60	100	67
21PHU311	Wave and Optics Practical	CC	6	g	0	0	4	2	40	60	100	70
21PHU312	Physics of Electronic Devices and Circuits Practical	CC	6	h	0	0	4	2	40	60	100	72
21PHU313A	Renewable Energy and Energy harvesting Practical	SEC	6	g	0	0	3	1	40	60	100	74
21PHU313B	Physics Workshop Skill Practical	SEC										75
21PHU314	Chemistry Practical–I	Allied	6	g	-	0	4	2	40	60	100	76

	Semester total				**15**		**15**	**22**	**320**	**480**	**800**	
SEMESTER – 4												
21PHU401	Thermal Physics and Statistical Mechanics	CC	3	b	4	0	0	4	40	60	100	77
21PHU402	Atomic and Nuclear Physics	CC	4,9	d	4	0	0	4	40	60	100	80
21PHU403A	Basic Instrumentation Skill	SEC	5	i	3	0	0	3	40	60	100	82
21PHU403B	Radiation Physics - Safety measurements	SEC	5	b								84
21PHU404	Chemistry –II	Allied	4	b	4	0	0	4	40	60	100	86
21PHU411	Thermal Physics and Statistical Mechanics – Practical	CC	6	g	0	0	04	2	40	60	100	88
21PHU412	Atomic and Nuclear Physics Practical	CC	6	g	0	0	04	2	40	60	100	90
21PHU413A	Basic Instrumentation Skill Practical	SEC	6	g	0	0	3	1	40	60	100	91
21PHU413B	Radiation Physics - Safety measurements Practical	SEC										93
21PHU414	Chemistry Practical–II	Allied	6	g	0	0	04	2	40	60	100	95
	Semester total				**15**		**15**	**22**	**320**	**480**	**800**	
Internship												
SEMESTER – 5												
21PHU501	Mathematical Physics	CC	4	e	04	0	0	4	40	60	100	96
21PHU502	Electromagnetic Wave Propagation	CC	8, 9	b, e	4	0	0	4	40	60	100	98
21PHU503	Elements of Modern Physics	CC	3	b, e	04	0	0	4	40	60	100	100
21PHU504A	Microprocessor and Microcontroller	DSE	5	D	03	0	0	3	40	60	100	102
21PHU504B	Medical Physics	DSE	5	d								104
21PHU511	Mathematical Physics Practical	CC	6	g	0	0	4	2	40	60	100	107
21PHU512	Electromagnetic wave Propagation Practical	CC	6	g	0	0	04	2	40	60	100	109
21PHU513	Elements of Modern Physics Practical	CC	6	g	0	0	04	2	40	60	100	111
21PHU514A	Microprocessor and Microcontroller Practical	DSE	6	g	0	0	03	1	40	60	100	113
21PHU514B	Medical Physics Practical	DSE	6	g								115
	Semester total				**15**		**15**	**22**	**321**	**480**	**800**	
SEMESTER – 6												
21PHU601	Classical and Quantum Mechanics	CC	8	c	04	0	0	4	40	60	100	117
21PHU602	Solid State Physics	CC	4	c	4	0	0	4	40	60	100	119
21PHU603A	Nanomaterials and Applications	DSE	9	h	4	0	0	4	40	60	100	121
21PHU603B	Biological Physics											123
21PHU611	Classical and Quantum Mechanics Practical	CC	6	b	0	0	4	2	40	60	100	125
21PHU612	Solid State Physics Practical	CC	6	h	0	0	4	2	40	60	100	126

21PHU613A	Nanomaterials and Applications Practical	DSE	6	h	0	0	4	2	40	60	100	128
21PHU613B	Biological Physics Practical											129
21PHU691	Project	DSE	3,6,7	b,h,f	06	0	0	4	40	60	100	130
	Semester total				**18**		**12**	**22**	**280**	**420**	**700**	
	ECA / NCC / NSS / Sports / General interest etc											
	G. Total							**140**	**1880**	**2820**	**4700**	

Ability Enhancement Courses (AEC)		
SEMESTER	**Course Code**	**Name of the Course**
I	21LSU101	Language –I
	21ENU 101	English –I
II	21LSU201	Language –II
	21ENU201	English-II
	21AEC201	Environmental Studies

Generic Elective Courses (GE) / Allied Courses			
SEMESTER		**Course Code**	**Name of the Course**
I	GEC-1	21PHU103	Mathematics –I
		21PHU113	Mathematics Practical-I
II	GEC-2	21PHU203	Mathematics – II
III	GEC-3	21PHU304	Chemistry –I
		21PHU314	Chemistry Practical–I
IV	GEC-4	21PHU404	Chemistry –II
		21PHU414	Chemistry Practical–II

Core Courses (CC)			
SEMESTER		**Course Code**	**Name of the Course**
I	CC-1	21PHU101	Mechanics
		21PHU111	Mechanics Practical
	CC-2	21PHU102	Properties of Matter
		21PHU112	Properties of Matter Practical
II	CC-3	21PHU201	Electricity and Magnetism
		21PHU211	Electricity and Magnetism Practical
	CC-4	21PHU202	Principles of Electronics

		21PHU212	Principles of Electronics Practical
III	CC-5	21PHU301	Waves and optics
		21PHU311	Wave and Optics Practical
	CC-6	21PHU302	Physics of Electronic Devices and Circuits
		21PHU312	Physics of Electronic Devices and Circuits
IV	CC-7	21PHU401	Thermal Physics and Statistical Mechanics
		21PHU411	Thermal Physics and Statistical Mechanics Practical
	CC-8	21PHU402	Atomic and Nuclear Physics
		21PHU412	Atomic and Nuclear Physics Practical
V	CC-9	21PHU501	Mathematical Physics
		21PHU511	Mathematical Physics Practical
	CC-10	21PHU502	Electromagnetic Wave Propagation
		21PHU512	Electromagnetic wave Propagation Practical
	CC-11	21PHU503	Elements of Modern Physics
		21PHU513	Elements of Modern Physics Practical
VI	CC-12	21PHU601	Classical and Quantum Mechanics
		21PHU611	Classical and Quantum Mechanics Practical
	CC-13	21PHU602	Solid State Physics
		21PHU612	Solid State Physics Practical

Skill Enhancement Courses (SEC)			
SEMESTER		**Course Code**	**Name of the Course**
III	SEC-1	21PHU303A	Renewable Energy and Energy harvesting
		21PHU313A	Renewable Energy and Energy harvesting Practical
	SEC-2	21PHU303B	Physics Workshop skill
		21PHU313B	Physics Workshop skill Practical
IV	SEC-3	21PHU403A	Basic Instrumentation Skill
		21PHU413A	Basic Instrumentation Skill Practical
	SEC-4	21PHU403B	Radiation Physics - Safety measurements

		21PHU413B	Radiation Physics - Safety measurements Practical

Discipline Specific Elective Courses (DSE)			
SEMESTER		**Course Code**	**Name of the Course**
V	DSE-1	21PHU504A	Microprocessor and Microcontroller
		21PHU514A	Microprocessor and Microcontroller Practical
	DSE-2	21PHU504B	Medical Physics
		21PHU514B	Medical Physics Practical
VI	DSE-3	21PHU603A	Nanomaterials and Applications
		21PHU613A	Nanomaterials and Applications Practical
	DSE-4	21PHU603B	Biological Physics
		21PHU613B	Biological Physics Practical
	DSE-5	21PHU691	Project

PROGRAMME OUTCOMES

i. Be able to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

ii. Understood the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.

iii. The graduate will have specialized knowledge and expertise to identify, formulate, investigate, analyze and implement on the problems in physical sciences.

iv. Realized how developments in any science subject helps in the development of other science subjects and vice-versa and how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments

v. Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.

vi. Work and communicate efficiently in inter-disciplinary circumstances.

vii. The graduate will have leadership quality to handle all kind of circumstances in diverse interdisciplinary and multidisciplinary learning environment.

viii. Select, design and apply appropriate experimental techniques with computational tools to solve problems of physics.

ix. Perform job in various fields' viz. science, engineering and business, etc. with precision, analytical mind, innovative thinking, clarity of thought and expression, systematic approach.

x. Understand ethical principles and responsibilities of a physics graduate to serve the society

PROGRAMME SPECIFIC OUTCOMES

a. Enhance the employable skills towards seeking appointments in the relevant areas.

b. Able to use advanced mathematical tools and algorithms to elucidate the practical problems.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To produce graduates who excel in the competencies and values required for leadership to serve a rapidly evolving global community

PEO2: To provide the students with academic excellence, leadership qualities and professional ethics to address the needs of the scientific community.

PEO3: To create strong interest in physics so as students can further develop themselves through self-study.

PEO4: To equip the students with the ability to utilize the concepts of Physics such as optics, electricity, Magnetism, Thermodynamics etc and their applications in addressing the practical and heuristic issues.

PEO5: To provide the students with creative and analytical skills for the sustainable developments and nation building initiatives.

PEO 6: Use basic laboratory equipments and data analysis techniques, including, propagating errors, and also representing data graphically.

PEO 7: Basic computer programming skills like C, C++, Scilab used in Physics can be used to solve laboratory data analysis.

PEO 8: basic mathematical tools commonly used in physics, including differential and integral calculus, vector calculus, ordinary differential equations, partial differential equations, and linear algebra to solve advanced problems encountered in the fields of applied physics and engineering.

PEO 9: To create awareness on recent trends in technology and help them to purse higher studies.

Pos	a	b	c	d	e	f	g	h	i	j	k	l
PEO1	X					X			X	X		
PEO2		X			X					X		
PEO3	X	X			X	X		X				X
PEO4		X	X	X	X						X	X
PEO5		X		X					X		X	
PEO6	X			X		X	X	X			X	
PEO7					X	X		X				
PEO8		X	X		X							X
PEO9		X		X	X			X				

SEMESTER – I

21LSU101 தமிழ் முதல் தாள் 4H – 4C

(இளநிலை அறிவியல் பட்ட வகுப்புகளுக்குரியது)

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும் மேம்படுத்துதல்.
- ஆய்வுநோக்கை மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப் பயன் விளைவு

- இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப் பாடமாக இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
- கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
- தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல் தமிழ்' ; 'இணைய தமிழ்' குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை மேம்பாடு.
- வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .
- சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்கு உறுதுணையாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை.
- மொழிபெயப்புத் துறைசார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்.

தாள்கள்வரிசையும்தேர்வுச்செயல்திட்டமும்
பகுதி-I தமிழ்
இளநிலைப்பட்ட அறிவியல் வகுப்புகள்

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண் அக/எழுத்து	மொத்தம்	மதிப்பீடு
ஒன்று	I	4	3	40 / 60	100	4

அலகு – I : தமிழ் இலக்கிய வரலாறு – I
(8 மணிநேரம்)

முச்சங்க வரலாறு - சங்க இலக்கியத்தொகுப்பு - பாட்டும் தொகையும் - சங்கஇலக்கியச் சிறப்பியல்புகள் - சங்கம் மருவிய காலம் - பதினெண்கீழ்க்கணக்கு நூல்கள் – திருக்குறள் -நாலடியார் - நான்மணிக்கடிகை - பழமொழி நானூறு – பிற்கால அறஇலக்கியங்கள் - கொன்றை வேந்தன் – நீதிநூல் - காப்பியங்கள் - தமிழில் காப்பிய இலக்கணம் - தமிழில் பெருங்காப்பியங்களும் சிறு காப்பியங்களும் - இரட்டைக்காப்பியங்களாகச் சிலம்பும் மேகலையும்.

அலகு – II : சங்க இலக்கியம் (12 மணிநேரம்)

அ). எட்டுத்தொகை

நற்றிணை : கொண்டல் மாமழை – குறிஞ்சி – தலைவன் கூற்று - 140

குறுந்தொகை : வாரார் ஆயினும், வரினும் –முல்லை– தலைவி கூற்று - 110

ஐங்குறுநூறு : மருதம் –தோழி கூற்று-வேட்கைப்பத்து: வாழிஆதன் வாழி அவினி - 6

பதிற்றுப்பத்து : சிதைந்தது மன்ற - 27

பரிபாடல்: புறத்திரட்டு- மதுரை நகர்ச்சிறப்பு – உலகம் ஒரு நிறையாத்தான்-7, மாயோன் கொப்பூழ்-8, செய்யாட்கு இழைத்த-9, கார்த்திகை காதில்-10, ஈவாரைக் கொண்டாடி-11.

கலித்தொகை : பாலைக்கலி- செவிலி – எறித்தரு கதிர்தாங்கி-9

அகநானூறு : அன்னை அறியினும் அறிக – தோழி - நெய்தல் - 110

புறநானூறு : யாதும் ஊரே யாவருங் கேளிர் –பொதுவியல்- 192

ஆ). பத்துப்பாட்டு: நெடுநல்வாடை - கார்காலச் சிறப்பு : வையகம் பனிப்ப -1-70

அலகு – III : அற இலக்கியம்

(10 மணிநேரம்)

1. **திருவள்ளுவர்- திருக்குறள்**– அதிகாரம் 67 – வினைத்திட்பம், அதிகாரம் 100 - பண்புடைமை
2. **முன்றுறையரையனார்** – **பழமொழி நானூறு** 5 பாடல்கள்

உணற்கு இனிய 5, பரந்த திறலாரை 32, நெடியது காண்கிலாய் 46, இனி யாரும் 153, உரைசான்ற 195.

3. **ஔவையார்** – **கொன்றை வேந்தன்** (1- 50 பாடல்கள்)

அன்னையும் பிதாவும் – புலையும் கொலையும் களவும் தவிர்

4. **வேதநாயகம்பிள்ளை - நீதிநூல்** – (அதிகாரம்-7- தாய்தந்தையரைப் போற்றுதல்-

தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள்)

சின்னவோர் பொருள், கடவுளை வருந்தி, எப்புவிகளும், வைத்தவர், ஈன்றவர்

அலகு - IV : காப்பிய இலக்கியம் (10 மணிநேரம்)

(அ). சிலப்பதிகாரம் (5 மணிநேரம்)

மங்கல வாழ்த்துப் பாடல்: (21-29)- நாக நீள் நகரொடு-கண்ணகி என்பாண் மன்னோ .

வழக்குரை காதை, (48-56) - நீர்வார் கண்ணை-புகா ரென்பதியே .

வஞ்சின மாலை: (5-34) - வன்னிமரமும் – பிறந்த பதிப் பிறந்தேன்.

நடுகற் காதை: (207-234) - அருத்திற லரசர் – மன்னவ ரேறென்

வாழ்த்துக்காதை: (9) - என்னேயிஃ தென்னே – மீவிசும்பிற் றோன்றுமால்.

(ஆ). மணிமேகலை (5 மணிநேரம்)

பசியின் கொடுமை: பாத்திரம் பெற்ற காதை:

'போதி நீழல்' - 'பெருகியதன்றோ' , 'ஆற்றுநர்க்களிப்போர்' - 'நல்லறம் கண்டனை' (73-98).

சிறைக்கோட்டம் அறக்கோட்டமாக்கிய காதை: மாவண் கிள்ளிக்கு காவலன் உரைத்தவை:

'பைஞ்சேறு மெழுகாப் பசும்பொன் மண்டபத்து -
அறவோர்க் காக்கினன் அரசாள் வேந்தன்' (116-163).

அலகு- V : அடிப்படை இலக்கணமும் பயன்பாட்டுத்தமிழும் - I

(8 மணிநேரம்)

அ). எழுத்து, சொல், பொருள் இலக்கணங்கள் (4 மணிநேரம்)

1. முதல் மற்றும் சார்பெழுத்துகள் - பெயர், வினை, இடை, உரிச்சொல் முதலான அடிப்படை இலக்கண விளக்கப் பயிற்சிகள்
2). அகத்திணை மற்றும் புறத்திணை இலக்கணங்கள்

ஆ). கடிதப்பயிற்சி (4 மணிநேரம்)

1. தன்விவரக் குறிப்புடன் வேலை வேண்டி விண்ணப்பம் எழுதுதல்
2. பல்கலைக்கழகப் பன்னாட்டுக்கருத்தரங்கச் செய்தியை நாளிதழில் வெளியிட வேண்டி நாளிதழின் பதிப்பாசிரியருக்குக் கடிதம்
3. கருத்தரங்கப் பங்கேற்புக்கு அனுமதிக் கடிதம்
4. பல்கலைக்கழக விழாவுக்குத் தலைமையேற்க வேண்டி, மாவட்ட ஆட்சியருக்கு விண்ணப்பம்
5. கல்விகடன் வேண்டி வங்கிமேலாளருக்கு விண்ணப்பம்
6. வசிப்பிடத்திற்கு அடிப்படை வசதி வேண்டி வட்டாட்சியருக்கு விண்ணப்பம்
7. தேசியவிருது பெற்ற நண்பனுக்குப் பாராட்டுக் கடிதம்
8. புத்தகங்கள் அனுப்பி உதவவேண்டி, பதிப்பகத்தாருக்கு விண்ணப்பம்

பாட நூல்: கற்பகச்சோலை – தமிழ் ஏடு.

வெளியீடு: மொழிகள் துறை – தமிழ்ப்பிரிவு,
கற்பகம் உயர்கல்விக்கழகம்.

SEMESTER – I

21ENU101 **ENGLISH -I** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives:

- To give basic knowledge on grammar.
- To train communication in real life situation.
- To be familiar with the four basic skills of English.
- To train students to acquire proficiency in English by reading different genres of literature and learning grammar.
- To provide aesthetic pleasure through literature.
- To develop the moral values of students.

Course Outcome:

1. Retrieve fundaments of English language to construct error free sentences.
2. Develop the knowledge of interpersonal skills.
3. Establish and maintain social relationships.
4. Develop communication skills in business environment.
5. Refine communication competency through LSRW skills.
6. Improving intrapersonal skills through literary works.

UNIT - I: **Grammar**

Types of Sentences, Subject and Predicate, Parts of Speech, Tenses, Preposition and Articles

UNIT – II: Communication Exercise

Importance of Business Language- Words often Confused- Words often Misspelt- Common Errors in English- Charts and Pictorial Writing.

UNIT - III: **Interpersonal Skills**

Greetings & Introduction- Giving & Denying Permission- Telephone Etiquette- Oral Presentation – Plan, PowerPoint Presentation- Preparation of Speech- Audience psychology- Secrets of Good Delivery

UNIT - IV: LSRW Skills

Listening- Listening and its types, Basic Listening Lessons

Speaking- Basics of speaking, Regular English, Business English, Interview English

Reading- Reading and its purposes, Types of Reading, Reading Techniques

Writing- Types of Writing, Components of Writing, Language and Style with accordance to the contexts

UNIT - V: Literature

Prose: Let's Do What India Needs from Us - Dr. A.P.J. Abdul Kalam

Poem: A Prayer for My Daughter - W.B. Yeats

Short Story: Sparrows- K. Ahmad Abbas

Suggested Reading:

1. Hewings Martin,2013Advanced Grammar in Use, Cambridge University Press
2. *Haines* Simon,2015 Advanced Skills, A resource Book of Advanced- Level Skill Activities

SEMESTER – I

21PHU101 **MECHANICS** **4H – 4C**

Instruction Hours / week: L: 5 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- To know how to use Newton's laws of motion
- To solve advanced problems involving the dynamic motion of mechanical systems and other advanced mathematics in the solution of the problems.
- To find the use of conservation of energy and linear and angular momentum
- To solve dynamics problems.
- To understand the concept of oscillations.
- To gain the knowledge on elasticity.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

- Understand the basic concepts of mechanics
- Understand the concepts of simple harmonic motion
- Define the motion of mechanical systems and their degrees of freedom.
- Study the interaction of forces between solids in mechanical systems.
- Application of the vector theorems of mechanics and interpretation of their results.
- Analyse the mechanics as a systematic tool for problem solving.

UNIT I- LAWS OF MOTION

Frames of reference. Newton's Laws of motion- Inertial frames of reference- Non inertial frames- Dynamics of a system of particles. Centre of Mass. Momentum and Energy: laws of Conservation of momentum. Work and energy. Conservation of energy. Differential equation of rocket motion. Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum.

UNIT II-GRAVITATION

Newton's Law of Gravitation. Experimental determination of the gravitation constant (G) Gravitational field- Gravitational potential-potential energy- Orbital velocity - velocity of escape from the earth- velocity of escape from the solar system-Gravitational potential field due to a spherical shell- Gravitational potential field due to a solid sphere- Gravitational potential field due to a circular disc-Superposition principle- gravitational self energy of a

body- gravitational self energy of a uniform solid sphere.

UNIT III-OSCILLATIONS

Simple harmonic motion. Simple pendulum and Compound pendulum- Kinetic energy of a vibrating particle - Total energy of a vibrating particle. Types of oscillations: Free oscillations - Damped oscillations - Maintained oscillations - Forced oscillations - Resonance.

Introduction to Friction, Laws of Friction, Types of Frictions and their applications.

UNIT IV-MOTION OF RIGID BODY

Moment of inertia of a rod, disc, spherical shell, solid and hollow spheres - Theory of Torsion pendulum and Kater's pendulum - Determination of 'g' - Derivation of expressions for angular momentum and kinetic energy of a system of N particles.

UNIT V- JET PLANES, ROCKETS AND SATELLITES

Jet propulsion – Thrust supplied by the jet – Efficiency of the Jet – Effect of smaller cross-section of the Jet – Rocket planes – Rocket fuel – specific impulse – Shape of Rocket – The multi stage of Rocket – Take off of the Rocket – Salvaging of the various stage rockets – Satellite – Conditions for a satellite to place in orbit – Launching of satellite – Stability of the rocket during flight – Form of the satellite – Weight and size of the satellite – Material of the frame of satellite – Duration of satellite's existence.

Suggested Readings:

1. Upadhyaya J.C. (1969), General Properties of Matter, Vol- I., Agra, Ram Prasad & Sons.
2. Mathur D.S. (2014), Mechanics, New Delhi, S. Chand & Co.
3. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
4. D. S. Mathur "Elements of Properties of Matter" S. Chand & Co.
5. University Physics. FW Sears, MW Zemansky & HD Young 13/e, 1986.Addison-Wesley
6. Mechanics Berkeley Physics course, v.1:Charles Kittel, et.al. 2007, Tata McGraw-Hill
7. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
8. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
9. https://lecturenotes.in/notes/15822-note-for-mechanics-mech-by-amity-kumar
10. https://www.coursera.org/learn/rigid-body-dynamics
11. https://ocw.mit.edu/courses/physics/8-01sc-classical-mechanics-fall-2016/week-10-rotational-motion/28.1-rigid-bodies/

SEMESTER – I

21PHU102 **PROPERTIES OF MATTER** **4H – 4C**

Instruction Hours / week: L: 5 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- To know how to use Newton's laws of motion
- To solve advanced problems involving the dynamic motion of mechanical systems and other advanced mathematics in the solution of the problems.
- To find the use of conservation of energy and linear and angular momentum
- To understand the surface tension and viscosity of fluid.
- To understand the concept of oscillations.
- To gain the knowledge on elasticity.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Understand the basic concepts of elastivity.
2. Understand the concepts of simple harmonic motion
3. Study the elastic behaviour and working of torsional pendulum
4. Understand the surface tension and viscosity of fluid
5. Know the theorems of viscosity and interpretation of their results.
6. Analyze the acoustics as a systematic tool for problem solving.

UNIT I- ELASTICITY

Introduction to Volumetric, longitudinal, bulk stress asssssnd strain - Hooke's law- Stress-strain diagram - Elastic moduli-Relation between elastic constants- Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants- Work done in stretching & work done in twisting a wire- Twisting couple on a cylinder- Determination of Rigidity modulus by static torsion- Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η& by Searles method.

UNIT II- BENDING OF BEAMS

Cantilever - Expression for bending moment - Expression for depression - Cantilever oscillations - Expression for time period - Experiment to find Young's modulus - Non uniform

bending - Experiment to determine Young's modulus by Koenig's method - Uniform bending - Expression for elevation - Experiment to determine Young's modulus using microscope.

UNIT III - HYDROSTATICS

Fluids – Liquids and Gases – Hydrostatic pressure – Hydrostatic Pressure due to a liquid column – The Hydrostatic Paradox – A liquid transmits pressure equally in all directions – Pascal law – Thrust on an immersed plane – Centre of Pressure – Change of Depth of Centre of Pressure – Principle of Archimedes – Equilibrium of Floating bodies – Stability of Equilibrium – Rolling and Pitching of a Ship – Determination of Metacentric Height – Pressure due to a Compressible Fluid or a Gas – Measurement of Atmospheric Pressure.

UNIT IV - SURFACE TENSION

Surface tension and Surface energy- Pressure difference across a spherical surface- Pressure difference across a curved surface - Angle of contact - Angle of contact for water in a glass - Vapour pressure over a flat and curved surface - Variation of Surface tension with temperature - Jaegar's method - Quincke's method.

UNIT V - VISCOSITY

Streamline flow and Turbulent flow - Stoke's law - Stoke's method for the coefficient of viscosity - Poiseuille's method for the coefficient of viscosity - correction to Poiseuille's equation - Ostwald's viscometer - Variation of viscosity with temperature and pressure - Friction and Lubrication - Searle's viscometer - Viscosity of gases - Modification of Poiseuille's formula for gases - Rankine's method for determining the coefficient of viscosity of a gas.

SUGGESTED READINGS

1. Mathur. D.S, 11th edition 2010, Elements of properties of matter, S. Chand .& company, New Delhi
2. A text book of Sound – Subramanyam and Brijlal – Vikas publishing House Pvt. Ltd, II Edition 1982.
3. Murugesan. R, Revised edition 2004, Properties of matter, S. Chand & Company, New Delhi.
4. Brijlal and N. Subramanyam, 1st edition 2004, Properties of matter, S. Chand & Company, NewDelhi.
5. Mathur.D.S., 2004 edition, Mechanics, S. Chand & Company, New Delhi.

6. Uppadahayay. J. C., 2003, Properties of Matter, Ram Prakash and Sons, Agra.
7. Katie Dicker 1st edition 2011 properties of matter Wind Mills book Ltd
8. A text book of Sound – Khanna and Bedi Atma Ram & Son's, New Delhi.
9. https://www.askiitians.com/revision-notes/physics/flow-of-liquids-and-viscosity/
10. https://www.engineeringtoolbox.com/dynamic-absolute-kinematic-viscosity-d_412.html
11. https://mbi-ctac.sites.medinfo.ufl.edu/files/2017/02/ultrasound-basics.pdf
12. http://web.mit.edu/1.63/www/Lec-notes/Surfacetension/Lecture1.pdf
13. http://web.mit.edu/16.unified/www/FALL/fluids/Lectures/surf_tension.pdf

SEMESTER – I

21PHU103 **MATHEMATICS - I** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The concepts of Matrices and their properties.
- Techniques of differentiation and integration.
- The transform of a periodic function.
- The applications of the inverse Laplace transform.
- To know the properties of definite integrals.
- To understand the concept of Beta and Gamma integrals.

Course Outcomes (COs)

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

1. Solve simultaneous equations with the help of matrices.
2. Mastery in the concepts of vector and scalar fields.
3. Gain the intellectual knowledge of complex functions and their applications.
4. Acquire fundamental knowledge in the techniques of differentiation.
5. Know the properties of definite integrals.
6. Understand the concept of Beta and Gamma integrals.

UNIT I: MATRICES

Definition of the Matrix – Algebra of Matrices – Types of a Matrices – Determinant – Inverse of Matrices – Eigen Values and Eigen vectors – Cayley-Hamilton theorem (without proof) – Verification and computation of inverse.

UNIT II: TRIGONOMETRY

Expansions of sin nθ, Cos nθ and Tan nθ – Expansions of $Sin^n\theta$, $Cos^n\theta$ -Expansions of sinθ , cosθ and tanθ in terms of θ – Hyperbolic and inverse hyperbolic functions and their properties – Logarithm of a complex number – General principal values – problems.

UNIT III: DIFFERENTIAL CALCULUS

The tangent line and the derivative of a function – Numerical differentiation, differentials of higher order derivatives, discontinuities, stationary points, maximum-minimum problems, inflexion points, limiting values of functions: L'Hospital's rule, combining limits, Calculus of

several variables: Functions, change of variables, total differential, chain rule, partial differentiation, Euler's theorem.

UNIT- IV: INTEGRAL CALCULUS

Integration, odd-even functions, indefinite integrals, standard integrals, methods of integration (by part, substitution, partial fractions and other) Reduction formula.

UNIT V: ORDINARY DIFFERENTIAL EQUATIONS

Higher order Linear differential equations with constant coefficients – Method of variation of parameters – Simultaneous first order linear differential equations with constant coefficients.

SUGGESTED READINGS

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
2. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
3. An Introduction to Ordinary Differential Equations, E.A Coddington, 1961, PHI Learning Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
4. Essential Mathematical Methods, K.F.Riley and M.P.Hobson, 2011, Cambridge University Press.
5. https://nptel.ac.in/courses/115/103/115103036/
6. https://www.physics.uu.se/digitalAssets/405/c_405910-l_1-k_notes_v3_0.pdf

SEMESTER – I

21PHU111 MECHANICS PRACTICAL 3H – 2C

Instruction Hours / week: L: 0 T: 0 P: 2 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To impart knowledge on various types of Mechanisms and instruments
- To impart skills to analyze the position, velocity and acceleration.
- To understand basic laws governing mechanics of a system.
- To determine the acceleration due to gravity using various methods.
- To determine the Moment of Inertia using various methods.
- To know forces their relationship to engineering applications

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Understand and analyze basic theory and principles of forces in mechanics
2. Know forces their relationship to engineering applications
3. Analyze motion, forces and motion, work and energy problems and their relationship to engineering applications
4. Understand basic laws governing mechanics of a system.
5. Determine the acceleration due to gravity using various methods.
6. Determine the Moment of Inertia using various methods.

ANY SIX EXPERIMENTS

1. Measurements of internal & external diameter of the given object using vernier caliper and Measuring the thickness of the given objects using screw gauge
2. To determine the Height of a Building using a Sextant.
3. To determine g by Kater’s Pendulum
4. Experimental verification of lami's theorem
5. To Find the Weight of a Given Body Using Parallelogram Law of forces.
6. To determine the co-efficient of friction between the slider and the inclined plane.
7. To determine g by compound pendulum
8. To study the Motion of a Spring and calculate Spring Constant
9. To determine the moment of inertia of a solid sphere
10. To determine g by Bar Pendulum.

SUGGESTED READINGS

1. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SEMESTER – I

21PHU112 PROPERTIES OF MATTER PRACTICAL 3H – 2C

Instruction Hours / week: L: 0 T: 0 P: 2 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To be able to identify solids, liquids and gases, and their main properties.
- To be able to identify changes of state.
- To be able to discuss changes of state in terms of the energy of molecules.
- Analyze motion, forces and motion, work and energy problems and their relationship to engineering applications.
- Conduct experiments on wooden bar and to identify its the strength
- Test a wire or cylindrical rod for its strength.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Study the elastic behavior and working of torsional pendulum.
2. Study the bending behavior of beams and analyse the expression for young's modulus.
3. Understand about the surface tension and viscosity of fluid.
4. Use different methods to determine the Young's modulus of different materials.
5. Use different methods to determine the Rigitity modulus of different materials.
6. Experience the practical knowledge on different matters.

ANY SIX EXPERIMENTS

1. To determine the Young's Modulus of the wooden by Optical Lever Method.
2. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
3. To determine the Young's modulus of the bar using pin and microscope – Non-uniform method.
4. To determine the Young's modulus of the bar using cantilever – Non-uniform method.
5. To determine the surface tension of water – capillary rise method
6. To determine the coefficient of viscosity by Stoke's method
7. Verification of laws of transverse vibration and frequency of tuning fork – Sonometer
8. Rigidity modulus – Torison pendulum
9. To determine the Young's modulus of the bar – Koenig's method
10. To determine the coefficient of viscosity of the liquid – Poiseuille's method

SUGGESTED READINGS

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. Elements of Properties of Matter by D.S. Mathur, S.Chand & Co.

SEMESTER – I

21PHU113 MATHEMATICS PRACTICAL – I 4H – 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

This course enables the students

- To develop skills for quantitative estimation using computer language.
- To code various differentiation and integration methods in a modern computer language.
- To plot the graphs of function
- Problem-solving through programming.
- Hands-on training using lab components.
- The usage of program to solve the differential equations.

Course Outcomes (COs)

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

1. Solve complicated matrix related problems like matrix inverse and matrix multiplication.
2. Acquire problem-solving skills through computer programming.
3. Plot various functions and parametric curves.
4. Solve the differential equations for physics problems
5. Gain the intellectual knowledge of complex functions and their applications.
6. Apply the mathematical concepts to physics problems with the aid of computer programming
7. Solve the geometry of the and plot variations of complex functions.

List of Practical

1. Finding addition, multiplication of two matrices.
2. Finding Inverse of a matrix and Determinant of a matrix.
3. Plotting of graphs of function $e^{ax + b}$, log(ax + b), 1/(ax + b), sin(ax + b), cos(ax + b), |ax +b| and to illustrate the effect of a and b on the graph.
4. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second
5. derivative graph and comparing them.
6. Evaluating definite integrals.(Line integral)
7. Evaluating integrals using Reduction formulae.
8. Solution of second order ordinary differential equations with initial conditions.
9. Solving system of linear differential Equations.

SUGGESTED READINGS

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd. Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Pub.
2. Numerical Recipes in C++: The Art of Scientific Computing, W.H. Press et.al., 2nd Edn., 2013, Cambridge University Press.
3. A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
4. An Introduction to computational Physics,T.Pang,2nd Edn., 2006,CambridgeUniv. Press

SEMESTER – II

21LSU201 **தமிழ் இரண்டாம் தாள்** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும் மேம்படுத்துதல்.
- ஆய்வுநோக்கை மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப் பயன் விளைவு

1. இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப் பாடமாக இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல் தமிழ்' ; 'இணைய தமிழ்' குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை வளர்ச்சி.
4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .
5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்கு உறுதுணையாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை.
6. மொழிபெயப்புத் துறைசார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்.

தாள்கள்வரிசையும் தேர்வுச்செயல்திட்டமும்

பகுதி-I தமிழ்

இளநிலைப்பட்ட அறிவியல் வகுப்புகள்

பருவம்	தாள்	கற்பிக்கும் நேரம்/ வாரம்	தேர்வு மணிகள்	மதிப்பெண் அக/எழுத்து	மொத்தம்	மதிப்பீடு
இரண்டு	II	4	3	40 / 60	100	4

அலகு – I : தமிழ் இலக்கிய வரலாறு- II (5 மணிநேரம்)

தமிழ் இலக்கிய வரிசையில் திருமுறைகளும் நாலாயிரத் திவ்யப்பிரபந்தமும் -பன்னிரு திருமுறைகள் அறிமுகம் - திருமுறை ஆசிரியர்களின் இலக்கியப் பங்களிப்பு-திருமுறைகளில் பக்திநெறியும் சமுதாய நோக்கும் - சமயக்குரவரின் அருள்நெறி - பன்னிரு ஆழ்வார்கள் வரலாறு - ஆழ்வார்களின் இலக்கியப் பங்களிப்பு - திவ்யப் பிரபந்தத்தில் பக்திநெறியும் இலக்கிய நயமும் - தமிழில் சிற்றிலக்கியக் காலமும் கருத்தும் - தொண்ணூற்றாறு வகைச் சிற்றிலக்கிய வரிசை - தமிழ் மொழியின் கவிதை - சிறுகதை – உரைநடை –இலக்கியங்களின் தோற்றம் – வளர்ச்சி – உத்திகள் – நாட்டுப்புற இலக்கியங்கள்-கொங்குநாட்டார் வாய்மொழி வழக்காறுகள்.

அலகு – II : பக்தி இலக்கியமும் சிற்றிலக்கியமும்: (12 மணிநேரம்)

அ). பக்தி இலக்கியம் (6 மணிநேரம்)

1. சைவம் - பெரியபுராணம் – இளையான்குடிமாறநாயனார் புராணம் - (**19 பாடல்கள்**) **.** (அம்பொன் நீடிய, கொண்டு வந்து, ஆளு நாயகர், செல்வம் மேவிய, மாரிக் காலத்து, ஈர மேனியை, நமக்கு முன்பிங்கு, செல்லல் நீங்க, மற்றம் மாற்றம், உள்ளம் அன்பு, காலினால் தடவி, வந்தபின் மனைவியாரும், முறித்தவை அடுப்பின், வழிவரும் இளைப்பினோடும், மனைவியார் கொழுநர், கணவனார் தம்மை, அழுந்திய இடருள், மாலயற் கரிய, அன்பனே அன்பர் பூசை)

2. வைணவம் – ஆண்டாள் நாச்சியார் திருப்பாவை: (11 பாடல்கள்): மார்கழித்திங்கள், வையத்து வாழ்வீர்காள், ஓங்கி உலகளந்த, ஆழி மழைக்கண்ணா, மாயனை மன்னுவட மதுரை, சிற்றம் சிறுகாலே, ஒருத்தி மகனாய், மாலே மணிவண்ணா, கூடாரை வெல்லும், கறவைகள் பின்சென்று, வங்கக்கடல் கடைந்த.

ஆ). சிற்றிலக்கியம் (6 மணிநேரம்)

1. **முக்கூடற் பள்ளு** - 2 பாடல்கள் - சித்திரக் காலிவாலான் (நெல்வகைகள்) குற்றாலத் திரிகூட மால்வரை (மீன் வகைகள்)
2. **நந்தி கலம்பகம்** - 5 பாடல்கள்- என்னையே புகழ்ந்தேன், பதிதொறு புயல்பொழி, இந்தப்புவியில், அடிவிளக்கும் துகில், வானுறுமதியை
3. **மதுரைச் சொக்கநாதர் தமிழ்விடு தூது** – தமிழின் சிறப்பு பாடியருள பத்துப்பாட்டும்-விளம்பக்கேள்.

அலகு – III: கவிதையும் சிறுகதையும் (16 மணிநேரம்)

அ). கவிதை இலக்கியம் (8 மணிநேரம்)

1. மகாகவி பாரதியார் – கண்ணன் – என் சீடன்
2. புரட்சிக்கவிஞன் பாரதிதாசன் – இளையார் ஆத்திசூடி - அழுபவன் கோழை
3. கவிமணி தேசிக விநாயகம் பிள்ளை – கோயில் வழிபாடு
4. கவிக்கோ. அப்துல்ரகுமான் – பாருக்குள்ளே நல்ல நாடு
5. சிற்பி பாலசுப்பிரமணியன் – மலையாளக் காற்று
6. கவிஞர் தாமரை – தொலைந்து போனேன்
7. கவிஞர் கரிகாலன் – விடுதலை

ஆ). சிறுகதை இலக்கியம் (8 மணிநேரம்)

1. சாபவிமோசனம் – புதுமைப்பித்தன்
2. நகரம் – சுஜாதா
3. அந்நியர்கள் – ஆர். சூடாமணி
4. இந்நாட்டு மன்னர் – நாஞ்சில்நாடன்

அலகு – IV : உரைநடை இலக்கியம் (8 மணிநேரம்)

1. ஆளுமைத்திறன் அறிவோம் - தன்னம்பிக்கை மாத இதழிலிருந்து
2. திருக்குறளும் சமுதாயவியலும் – முனைவர் புரிசை நடராசன்
3. தமிழ் – உயர்தனிச் செம்மொழி – முனைவர் இரா. குணசீலன்
4. நொய்யல் – முனைவர் ப. தமிழரசி

அலகு- V : அடிப்படை இலக்கணமும் பயன்பாட்டுத்தமிழும் – II (7 மணிநேரம்)

இலக்கணப் பயிற்சி: 1. அணி இலக்கணம்

உவமையணி - பிறிது மொழிதல் அணி - சிலேடை அணி - தீவக அணி - ஏகதேச உருவக அணி – வேற்றுமையணி – பின்வருநிலையணிக்கான விளக்கங்கள்.

2. **துறை சார் கலைச்சொல் பயன்பாட்டாக்கம்**
3. **படைப்பிலக்கியப் பயிற்சிகள்**
   1. மரபுக்கவிதை, புதுக்கவிதை, சிறுகதை, கட்டுரை படைப்பாக்க உத்திகள் - பயிற்சிகள்
   2. எழுத்தாளருடனான நேர்காணல் மற்றும் கள ஆய்வுக்கான வினா நிரல் தயாரித்தல் நுட்பங்களும் பயிற்சிகளும்.
4. **மொழிபெயர்ப்புப்பயிற்சிகள்**
   1. தமிழ்-ஆங்கில மொழிபெயர்ப்புப் பயிற்சிகள் -2.
   2. ஆங்கிலம்-தமிழ் மொழிபெயர்ப்புப் பயிற்சிகள்-2.

பாட நூல்: கற்பகச்சோலை – தமிழ் ஏடு.

வெளியீடு: மொழிகள் துறை – தமிழ்ப்பிரிவு,
கற்பகம் உயர்கல்விக்கழகம்

21ENU201 ENGLISH -II 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective:

- To refresh the grammar knowledge of the students to improvise their language.
- To make the students to speak and write error free English.
- To make the students understand different kinds of communication.
- To develop knowledge on the business environment communication.
- To help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

Course Outcome:

1. Strengthen the foundation of the language to elevate the command of standard grammar.
2. Inculcate the proper communication strategy.
3. Formulate and communicate persuasive arguments for specific business outcome.
4. Apply fundamentals of language for reading, writing and effective communication.
5. Standardize and demonstrate understanding of LSRW skills.
6. Introduce literature to enhance the moral and aesthetic values.

UNIT –I – Grammar

Voice, Idioms and Phrases, Clauses and Reported Speech

UNIT –II –Business and Technical Reports

Business Correspondence – Memo, Notices, Agenda, Minutes- Resume Writing- Report Writing- Letter Writing- Personal and Social Letters- E-mail Writing

UNIT –III – Communication Practice

Verbal and Non-Verbal Communication- Group Discussion and Seminars- Note-Taking and Note-Making

UNIT –IV – LSRW Skills

Listening Skills- Listening Talks and Presentations

Speaking Skills- Public Speaking- Preparatory steps, Time Management, Handling Questions and Meeting unexpected situations

Reading Skills- Language of Newspapers, Magazines and Internet

Writing Skills- Writing Paragraphs and Essays- Content Writing

UNIT –V – Literature

Prose- Morals in the Indian Context by Francis Nicholas Chelliah
Poetry- Telephone Conversation by Wole Soyinka
Short Stories- The Last Leaf by O' Henry

Suggested Readings

Oxford Handbook of Writing: St. Martins Handbook of Writing 2013 CU Press
Sound Business, Julian Treasure 2012OUP

SEMESTER – II

21PHU201 ELECTRICITY AND MAGNETISM 6H – 5C

Instruction Hours / week: L: 6 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- To establish grounding in electromagnetism in preparation for more advanced courses.
- The major concepts covered are: the abstraction from forces to fields using the examples of the gravitational, electric and magnetic fields, with some applications; the connection between conservative forces and potential energy; how charges move through electric circuits; the close connection between electricity and magnetism, leading to the discovery of electromagnetic waves.
- To use electromagnetic theory and principles in a wide range of applications.
- To understand the calculus along with physical principles
- To effectively solve problems encountered in everyday life, further study in science, and in the professional world.
- To gain confidence in their ability to apply mathematical methods to understand electromagnetic problems to real-life situations.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
2. Gain confidence in their ability to apply mathematical methods to understand electromagnetic problems to real-life situations.
3. Use an understanding of calculus along with physical principles to effectively solve problems encountered in everyday life, further study in science, and in the professional world.
4. Be able to use electromagnetic theory and principles in a wide range of applications.
5. Design experiments and acquire data in order to explore physical principles, effectively communicate results, and critically evaluate related scientific studies.
6. To develop an understanding of the principles of electricity and magnetism.

UNIT I - GAUSS THEOREM AND ITS APPLICATIONS

Coulomb's law of force – Scope of Coulomb's law – Limitations. Normal electric induction Gauss theorem, application of guass theorem - Electric intensity at a point immediately adjacent to a charged conductor - Energy stored in unit volume of an electric field.

Capacitance and Capacitors Spherical capacitor: Principle of capacitor - Cylindrical capacitor, Force of attraction between charged plates of a capacitor – capacity of a parallel plate capacitor; effect of introducing a dielectric slab between the plates – Guard ring condenser - polarization in dielectric materials.

UNIT II – INTRODUCTION TO MAGNETOSTATICS

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. magnetic field B; magnetization M; magnetic field intensity H; magnetic susceptibility and magnetic permeability; magnetic materials and magnetization; magnetic hysteresis -Brief introduction of dia-, para- and ferro-magnetic materials.

Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law – Applications of Ampere's law. BH Curve Hysterisis loop. Ballistic Galvanometer – Applications of Ballistic Galvanometer.

UNIT III

THERMO ELECTRICITY: Seebeck effect – Laws of thermo e.m.f – Peltier effect; Peltier Coefficient – determination of Peltier co-efficient – thermo dynamical consideration of Peltier effect – Thomson effect – Thomson Co-efficient – e.m.f generated in a thermocouple taking both Peltier effect and Thomson effect in the metals – Thermo electric power – Application of thermodynamics to Thermocouple – Thermoelectric diagrams and their uses.

UNIT IV – INTRODUCTION TO ELECTROMAGNETIC INDUCTION

Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. Self-Inductance – Mutual Inductance - Comparison of two inductances. Transformer principle and working.

UNIT V DYNAMICS OF CHARGED PARTICLES

Charged particles in a uniform and constant electric field – Charged particles in an alternating electric field – Charged particles in a uniform and constant magnetic field – magnetic focusing – charged particles in combined electric and magnetic field when the fields are parallel and are in mutually perpendicular direction. Positive rays and Cathode rays.

SUGGESTED READINGS

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
2. University Physics, Ronald Lane Reese, 2103, Thomson Brooks/Cole.
3. D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
4. D Halliday, R Resnick and J Walker, Fundamentals of Physics (Extended) 6th ed., John Wiley, 2001.

5. https://ocw.mit.edu/courses/physics/8-02t-electricity-and-magnetism-spring-2005/lecture-notes/
6. https://cpb-us-e1.wpmucdn.com/cobblearning.net/dist/e/1364/files/2014/03/Magnets-webquest-answers-2jdthlu.pdf

SEMESTER – II

21PHU202 PRINCIPLES OF ELECTRONICS 5H – 4C

Instruction Hours / week: L: 5 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To know about power semiconductor devices frequently used in industries.
- To have an idea about the principle and operation of circuits using semiconductor devices to control various operations.
- To acquaint with industrial and domestic applications of power semiconductor devices.
- To understand the concepts of electronic devices and their communication systems.
- To develop their knowledge on digital communication technology.
- To design the electronic circuits and their block diagrams with number of different electronic components.

Course outcomes

After successful completion of the course, the student is expected to

1. Understand the construction and working of different semiconductor devices.
2. Study about Basics electronics Technology
3. Develop explicit problem-solving strategies that emphasize qualitative analysis steps
4. to describe and clarify the problem.
5. Develop knowledge on design trade-offs in various digital electronic families with a view towards reduced power consumption
6. Realize the importance of different electronic communication systems.
7. Design power electronic circuit for real time application like rectifier and convertor etc.

UNIT I ELECTRICITY

Positive and Negative Polarities – Electrons and Protons in the atom –Conductors, Insulators and semiconductors. The coulomb unit of electric charge – the volt unit of Potential Difference – charge in motion is current – Resistance, Conductance – the closed circuit – the direction of the current – Direct current and Alternating Current – sources of electricity. Resistors: Types – Colour coding – Variable resistors – Rheostats and Potentiometers –Power rating of resistor – Resistance in series – Parallel, simple problems.

UNIT II CAPACITORS AND INDUCTORS

Capacitors:

Charge Stored in Dielectric – Charging and Discharging Capacitor – The Farad Unit of Capacitance – Typical Capacitors – Electrolytic Capacitors – Parallel Capacitors – Series Capacitors.

Inductors: Types of Inductors: Fixed, Variable - Self and Mutual Inductance - Faraday's Law and Lenz's law of Electromagnetic Induction - Energy Stored in an Inductor - Inductance in Series and Parallel - Testing of Resistance and Inductance using Multimeter

UNIT III

CIRCUIT CONCEPTS: Ohms Law: The current – the Voltage – the Resistance – Practical, Multiple units. Electric Power – Power dissipation in resistance – Power formulas – choosing the resistor for a circuit. Kirchoff's law-Kirchoff's current law - Analysis of resistance in series circuits, parallel circuits and series parallelcircuits - Voltage divider; Current divider; Concept of voltage source and current source - Voltage source in series and current source inparallel - Simple problems in DC circuits.

UNIT IV

NETWORK THEOREMS: Superposition theorem - Thevenin Theorem - Thevenizing a circuit with two voltage sources – thevenizing a bridge circuit - Norton's Theorem - Thevenin Norton conversion - Conversion of voltage and current sources - Millman's Theorem - Star and Delta conversion - Maximum power transfer theorem - Simple problems in DC circuits.

UNIT V

AC CIRCUITS: Introduction to Sinusoidal wave - RMS value - Average value - AC circuits with resistance - Circuits with XL alone – Circuits with XC alone - Series reactance and resistance - Parallel reactance and resistance - Series parallel reactance and resistance - Real power - Series resonant circuit – Parallel resonant circuit - Q factor. Passive filters: Low pass filters, High pass filters, Band pass filters and Band rejection filters.

SUGGESTED READINGS

1. BernardGrob ―Basic Electronics Tata McGraw-Hill Publishing Company Limited, 9thEdition. Reference books:
2. S.Salivahanan, N.Suresh Kumar, A.Vallavaraj "Electronic Devices and Circuits"-Tata McGraw-Hill Publishing Company Limited, New Delhi. 1998.

3. B.L.Theraja, “Basic Electronics-Solid State Devices”,S.Chand Company Ltd. 2000
4. Millman's Electronic Devices And Circuits (3rd Edition), Jacob Millman, Christos C. Halkias, Sathyabarta Jit, Mc Graw Hill.
5. Electronic devices and integrated circuits, A.K. Singh, 2011, PHI Learning Pvt. Ltd.
6. Physics of Semiconductor Devices, By Massimo Rudan, 2015, Springer New York Heidelberg Dordrecht London, ISBN- 978-1-4939-1150-9,
7. Semiconductor Devices: Physics and Technology by S. M. Sze, John Wiley & Sons Singapore Pte. Limited, 2012, ISBN - 9780470873670.
8. Linear Integrated Circuits & Applications by U.A.Bakshi, A.P.Godse, Technical Publications Pune, 2010, ISBN- 9788184317619.

SEMESTER – II

21PHU203 **MATHEMATICS - II** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- The Concept of Fourier analysis and solving boundary value problems.
- Techniques of Fourier and Laplace transform
- To solve differential equations.
- Numerical techniques of differentiation and integration.
- The basic concepts of Reduction of second order Linear Equations to canonical forms
- The Systems of linear differential equations and its applications.
- The concept of second order linear homogeneous, non-homogeneous differential equations with constant coefficients.

Course Outcomes (COs)

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

1. Appreciate the physical significance of Fourier series
2. Understandthe mathematical principles on transforms.
3. Apply mathematical foundation to formulate and solve problems arising in physics
4. Synthesize numerical techniques for practical problems.
5. Solve the numerical problem for physics
6. Apply the numerical methods to solve the real life problem

UNIT-I: VECTOR CALCULUS

Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl - Integration of vectors – line integral – surface integral – Green's theorem in the plane – Gauss divergence theorem – Stokes theorem – (Statements only).

UNIT II: PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations by elimination of arbitrary constants and functions - Definitions of general, particular and complete solutions - solving standard forms $f(p, q) = 0$, $f(x,p,q) = 0$, $f(y,p,q) = 0$, $f(z, p, q) = 0$, $f(x,p) = f(y,q)$, $z = px + qy + f(p,q)$ - Lagrange's Differential equations $Pp+Qq = R$.

UNIT III: FOURIER SERIES

Dirichlet's Conditions – Definition of Fourier series – Finding Fourier Coefficients for a given periodic function 2π with interval $(0,2\pi)$ and $(-\pi, \pi)$ – Odd Functions – Even functions – Half Range Sine Series – Half Range Cosine series – Harmonic Analysis.

UNIT IV: MULTIPLE INTEGRAL

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

UNIT V: NUMERICAL METHODS

Solving simultaneous equations–Gauss Elimination method, Gauss Jordan method, Gauss Jacobi Method, Gauss – Seidel method. Numerical Integration – Trapezoidal Rule and Simpson's Rule.

SUGGESTED READINGS

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
5. Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
6. Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
7. Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books
8. https://tutorial.math.lamar.edu/classes/de/fourierseries.aspx
9. https://math.mit.edu/~gs/cse/websections/cse41.pdf
10. http://www.csun.edu/~ac53971/courses/math650/fourier.pdf

SEMESTER – II

21PHU211 ELECTRICITY AND MAGNETISM PRACTICAL 2H – 1C

Instruction Hours / week: L: 0 T: 0 P: 2 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- To establish grounding in electromagnetism in preparation for more advanced courses.
- Assess the contributions of physics to our evolving understanding of global change and sustainability while placing the development of physics in its historical and cultural context.
- To gain practical knowledge on RC Circuit
- To develop skills in the basic concept of electric forces.
- To understand Gauss law and its applications.
- To gain practical knowledge on magnetic moment.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Gain practical knowledge on RC Circuit
2. Develop skills in the basic concept of electric forces.
3. Understand Gauss law and its applications.
4. Gain practical knowledge on magnetic moment.
5. Determine a Low Resistance by Carey Foster's Bridge
6. Compare capacitances using De'Sauty's bridge

ANY SIX EXPERIMENTS

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B & its variation in a Solenoid (Determine dB/dx).
5. To study the Characteristics of a Series RC Circuit.
6. To study a series LCR circuit and determine its (a) Resonant Frequency,
7. To determine a Low Resistance by Carey Foster's Bridge.
8. TAN A – Determination of magnetic moment of the bar magnet
9. TAN B – Determination of magnetic moment of the bar magnet
10. Measurement of charge and current sensitivity of Ballistic galvanometer
11. Calibration of low range voltmeter - Potentiometer

SUGGESTED READINGS

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SEMESTER – II

21PHU212 PRINCIPLES OF ELECTRONICS PRACTICAL 2H – 1C

Instruction Hours / week: L: 0 T: 0 P: 2 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- The objective of this paper is to give information about different analog electronic circuits and their applications.
- To understand operation of semiconductor devices.
- To study the characteristics of a Bipolar Junction Transistor in CE configuration.
- To study the various biasing configurations of BJT for normal class A operation.
- To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
- To design an inverting amplifier using Op-amp for dc voltage circuits

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Understand the basics of diode
2. Analyse the characteristics of Bipolar Junction Transistor
3. Perform the procedures for the working of RC-coupled transistor
4. Analyse the relationship between V-I & power curves
5. Understand the applications of Op-amp
6. Develop the ability to analyze and design analog electronic circuits using discrete components.
7. Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier.

Any 6 experiments

1. To study V-I characteristics of PN junction diode.
2. To study the V-I characteristics of a Zener diode.
3. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
6. To study the frequency response of voltage gain of a RC-coupled transistor amplifier.
7. To design Adder and Subtractor using Op-Amp

8. To design a phase shift oscillator of given specifications using BJT.
9. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain
10. To design inverting amplifier using Op-amp (741,351) and study its frequency response
11. To design non-inverting amplifier using Op-amp (741,351) & study its frequency response

SUGGESTED READINGS

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
2. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
3. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
4. Electronic Devices & circuit Theory, R.L. Boylestad & L.D. Nashelsky, 2009, Pearson

SEMESTER – II

21AEC201 ENVIRONMENTAL STUDIES 3H – 3C

Instruction Hours / week: L: 3 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- To create the awareness about environmental problems among people.
- To develop an attitude of concern for the environment.
- To motivate public to participate in environment protection and improvement.
- To understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- To apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- To gain knowledge on environmental issues.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
7. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as interdisciplinary scholars and / or practitioners.

Unit I – INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS

Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit II - NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES

Natural resources - Renewable and Non – Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources - Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources - Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit III - BIODIVERSITY AND ITS CONSERVATION

Levels of biological diversity - genetic, species and ecosystem diversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Unit IV - ENVIRONMENTAL POLLUTION

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution. Nuclear hazards and human health risks. Solid waste management and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Case studies.

Unit V - SOCIAL ISSUES AND THE ENVIRONMENT

Concept of sustainability and sustainable development. Water conservation - Rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act). International agreements (Montreal and Kyoto protocols). Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG

vehicles in Delhi). Human population growth: Impacts on environment, human health and welfare.

SUGGESTED READINGS

1. Tripathy.S.N. & Sunakar Panda. (2004). Fundamentals of Environmental Studies. 2nd Edition. New Delhi: Vrianda Publications Private Ltd.
2. Arvind Kumar. (2004). A Textbook of Environmental Science. New Delhi: APH Publishing Corporation.
3. Verma P.S., & .Agarwal. V.K. (2001). Environmental Biology :Principles of Ecology. New Delhi: S.Chand and Company Ltd.
4. Anubha Kaushik, C.P. & Kaushik, (2004). Perspectives in Environmental Studies. New Delhi: New Age International Pvt. Ltd. Publications.
5. Singh, M.P., Singh, B.S. & Soma S. Dey, (2004). Conservation of Biodiversity and Natural Resources. Delhi: Daya Publishing House.
6. Daniel B.Botkin & Edward A.Keller. (1995). Environmental Science. NewYork: John Wiley and Sons, Inc.
7. Uberoi, N.K., (2005). Environmental Studies, New Delhi, India: Excel Books Publications.

SEMESTER – III

21PHU301 WAVE AND OPTICS 4H-4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- This course builds the ideas of harmonic motion to cover in depth concept of waves in physics with particular emphasis on light waves as an example.
- The foundation of the course is Fourier theory, which will then be used to understand dispersion of waves, image formation in optics and diffraction and other aspects of Fourier optics.
- Understand how the principle of superposition is applied when two pulses meet
- Define three terms to describe periodic waves: speed, wavelength, and frequency
- Explain the characteristics of transverse and longitudinal waves.
- Identify the relationship between the speed, wavelength, and frequency of a wave.

Course Outcome

After successful completion of the course, the student is expected to

1. To develop an understanding of the principles of optics.
2. Understand linear, time-invariant systems.
3. Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems
4. To build connections between mathematical development and conceptual understanding.
5. Understand dispersion in waves and model dispersion using Fourier theory.
6. Understand optical phenomena such as polarization, birefringence, interference and diffraction in terms of the wave model.

UNIT I

WAVE OPTICS: Introduction to particle theory of light and wave theory of light - propagation of light waves – Maxwell’s equation -. Definition and Properties of wave front - Huygen's wave theory of light - Huygen's principle - construction of Huygen's wavefront - Laws of reflection and refraction of a plane wave front at a plane surface- Laws of reflection and refraction of a spherical wave front at a spherical surface.

UNIT II

INTERFERENCE: Introduction to Interference -Young’s double slit experiment –theory and experiment of Fresnel’s Bi-prism - Coherent sources and their production - Conditions for

observing interference constructive and destructive interference – Calculation of thickness of the Coherent sources by division of amplitude - Interference in thin films - reflected and transmitted light - Theory of air wedge -Newton's Rings: Measurement of wavelength and refractive index - Determination of Refractive index of a liquid. Experiment to find the velocity of light – Focault's rotating mirror method, Michaelson's method.

UNIT - III

Diffraction: Introduction to Fresnel and Fraunhofer diffraction - Fresnel diffraction Concept of Fresnel's half period zones - Theory of rectilinear propagation - Construction and working of Zone plate - Comparison of Zone plate with lens - Theory of diffraction due to a straightedge - Fraunhofer diffraction theory at a single slit - Theory of plane diffraction grating - Discussion of Dispersive power of grating –Applications of Resolving power - Expression for resolving power of prism, grating and telescope.

UNIT IV

Polarization: Introduction to Polarization and types of polarized light –production methods – Brewster's law - Huygens' explanation of double refraction -Theory of superposition of two plane polarized waves with perpendicular vibrations- Theory of retarding plates - Quarter wave plates and Half wave plates - Production of linearly, elliptically and circularly polarized light - Detection of linearly, elliptically and circularly polarized light Optical activity - Fresnel's explanation, Laurent's half shade polarimeter. Application of polaroid's.

UNIT-V

Applications of Optics: The Electro-optic effect - Applications of Pockel effect and Kerr effect - Acousto-optic effect - Magneto optic effect.

Fiber Optics: Total internal reflection – modes of propagation of light in optical fibers – evaluation of numerical aperture and acceptance angle - types of optical fibers– fiber optical communication system (block diagram).

SUGGESTED READINGS

1. Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill Principles of Optics, B.K. Mathur, 1995, Gopal Printing
2. Fundamentals of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand

Publications
3. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley.
4. Pedrotti, Frank L.; Pedrotti, Leno S.; Pedrotti, Leno Matthew, Introduction to optics, 3.ed.: Harlow, Essex: Pearson, 2014.
5. Young, Hugh D.; Freedman, Roger A.; Ford, A. Lewis; Sears, Francis Weston 13th ed., international edition: San Francisco: Pearson Addison Wesley, cop. 2012.
6. https://www.cleariitmedical.com/2019/05/physics-notes-wave-optics.html
7. https://nucleoniitjeekota.com/topic-notes.php?topic=Wave%20Optics.

SEMESTER – III

21PHU302 PHYSICS OF ELECTRONIC DEVICES AND CIRCUITS 4H-4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- The objective of this paper is to give information about different analog electronic circuits and their applications.
- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To implement mini projects based on concept of electronics circuit concepts.
- To apply concepts for the design of Regulators and Amplifiers.
- To verify the theoretical concepts through laboratory and simulation experiments.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Apply concepts for the design of Regulators and Amplifiers.
2. Acquire knowledge about how a semiconductor diode rectifies an input ac signal
3. Verify the theoretical concepts through laboratory and simulation experiments.
4. Be able to know about the Field Effect Transistors, their principles and applications
5. Learn how to construct a transistor amplifier and how its gain varies with frequency
6. To implement mini projects based on concept of electronics circuit concepts.

UNIT I

SEMICONDUCTOR DIODES

Introduction, Semiconductor, Energy band description of semiconductors, Hole current, Intrinsic semiconductor and extrinsic semiconductor, n-type and p-type semiconductor, semiconductor diode, equivalent circuit of crystal diode, pn junction, properties of pn junction, Applying D.C voltage across pn junction or biasing a pn junction, Current flow in a forward biased pn junction, Breakdown voltage, Knee voltage. Semiconductor diode, equivalent circuit of crystal diode, Forward current, Peak inverse voltage, Reverse current.

UNIT II

TWO-TERMINAL DEVICES AND THEIR APPLICATIONS

Half-Wave rectifier, Full-Wave rectifier: Centre-Tap Full-Wave rectifier, Full-Wave Bridge rectifier, Ripple factor, Filter circuits and its types, Voltage stabilization, Zener diode and its equivalent circuit, Principle and Working of LED, Photo-diode and Solar cell. Transistor, Transistor action: Working of NPN and PNP transistor, Common emitter

connection, Common base connection, Relations between α and β, Transistor load line analysis, Operating point, Cut off, Saturation and Active region.

UNIT III

AMPLIFIERS

Transistor Biasing and Stabilization Circuits. Fixed base biasing and Voltage divider bias method. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance, Current, Voltage and Power Gains. Classification of power amplifiers: Class A, B & C Amplifiers. RC coupled amplifier: frequency response curve. Feedback in amplifiers: Feedback, Positive feedback and negative feedback.

UNIT IV

SINUSOIDAL OSCILLATORS

Sinusoidal oscillator, Explanation of Bark hausen criterion. Types of oscillators: Hartley and Colpitt's oscillator, Phase shift and Wien bridge oscillator. Operational Amplifiers: Operation amplifier, CMRR, A.C. analysis of OP-Amp: Practical and Ideal OP-Amp, Slew rate, Frequency response of an OP-Amp.

UNIT V

APPLICATIONS OF OP-AMPS

Inverting and Non-Inverting amplifier, Voltage follower, Multistage OP-Amp circuits, Averaging or Adding amplifier, Subtractor amplifier, OP-Amp Integrators and Differentiators, Square wave generator, Zero-crossing detector, Level detector.

SUGGESTED READINGS

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. Solid State Electronic Devices, B.G.Streetman & S.K.Banerjee, 6th Edn.,2009, PHI Learning
4. Electronic Devices & circuits, S.Salivahanan & N.S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
5. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
6. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,

Oxford University Press.
7. Electronic circuits: Handbook of design & applications, U.Tietze, C.Schenk,2008, Springer
8. Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
9. Microelectronic Circuits, M.H. Rashid, 2nd Edition, Cengage Learning Electronic Devices, 7/e Thomas L. Floyd, 2008
10. ilectureonline.com/lectures/subject/ENGINEERING/28/255
11. https://www.coursera.org/lecture/electronics/2-1-introduction-to-op-amps-and-ideal-behavior-Q5Di2
12. https://www.electronics-tutorials.ws/opamp/opamp_1.html

SEMESTER – III

21PHU303A RENEWABLE ENERGY AND ENERGY HARVESTING 3H - 3C

Instruction Hours / week: L: 3 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To understand the various forms of conventional energy resources.
- To learn the present energy scenario and the need for energy conservation
- To explain the concept of various forms of renewable energy
- Give outline division aspects and utilization of renewable energy sources for both domestics and industrial application.
- To provide the awareness and need of renewable energy.
- To describe the uses, needs and applications of various renewable energy sources.

Course Outcome

After successful completion of the course, the student is expected to

1. Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
2. Understand the concept of hydro energy resources and their classification.
3. Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.
4. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
5. Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications.
6. Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.

UNIT -I

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, solar energy.

UNIT- II

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, flat plate collector, solar distillation,

solar cooker, solar green houses, absorption air conditioning.

Solar Radiation, Measurements of Solar Radiation, Solar Direct Thermal Applications - solar water heater, Solar Thermal Power Generation, Fundamentals of Solar Photo Voltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV Applications.

UNIT -III

Energy harvesting: Wind Energy: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

UNIT - IV

GEOTHERMAL ENERGY

Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC.

UNIT – V

Piezoelectric Energy Harvesting: Physics and Characteristics of Piezoelectric Effects, Materials, and Mathematical Description of Piezoelectricity Effect. Piezoelectric Parameters, and Modeling Piezoelectric Generators, Power Electronic Interfaces for Piezoelectric Energy Harvesting, Piezoelectric Energy Harvesting Applications.

SUGGESTED READINGS

1. Non-conventional energy sources, B.H. Khan, McGraw Hill
2. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, 3rd Edn., 2012, Oxford University Press.
4. Renewable Energy, 3rd Edition,

5. Solar Energy: Resource Assesment Handbook, P Jayakumar, 2009
6. Biomass Energy, Oxford &IBH Publication Co.
7. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
8. https://www.edfenergy.com/for-home/energywise/renewable-energy-sources
9. https://www.nrdc.org/stories/renewable-energy-clean-facts
10. https://www.nationalgeographic.com/environment/energy/reference/renewable-energy/

SEMESTER – III

21PHU303B PHYSICS WORKSHOP SKILL 3H - 3C

Instruction Hours / week: L: 3 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives:

The objective of this course is

- To enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode.
- To extend their skill on workshop tools and their usages.
- To apply their knowledge on making new materials by using various operating machines.
- To develop their knowledge about household electrical appliances, electric shock, etc.
- To use their knowledge towards industries.
- To think and correlate the physics of engineering materials and their applications.

Course outcome

After successful completion of the course, the student is expected to

1. Acquire knowledge about various types of wiring systems, wiring tools, lighting & wiring accessories, wiring estimation & costing, etc.
2. To get familiarized with the welding process.
3. Understand the concept of machining, forming and welding process.
4. Develop knowledge on Operation of oscilloscope.
5. Acquire knowledge about household electrical appliances, electric shock, etc.
6. To get familiarized with the properties of different materials- metals and non metals

UNIT -I

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier caliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

UNIT -II

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood.

UNIT- III

Machine processing: Common machine tools: lathe - Cutting tools - Cutting of a metal sheet using blade - lubricating oils, shaper, drilling and milling - surface machines. Smoothening of cutting edge of sheet using file. Use of bench vice and tools for fitting.

UNIT -IV

Electrical Skill: Alternating Current and Voltage - Transformers: Working principle, construction and classification - Three- Phase transformers - Induction Motors - Single Phase Induction Motors

Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

UNIT -V

Refrigeration and Air Conditioning System: Introduction, Performance of machine, Refrigerating machine, vapour compression cycle, simple vapour absorption cycle.

Air Conditioning System: Purpose of Air Conditioning, Factors affecting air conditioning, Evaporating cooling system in a desert country, window air conditioning.

SUGGESTED READINGS

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Electrical Machines by Bhattacharya. Tata McGraw Hill Co.
5. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
6. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480
7. https://www.electronics-notes.com/articles/test-methods/oscilloscope/scope-basics.php
8. https://www.ibiblio.org/kuphaldt/socratic/output/scope1.pdf
9. https://ocw.mit.edu/courses/mechanical-engineering/2-996-biomedical-devices-design-laboratory-fall-2007/lecture-notes/lecture02.pdf
10. https://www.iitk.ac.in/ee/data/pcb/pcb-lab.pdf

SEMESTER – III

4H - 4C

21PHU304 CHEMISTRY - I

Instruction Hours/week: L: 4 T:0 P:0 **Marks: Internal:40 External: 60 Total:100**

Course Objectives

The student should know

- The molecular orbital theory, preparation and properties of inorganic compounds.
- Theory of covalent bond, polar effects and stereochemistry of organic compounds.
- To know about the important industrial chemicals like silicones, fuel gases and fertilizers and their impact on environment.
- To get intrest on elements of photochemistry, chemical kinetics and chromatography.
- To gain knowledge about the dyes, chemotherapy and vitamins.
- Correlate the chemistry with physics concpts and their applications.

Course Outcome

After successful completion of the course, the student is expected to

1. The molecular orbital theory, preparation and properties of inorganic compounds.
2. Theory of covalent bond, polar effects and stereochemistry of organic compounds.
3. About important industrial chemicals like silicones, fuel gases and fertilizers and their impact on environment.
4. Elements of photochemistry, chemical kinetics and chromatography.
5. Know about the dyes, chemotherapy and vitamins.
6. Understand the concept of chemical bondings and their applications.

UNIT-I

Chemical Bonding: Molecular orbital theory-linear combination of atomic orbitals-bonding and antibonding molecular orbitals-energy level diagram-bond order- M.O. configuration of H_2, N_2 and F_2 molecules. Diborane: Preparation, properties and structure. $NaBH_4$: Preparation and uses. Borazole: Preparation and properties. Interhalogen compounds: ICl, BrF_3, IF_5 - preparation, properties, uses and structure. Basic properties of iodine. Compounds of sulphur: Sodium hydrosulphite- preparation, properties, uses and structure. Per acids of sulphur: Preparation, properties, uses and structure.

UNIT- II

Covalent Bond and Stereoisomerism: Covalent Bond: Orbital overlap, hybridization and geometry of CH_4, C_2H_4 and C_2H_2. Polar effects: Inductive effect-electromeric effect-mesomeric effect- steric effect- hyperconjugation. **Stereoisomerism:** Elements of symmetry-

polarised light and optical activity-isomerism in tartaric acid-racemisation- resolution-geometrical isomerism of maleic and fumaric acids-keto-enol tautomerism of acetoacetic esters.

UNIT-III

Industrial Chemistry: Silicones: Synthesis, properties and uses. Fuels gases: Natural gas-water gas-semi water gas-carbureted water gas-producer gas- oil gas (Manufacturing details not required).Fertilizers: NPK fertilizer-ammonium sulphate-urea-superphosphate of lime-triple superphosphate- potassium nitrate-ammonium nitrate. Pollution: Water, air and soil pollution-sources and remedies-acid rain-ozone hole-greenhouse effect.

UNIT-IV

Elements of Photochemistry, Chemical Kinetics and Chromatography: Elements of Photochemistry: Photochemical laws-Beer Lambert's law-Grotthuss-Draper law-Stark-Einstein law (statement only). **Chemical Kinetics:** Rate-order-molecularity-pseudo first order reactions-zero order reactions-determination of order of reaction-measurement of order and rates of reactions-effect of temperature on reaction rate-energy of activation. **Chromatography:** Principles and applications of Column, Paper and Thin Layer Chromatography.

UNIT- V

Dyes, Chemotherapy and Vitamins: Dyes: Terms used chromophore, auxochrome, bathachromic shift and hypsochromic shift- classification of dyes– based on chemical structure and application-one example each for azo, triphenylmethane, vat and mordant dyes-preparation.

Chemotherapy: Preparation, uses and mechanism of action sulpha drugs- preparation and uses of prontosil, sulphadiazine and sulphafurazole-structure and uses of pencillins and Chloromycetin. **Vitamins:** Diseases caused by the deficiency of vitamins A, B_1, B_2, C and D-sources of these vitamins.

Suggested Readings

1. Thangamani, A. (2018). Text Book on Allied Chemistry (1st Edition). Coimbatore: Karpagam Publication.

2. Puri, B.R., Sharma, L. R., & Kalia, K. C. (2017). Principles of Inorganic Chemistry (33rd Edition). Jalandar: Vishal Publishing Company.
3. Bahl, A., & Bahl, B.S. (2015). A Textbook of Organic Chemistry (21st Revised Edition). New Delhi: S.Chand & Company Pvt. Ltd.
4. Puri, B. R., Sharma, L. R. & Pathania, M. S. (2014). Elements of Physical Chemistry (46th Edition). Jalandhar: Vishal Publishing Company.
5. Gopalan, R., & Sundaram, S. (2013). Allied Chemistry (III Edition). New Delhi: Sultan Chand & Sons.
6. http://chemocare.com/chemotherapy/health-wellness/vitamins-and-cancer.aspx
7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3389405/

SEMESTER – III

20PHU311 WAVE AND OPTICS PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- Understand and working of polarimeter.
- Understand the resolving power of different optical instruments.
- To experience the practical difficulties to find the physical constant values.
- To apply the theoretical knowledge into the experiments and find the solutions.
- Students will be observe the readings practically.
- Students will experience the phenomena of reflection, refraction, etc.,

Course Outcomes

After successful completion of the course, the student is expected to

1. Gain knowledge on various theories of light.
2. Acquire skills to identify and apply formulas of optics and wave physics.
3. Understand the properties of light like reflection, refraction, interference, and diffraction etc.,
4. Understand the applications of diffraction and polarization.
5. Determine the different optical properties by using various apparatus.
6. Know the importance of optical materials in the industrials.

Any 8 Experiments

1. Spectrometer – Determination of the angle of the prism and refractive index of the prism.
2. Spectrometer – To draw the i-d curve for a given prism and hence to calculate the refractive index of the material.
3. Spectrometer – Determination of wavelength of spectral lines of mercury
4. Spectrometer – Determine the dispersive power and resolving power of the material of the given prism.
5. Spectrometer – To determine the Resolving Power of a Prism.
6. Spectrometer – Determination of wavelength of spectral lines of Na atomes by using grating
7. Determine the specific rotation of Sugar, Glucose using polarimeter.
8. To determine wavelength of sodium light using Newton’s Rings.
9. Determination of refractive index of water using Newton’s Rings.
10. Determine the thickness of the given wire using air wedge method

11. To determine the wavelength of Laser light using Diffraction grating.
12. Fraunhoffer diffraction at single slit using He-Ne laser.
13. To determine wavelength of sodium light using Fresnel Biprism.
14. Determine the thickness of the given wire by diffraction pattern using He-Ne laser.
15. Verification of Malus law using half and quater wave plate.

SUGGESTED READINGS

1. Practical Physics and Electronics by C.C. Ouseph, U.J. Rao, V.Vijayendran, 2016, S.Viswanathan, Printers & Publishers Pvt Ltd
2. Advanced level Physics practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SEMESTER III

4H-2C

21PHU312 PHYSICS OF ELECTRONIC DEVICES AND CIRCUITS PRACTICAL

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To know about semiconductor devices frequently used in industries.
- To acquaint industrial and domestic applications of semiconductor devices.
- To experience the practical difficulties to find the physical constant values.
- To apply the theoretical knowledge into the experiments and find the solutions.
- To understand operation of diodes, transistors in order to design basic circuits.
- To design, fabricate and test the different electronic circuit.

Course Outcome

After successful completion of the course, the student is expected to

1. By the end of this subject, students should have acquired reasonable proficiency in the analysis and design of basic electronic circuits.
2. Apply the concepts of basic electronic devices to design various circuits.
3. Understand operation of diodes, transistors in order to design basic circuits.
4. Design small and large signal amplifier circuits for various practical applications.
5. The course as a whole outline some ways of thinking about analog circuits that hopefully will help to develop intuition.
6. Design, fabricate and test small electronic circuit.

Any 6 Experiments

1. To design a power supply using bridge rectifier and study effect of C-filter.
2. To design the active Low pass and High pass filters of given specification.
3. To design the active filter (wide band pass and band reject) of given specification.
4. To study the output and transfer characteristics of a JFET.
5. To design a common source JFET Amplifier and study its frequency response.
6. To design an Amplitude Modulator using Transistor.
7. To design an Astable multivibrator of given specifications using IC 555.
8. To study the zero-crossing detector and comparator
9. To design a digital to analog converter (DAC) of given specifications.
10. To study the analog to digital convertor (ADC) IC.
11. To investigate the use of an op-amp as a Differentiator and Integrator.

SUGGESTED READINGS

1. Physics of Semiconductor Devices, S.M. Sze & K.K. Ng, 3rd Ed.2008, John Wiley & Sons
2. Electronic devices and integrated circuits, A.K. Singh, 2011, PHI Learning Pvt. Ltd.
3. Op-Amps & Linear Integrated Circuits, R.A.Gayakwad,4 Ed. 2000,PHI Learning Pvt. Ltd
4. Electronic Devices and Circuits, A. Mottershead, 1998, PHI Learning Pvt. Ltd.
5. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
6. Introduction to Measurements & Instrumentation, A.K. Ghosh, 3rd Ed., 2009, PHI Learning Pvt. Ltd.
7. Semiconductor Physics and Devices, D.A. Neamen, 2011, 4th Edition, McGraw Hill
8. PC based instrumentation; Concepts & Practice, N.Mathivanan, 2007, Prentice-Hall of India.
9. https://www.electronics-tutorials.ws/
10. https://www.electrical4u.com/

SEMESTER – III

21PHU313A RENEWABLE ENERGY AND ENERGY HARVESTING 3H - 1C

PRACTICAL

Instruction Hours / week: L: 0 T: 0 P: 3 **Marks:** Internal: **40** External: **60** Total: **100**

End SEMESTER Exam: 3 Hours

Course Objective

- To describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the environment.
- To experience the practical difficulties to find the physical constant values.
- To apply the theoretical knowledge into the experiments and find the solutions.
- To obtain knowledge on renewable energy sources.
- To experience the needs of renewable energy sources.
- To develop the new concept of renewable energy sources.

Course Outcome

After successful completion of the course, the student is expected to

1. Demonstrate Training modules on Solar energy, wind energy, etc.
2. Convert units of energy-to quantify energy demands and make comparisons among energy uses, resources, and technologies.
3. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.
4. Understand the needs of renewable energy sources.
5. Experience the calculation of wind velocity.
6. Study of box type solar cooker.

Any 5 Experiments

1. Solar cell characteristics
2. Solar Water heater.
3. Solar distillation unit.
4. Analysis of wind velocity
5. Analysis of solar radiation for a day
6. Study of solar distiller.
7. Study of box type solar cooker.
8. Determination of instantaneous thermal efficiency of parabolic collector.
9. Efficiency and fill factor of solar cells.

SUGGESTED READINGS

1. Non-conventional Energy sources, G. D. RAI (4th edition), Khanna Publishers, Delhi.
2. Solar Energy, S.P. Sukhatme (second edition), Tata Mc.Graw Hill Ltd, New Delhi.
3. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers,Delhi.

SEMESTER – III

21PHU313B PHYSICS WORKSHOP SKILL PRACTICAL 3H - 1C

Instruction Hours / week: L: 0 T: 0 P: 3 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives

- To understand concepts of various basic equipments and devices.
- To gain a knowledge and to understand fundamental physical concepts.
- To experience the practical difficulties to find the physical constant values.
- To apply the theoretical knowledge into the experiments and find the solutions.
- To develop the skill on operating the modern machines.
- To enhance their knowledge on foundry tools.

Course Outcomes

After successful completion of the course, the student is expected to

1. Develop skills in assessing the quality of one's own and others' work
2. Develop skills in observation, interpretation, reasoning, synthesis, generalizing, predicting, and questioning as a way to learn new knowledge.
3. Use the multimeters and other electronic kits.
4. Operate the oscilloscope and PCB.
5. Make different shape of materials using foundry tools.
6. Construct the circuit of regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Any 4 Experiments

1. Screw guage, Vernier Calipers, Spherometer, Least count, Zero error, Measurement of thickness of the scale, breadth of scale, radius of curvature of a concave and convex surface.
2. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block.
3. Use of bench vice and tools for fitting. Make funnel using metal sheet.
4. Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB.
5. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

SUGGESTED READINGS

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

SEMESTER – III

21PHU314 CHEMISTRY PRACTICAL – I 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To make the student able to identify the elements and the functional groups present in an organic compound.
- To calculate percent composition given a molecular formula and molecular formula given the percent composition.
- To experience to find name of the salts, acids, bases and covalent compounds and provide formulas for these given a molecular formula.
- To identify weak and strong acids and bases and insoluble compounds using dissociation and solubility rules.
- Molarity i.e. moles per liter or decimeter is widely used unit of concentration.

Course Outcome

On successful completion of the course the students should have

1. Learnt about the qualitative analysis of organic compounds.
2. Learnt the detection of elements and functional groups present in an organic compound by systematic analysis.
3. Gain knowledge on basic test of organic compounds.
4. Differentiate the chemicals and their families.
5. Identify the compound whether it is aromatic or aliphatic.
6. Confirm different functional group by confirmation studies.

Systematic analysis of an organic compound

- Preliminary tests
- Detection of elements present
- Aromatic or aliphatic
- Saturated or unsaturated
- Nature of the functional group,
- Confirmatory tests– aldehydes, ketones, amines, amides, diamide, carbohydrates, phenols, acids, esters & nitro compounds.

Note: Each student should analyse minimum 6 compounds.

References:

1. Thomas, A.O. (2012). Practical Chemistry for B.Sc. Main Students. Cannanore: Kerala, Scientific Book Centre.
2. Ramasamy, R. (2011). Allied Chemistry Practical Book. Karur: Priya Publications.
3. Venkateswaran, V., Veeraswamy, R., & Kulandaivelu, A. R. (2015). Basic Principles of Practical Chemistry (2nd ed.). New Delhi: S. Chand Publications.

SEMESTER IV

21PHU401 THERMAL PHYSICS & STATISTICAL MECHANICS 4H - 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- The objective of this course is to give awareness on different laws of thermodynamics and its effect on different aspects in life.
- The aim of statistical mechanics is to give knowledge on the laws of classical thermodynamics for macroscopic systems using the properties of its atomic particles.
- To apply the concepts and principles of black-body radiation to analyze radiation phenomena in thermodynamic systems.
- To apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc.
- To give knowledge on the statistical mechanics and explain the applications of thermodynamics.
- To provide the correlation of thermodynamical problems with statistical concepts.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Identify and describe the statistical nature of concepts and laws in thermodynamics, in particular: entropy, temperature, chemical potential, Free energies, partition functions.
2. Realize the importance of thermo dynamical functions and their applications.
3. Statistical physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems.
4. Become familiar with various thermodynamic process and work done in each of these processes.
5. Apply the concepts and principles of black-body radiation to analyze radiation phenomena in thermodynamic systems.
6. Apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc.

UNIT - I

Laws of Thermodynamics:

Basic Concepts –Continuum and macroscopic approach, thermodynamic systems - thermodynamic properties and equilibrium - Zeroth law of thermodynamics - concept of temperature and heat. First Law of Thermodynamics: Energy – enthalpy - specific heats -

Various Thermodynamical Processes - Applications of first law. Second Law of Thermodynamics: Kelvin-Planck and Clausius statements - reversible and irreversible processes – concept of Entropy. Third law of thermodynamics.

UNIT - II

Thermodynamic Potentials:

Enthalpy – Gibbs - Helmholtz and Internal Energy functions -Equilibria and stability - Maxwell's relations and applications - Joule-Thompson Effect -Maxwell construction - Gibbs Phase Rule- Clausius- Clapeyron Equation - Expression for ($C_P - C_V$) and C_P/C_V-the TdS equations -Cooling due to adiabatic demagnetization.

UNIT - III

Kinetic Theory of Gases:

Introduction to the kinetic theory of an ideal gas - Law of equipartition of energy – Calculation of specific heat of monatomic gas. Concept of Real Gas: Van der Waals model - equation of state - comparison with experimental P-V curves. Derivation of Maxwell's law of distribution of velocities - Mean free path Transport Phenomena: Viscosity, Conduction and Diffusion. Liquification of hydrogen and helium

UNIT - IV

Basic Statistical Mechanics:

Introduction -comparison of classical and quantum statistics - Phase space, Macrostate Thermodynamic probability - Measurement of macro-properties of a thermodynamic system - Fluctuations in thermodynamic variables -Statistical interpretation of thermodynamics - Ensemble - Types of ensembles -Properties of ensembles - Application of Gibbs canonical ensembles -Black body Radiation - Stefan-Boltzmann law - Wien's displacement law.

UNIT – V

Statistical Mechanics with thermodynamics:

Statistical postulates – thermodynamic probability- Boltzman Relation between entropy and probability -Evaluation of Stirling's approximation - Maxwell-Boltzmann energy distribution law - quantum statistics - most probable distribution condition - Bose-Einstein energy distribution law - quantum statistics - most probable distribution condition - Fermi-Dirac

energy distribution law - quantum statistics - most probable distribution condition - comparison of three statistics.

SUGGESTED READINGS

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
2. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and
3. G.L.Salinger. 1988, Narosa
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.
6. https://study.com/academy/lesson/introduction-to-thermal-physics.html.
7. https://farside.ph.utexas.edu/teaching/sm1/Thermal.pdf

SEMESTER – IV

21PHU402 ATOMIC AND NUCLEAR PHYSICS 4H - 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective

- This is a basic course in Physics which deals with the phenomena taking place in the nuclear domain. Students will be given an insight into the dimensions of a nucleus.
- The aim is to tell them about the stability of nucleus and various other properties.
- The students will learn about various types of radiations and their interaction with matter.
- Students will learn the methods to find the mass and charge of any nucleus by using some instruments.
- To gain knowledge in the content areas of nuclear and particle physics.
- Students will learn the concept of nuclear reactions.

Course Outcomes

After successful completion of the course, the student is expected to

1. Determine the charge, mass of any nucleus by using various spectrographs.
2. They are able to understand the size of nucleus and all its properties.
3. Develop and communicate analytical skills in subatomic physics.
4. This course has led the students to understand interaction of various types of radiation with matter which they observe in their daily life. It's easy for them now to relate the theory to practical.
5. Acquire knowledge in the content areas of nuclear and particle physics, focusing on concepts that are commonly used in this area.
6. Students now know various methods of accelerating various types of particles to perform scattering experiments.

UNIT-I

The Atom: Structure of the Atom-Rutherford model-The Bohr atom model – Zeeman Effect - Spectral series of hydrogen atom- Critical Potentials – Method of excitation of atoms – Experimental determination of critical potentials by Davis and Goucher's method - Sommerfield's relativistic model– Vector atom model – Quantum numbers associated with Vector atom model – coupling schemes (LS, JJ coupling) – Pauli's exclusion principle – Periodic classification of elements

UNIT-II

Cathode Rays: Cathode rays – properties – e/m of cathode rays – Milliken's oil drop method – Positive rays – Properties – e/m of Positive rays: Thomson's parabola method – Aston's Bain's bridge - Determination of critical Potential – Franck and Hertz's experiment - Davi'srs and Goucher method.

UNIT- III

General Properties of Nuclei: History, basic terminology, Intrinsic properties, quantitative facts about size, shape, mass, charge density (matter energy), Nuclear force, binding energy, main features of binding energy versus mass number curve.

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model.

UNIT -IV

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

UNIT- V

Nuclear Reactors: Nuclear fission - Energy released in fission - Bohr and Wheeler's theory of nuclear fission - Chain reaction - Multiplication factor - Natural uranium and chain reaction - Design of nuclear reactor - Breeder reactor - Nuclear fusion - Source of stellar energy - Thermonuclear reactions - Transuranic elements.

Ionization chamber – Geiger-Muller counter – Proportional counter – Wilson's cloud chamber – Bubble chamber.

SUGGESTED READINGS

1. Introductory nuclear Physics by Kenneth S.Krane (Wiley India Pvt. Ltd., 2008). Concepts of nuclear physics by Bernard L.Cohen.(Tata Mcgraw Hill, 1998).
2. Introduction to the physics of nuclei & particles, R.A.Dunlap. (Thomson Asia, 2004)
3. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
4. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde

(IOP- Institute of Physics Publishing, 2004).
5. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000)
6. Nuclear and Particle Physics, Axel Maas, Lecture in SS 2016 at the KFU Graz.
7. Nuclear and Particle Physics, B. R. Martin, Online ISBN:9780470035474, 2006 John Wiley & Sons, Ltd.
8. https://www.springer.com/gp/physics/particle-nuclear-physics
9. https://iopscience.iop.org/book/978-0-7503-1140-3
10. https://www.wiley.com/en-us/Nuclear+and+Particle+Physics%3A+An+Introduction-

SEMESTER IV

21PHU403A BASIC INSTRUMENTATION SKILL 3H - 3C

Instruction Hours / week: L: 3 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- This course is to get exposure with various aspects of instruments and their usage through hands-on mode.
- To impart physical measurement skills.
- To make the students understand coherence between theoretical and practical measurement.
- Identify the signals and systems.
- To use the techniques, skills and modern technical tools necessary for technical or engineering practice.
- The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation and analysis of instruments.

Course Outcome

After successful completion of the course, the student is expected to

1. Develop skills to impart practical knowledge in real time solutions.
2. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
3. Understand the terminology used in various instruments.
4. Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
5. Connect concepts with the instruments to enhance understanding.
6. Understand measurement technology, usage of new instruments and real time applications in engineering studies.

UNIT-I

Basic of Measurement: Instrument's accuracy, precision, sensitivity, resolution range. Errors in measurements and loading effects-vernier caliper and screw guage- Multimeter**:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

UNIT- II

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance.

AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter**,** specifications and their significance.

UNIT- III

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only – no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance.

UNIT- IV

CRO Measurement: Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

UNIT- V

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic(balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

Digital Instruments: Principle and working of digital meters. Comparison of analog &digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

SUGGESTED READINGS

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
7. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India
9. https://www.electrical4u.com/electronic-dc-voltmeter/
10. https://electricalacademia.com/instrumentation-and-measurements/electronic-voltmeter-working-block-diagram/

SEMESTER IV

21PHU403B RADIATION PHYSICS – SAFETY MEASURMENTS 3H - 3C

Instruction Hours / week: L: 3 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective

- To identify the parts of the x-ray machine and explain their purpose and function.
- Explain how x-rays are produced and how they travel.
- Compare the effects that x-radiation has on a variety of biological and non-biological materials.
- Describe the spectrum of electromagnetic radiation.
- The goal is for the students to develop a basic knowledge of the methods employed in veterinary hospitals and clinics to protect employees and the veterinarians themselves against radiation exposure.
- Discuss the difference between a rotating anode and a fixed anode.
- Discuss which types of machines today have fixed and which have rotating anodes.

Course Outcomes

After successful completion of the course, the student is expected to

1. List and describe the function the parts of the x-ray machine
2. Describe the spectrum of electromagnetic radiation.
3. Understand the terminology used in radiation safty.
4. Gain knowledge of new concept in the field of radiation.
5. They are able to understand the Interaction of Radiation with matter.
6. Discuss the advantages to the utilization of a rotating anode.
7. Impact knowledge on different radiation detector.

UNIT- I

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

UNIT -II

Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma andNeutron and their sources, sealed and unsealed sources, **Interaction of Photons** - Photo-electric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, **Interaction of Charged Particles:** Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles-

Collision and Radiation loss (Bremsstrahlung), **Interaction of Neutrons**- Collision, slowing down and Moderation.

UNIT -III

Radiation detection and monitoring devices: Radiation Quantities and Units: Basicidea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

UNIT -IV

The Measurement and Detection of Charged Particles

The Wilson Cloud Chamber, The Bubble Chamber, Ionization Chambers, The Proportional Counter, The Geiger-Muller Counter, Scintillation Counters and Semiconductor Counters, The Spark Chamber, The Cerenkov Counter, Neutron Counting, The Photographic Plate.

UNIT- V

Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

SUGGESTED READINGS

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B. Massey, “Fundamental Physics of Radiology”. John Wright and Sons, UK, 1989.
5. J.R. Greening, “Fundamentals of Radiation Dosimetry”, Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
7. Martin and S.A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. W.R. Hendee, “Medical Radiation Physics”, Year Book – Medical Publishers Inc. London, 1981.
10. http://www.barc.gov.in/publications/nl/2003/200301-2.pdf

SEMESTER IV

21PHU404 **CHEMISTRY – II** **4H - 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives

- To make the student to be conversant with the extraction of metals, coordination chemistry, preparation, properties uses and structure of naphthalene and heterocyclic compounds.
- To make the student acquire sound knowledge of electrochemistry, biological functions of amino acids and proteins, thermodynamic laws, entropy, enthalpy change and the principles of electroplating.
- Learned how to think critically and analyze chemical problems.
- To use of modern computing resources involving chemical applications.
- To get knowledge of chemical principles appropriate to a physics program.
- General familiarity with the following areas in chemistry: analytical, biochemistry, inorganic, organic and physical.

Course Outcome (COs)

After successful completion of the course, the student is expected to

1. The student understand the metallurgy of metals and the theories of coordination compounds
2. The industrial importance of EDTA, haemoglobin and chlorophyll.
3. Understand the concept of aromaticity and preparation of aromatic compounds including heterocyclic compounds.
4. Understand the preparation, classifications and properties of amino acids, proteins and carbohydrates.
5. Understand the concepts of first and second laws of thermodynamics.
6. Understand the fundamentals of electrochemistry.

Unit-I

Metals and Coordination Chemistry: Metals: General methods of extraction of metals-methods of ore dressing-types of furnaces-reduction methods-electrical methods-types of refining-Van Arkel process-Zone refining. **Coordination Chemistry:** Nomenclature-theories of Werner, Sidgewick and Pauling-chelation and its industrial importance-EDTA-haemoglobin-chlorophyll-applications in qualitative and quantitative analysis.

Unit-II

Aromatic Compounds and Heterocyclic Compounds:

Aromatic Compounds: Aromaticity-Huckel's (4n+2) rule- aromatic electrophilic substitution in benzene- mechanism of nitration, halogenation, alkylation, acylation and sulphonation.

Naphthalene: Isolation, preparation, properties and structure. **Heterocyclic Compounds:** Preparation and properties of pyrrole, furan, thiophene and pyridine.

Unit-III

Amino acids, Proteins and Carbohydrates: Amino acids: Classification, preparation and properties. Peptides-preparation of peptides (Bergmann method only). **Proteins:** Classification, properties, biological functions and structure. **Carbohydrates:** Classification, preparation and properties of glucose and fructose- discussion of open chain and ring structures of glucose and fructose-glucose-fructose interconversion.

Unit-IV

Energetics: Type of systems-processes and their types - isothermal, adiabatic, reversible, irreversible and spontaneous processes-statement of first law of thermodynamics-need for the second law of thermodynamics-heat engine-Carnot cycle-efficiency-Carnot theorem-thermodynamics scale of temperature-Joule-Thomson effect- Enthalpy- Entropy and its significance-Free energy change.

Unit-V

Electrochemistry: Kohlrausch law-conductometric titrations-hydrolysis of salts-galvanic cells-E.M.F.-standard electrode potentials-reference electrodes- electrochemical series and its applications-buffer solution-buffer solution in the biological systems-pH and its determination-principles of electroplating.

SUGGESTED READINGS:

1. Veeraiyan, V., & Vasudevan, A.N.S. (2012). Text Book of Allied Chemistry (II Edition). Chennai: Highmount Publishing House.
2. Puri, B.R., Sharma, L. R., & Kalia, K. C. (2017). Principles of Inorganic Chemistry (33rd Edition). Jalandar: Vishal Publishing Company.
3. Bahl, A., & Bahl, B.S. (2015). A Textbook of Organic Chemistry (21st Revised Edition). New Delhi: S.Chand & Company Pvt. Ltd.
4. Puri, B. R., Sharma, L. R. & Pathania, M. S. (2014). Elements of Physical Chemistry (46th Edition). Jalandhar: Vishal Publishing Company.
5. Gopalan, R., & Sundaram, S. (2013). Allied Chemistry (III Edition). New Delhi: Sultan Chand & Sons.

SEMESTER – IV

21PHU411 THERMAL PHYSICS AND STATISTICAL MECHANICS PRACTICAL 4H-2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives

- The objective of this course is to learn how to apply thermodynamic principles in order to interpret thermodynamic systems and predict their behaviors.
- To determine Stefan's Constant.
- To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
- To apply the theoretical knowledge into the experiments and find the solutions.
- To apply the concepts and principles of black-body radiation to analyze radiation phenomena in thermodynamic systems.
- To experience the practical difficulties to find the physical constant values.

Course Outcome

After successful completion of the course, the student is expected to

1. Understand the process of thermal conductivity, viscosity and diffusion in gases
2. Able to correlate theory and practicals.
3. Understand the basic thermal properties via experiments.
4. Verify the Newton's law.
5. Analyse the characteristics of Bipolar Junction Transistor
6. Understand the applications of thermal conductance materials.
7. Apply the laws of thermodynamics to real physical systems and processes.
8. Apply the concepts and principles of black-body radiation to analyze radiation phenomena in thermodynamic systems.

Any 7 Experiments

1. To determine the coefficient of thermal conductivity of a bad conductor by Lee's disc method.
2. Verification of Newton's law of cooling.
3. Determination of thermal conductivity of rubber.
4. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
5. Cooling Curve of a metallic body.
6. To determine the temperature co-efficient of resistance of the given thermistor using post-office box.
7. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system

8. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge
9. Coefficient of thermal conductivity of copper by Searle's method
10. Thermal conductivity of copper by angstrom method.
11. To determine the specific heat capacity of liquid by Joule's Calorimetre.

SUGGESTED READINGS

1. A Text Book of practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
2. B.Sc., Practical Physics by Prof.M.N.Namboodirippad, Prof.P.A.Daniel, 1982 G.B.C. Publications

SEMESTER IV

21PHU412 ATOMIC AND NUCLEAR PHYSICS PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives

- To understand the operation of G.M. counter.
- To study the general properties of nucleus
- To study the nuclear forces and nuclear reactions.
- To analyse the B-H curve and their concepts practically.
- To introduce the concept of elementary particles practically.
- To apply the theoretical knowledge into the experiments and find the solutions.

Course Outcomes

After successful completion of the course, the student is expected to

1. Acquire basic knowledge about nuclear and particle physics
2. Develop the nuclear reactions and neutron physics.
3. Know the calculations of e/m and their applications.
4. Understand the operation of G.M. counter
5. Verify the B-H curve of radiative materials.
6. Understand the difference between Magnetron and Thomson methods.

Any 5 Experiments

1. G.M.Counter-Absorption co-efficient and inverse square law.
2. Measurement of counts of radiation by radioactive source using GM counter
3. ‘e/m’ by Magnetron method.
4. ‘e/m’ by Thomson method
5. ‘e/m’ by Millikan oil drop method.
6. Absorption spectra of Iodine
7. Atomic transistion of Copper using Arc spectrum
8. Rydberg constant by Hydrogen gas spectrum.
9. Diameter of Lycopodium powder particies by Carona rings.
10. Absorption spectrum of Alkali earth metal - Stark effect

SUGGESTED READINGS

1. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000)
2. Nuclear and Particle Physics, Axel Maas, Lecture in SS 2016 at the KFU Graz.
3. Nuclear and Particle Physics, B. R. Martin, Online ISBN:9780470035474, 2006 John
4. Wiley & Sons, Ltd.

SEMESTER IV

21PHU413A BASIC INSTRUMENTATION SKILL PRACTICAL 3H - 1C

Instruction Hours / week: L: 0 T: 0 P: 3 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives:

- To familiarize the students with working, design and analysis of basic amplifier circuits.
- To design and analyse wave shaping circuits, rectifiers and power supply circuits
- Introduce the basic concept of qualitative and quantitative analysis of an instruments.
- Study the concept of separation science and its applications.
- To demonstrate their knowledge in designing the control loops for these processes.
- To apply the theoretical knowledge into the experiments and find the solutions.

Course Outcomes:

After successful completion of the course, the student is expected to

1. Handle any kind of process by framing it in block diagram, mathematical model and different process variables.
2. Use modern engineering tools and techniques in the practice of electronic devices.
3. Know all the industrial processes and demonstrate their knowledge in designing the control loops for these processes.
4. Understand the working of various types of amplifiers, oscillators, wave shaping and power supply circuits
5. Design and Analyse the various types of amplifiers, oscillators, wave shaping and power supply circuits for any practical situation.
6. Discuss the terms, principle, instrumentation, operation and applications of instruments.

The test of lab skills will be of the following test items:

1. Calibration of a low range voltmeter-potentiometer.
2. Full wave rectifier
3. Calibration of an ammeter-potentiometer
4. Half wave rectifier
5. Measurement of unknown frequency using Lissajous figures by CRO.
6. Measurement of risetime and fall time using CRO.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges

Laboratory Exercises

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/ frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

SUGGESTED READINGS

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
7. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

SEMESTER IV

21PHU413B RADIATION PHYSICS – SAFETY MEASURMENTS PRACTICAL

3H - 1C

Instruction Hours / week: L: 0 T: 0 P: 3 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives:

- Student will get idea about the basic radiation principle.
- To know the nuclear interactions with matter and detection.
- To identify the Biological effects of radiation and measurement.
- To give the demonstration of Gamma spectrum of Gas Light mantle
- To know the Shielding of nuclear radiation.
- To know the importance of background radiation levels using Radiation meter.

Course Outcomes:

After successful completion of the course, the student is expected to

1. Understood the concepts of nuclear radiation.
2. Know the interaction of nuclear radiation with matter.
3. Detect the nuclear radiation.
4. Be familiar with dosimeters and measurements.
5. Know the importance of background radiation levels using Radiation meter.
6. Identify the α particles using reference source & determining its half-life using spark counter.

Any 4 Experiments

1. Study the background radiation levels using Radiation meter
2. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
3. Study of counting statistics using background radiation using GM counter.
4. Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
5. Study of absorption of beta particles in Aluminum using GM counter.
6. Detection of α particles using reference source & determining its half life using spark counter
7. Gamma spectrum of Gas Light mantle (Source of Thorium)

SUGGESTED READINGS

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". John Wright and Sons, UK, 1989.
5. J.R. Greening, "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
7. Martin and S.A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. W.R. Hendee, "Medical Radiation Physics", Year Book – Medical Publishers
10. Inc. London, 1981

SEMESTER IV

21PHU414 CHEMISTRY PRACTICAL– II 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective

- The basic analytical and technical skills to work al and technical skills to work effectively in the various fields of chemistry.
- The student on successful completion of the course should learn the principles of volumetric analysis.
- To estimate the compounds by acidimetry, alkalimetry and permanganometry.
- To acquire practical skills in volumetric analysis.
- To understand the basic principles of volumetric analysis.
- To estimate the Acidimetry & Alkalimetry by volumetric analysis
- To perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions.

Course Outcome

After successful completion of the course, the student is expected to

1. Learnt about the qualitative analysis of organic compounds.
2. Learnt the detection of elements and functional groups present in an organic compound by systematic analysis.
3. Gain knowledge on basic test of organic compounds.
4. Differentiate the chemicals and their families.
5. Estimate the Acidimetry & Alkalimetry by volumetric analysis
6. Experience the practical knowledge of Acidimetry & Alkalimetry, Permanganometry

Volumetric analysis

A. Acidimetry & Alkalimetry

1. Estimation of sodium carbonate using standard sodium hydroxide.
2. Estimation of sodium hydroxide using standard sodium carbonate.
3. Estimation of sulphuric acid using standard oxalic acid.
4. Estimation of potassium permanganate using standard sodium hydroxide.

B. Permanganometry

1. Estimation of ferrous sulphate using standard Mohr’s salt.
2. Estimation of oxalic acid using standard ferrous sulphate.

3. Estimation of calcium-direct method.

SUGGESTED READINGS:

1. Thomas, A.O. (2012). Practical Chemistry for B.Sc. Main Students. Cannanore: Kerala, Scientific Book Centre.
2. Ramasamy, R. (2011). Allied Chemistry Practical Book. Karur: Priya Publications.
3. Venkateswaran, V., Veeraswamy, R., & Kulandaivelu A. R. (2015). Basic Principles of Practical Chemistry (2nd edition). New Delhi: S. Chand Publications.

SEMESTER – V

21PHU501 MATHEMATICAL PHYSICS 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective

- The aim of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.
- Students should be able to tackle with problems in the physical science using computer and different software.
- Identify and describe the characteristics of various numerical methods.
- Independently program computers using leading-edge tools,
- Formulate and computationally solve a selection of problems in physics,
- Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations.

Course Outcome

After successful completion of the course, the student is expected to

1. Demonstrate basic knowledge of numerical methods.
2. Demonstrate basic programming skills.
3. Demonstrate an understanding of the applicability of numerical methods for modeling physical systems and its advantages and disadvantages.
4. Demonstrate the ability to estimate the errors in the use of numerical methods.
5. Demonstrate skills to write and develop simple programs in FORTRAN.
6. Understand the Importance of graphical analysis and its limitations.

UNIT I - BASIC OF C LANGUAGE

Introduction, Fundamentals in C - Data types, Operators and Expressions, Conditional Statements, Input and output Statements (Programs) – Control statements – Function.

UNIT II - COMPLEX ANALYSIS

Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula.

UNIT III - VECTOR CALCULUS

Operator – Divergence – The Laplacian Operator – Curl of a Vector – Line Integral– Surface

Integral – Volume Integral – Gauss's Divergence theorem and it's proof – Stoke's and Green's theorem - example problems. Applications of Vectors to Heat flow and electromagnetic field.

UNIT IV

DIFFERENTIAL CALCULUS: Differentiation- Curvature and radius of Curvature in Cartesian and Polar form – Evolutes – Involute.

INTEGRAL CALCULUS: Definite and Indefinite integrals – Methods of Integration – Integration by substitution – Integration by parts – Fourier series and Fourier integral with problems.

UNIT V - SPECIAL FUNCTIONS

Definition – The Beta function – Gamma function – Evaluation of Beta function – Other forms of Beta function – Evaluation of Gamma function – Other forms of Gamma function - Relation between Beta and Gamma functions – Problems.

SUGGESTED READINGS

1. Satya Prakash.,2002. Mathematical Physics , 4th edition, S.Chand & Co, New Delhi.
2. Gupta.B.D., 2002, .Mathematical Physics, 2nd edition, Vikas publishing company, New Delhi.
3. Singaravelu.V., 2008. Numerical methods, 2nd edition, Meenakshi publications, Sirkali.
4. Rajput.B.S., 2003. Mathematical Physics, 16th edition, Pragati Prakashan, Meerut.
5. Gupta. P.P., Yadav., and Malik.,2012. Mathematical Physics, Kedar Nath & Ram Nath, Meerut.
6. Venkataraman.M.K., 2003. Numerical methods in Science & Engineering, 5th edition, The National Publishing Company, Chennai.
7. Butkov, 2007, Mathematical Physics, Addison Wesley, New York
8. A.W. Joshi, 2008, Tensors and Matrices, reprint, Wiley Interscience, New York.
9. George B. Arfken, Hans J. Weber, Frank E. Harris, 7 edition, 2012, Academic Press;
10. https://nptel.ac.in/courses/115103036/
11. https://nptel.ac.in/courses/115105097/

SEMESTER V

21PHU502 ELECTROMAGNETIC WAVE PROPAGATION 4H - 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

The aim and objective of the course

- The aim of this course is to provide the students with the fundamental principles of electrical energy (electro- magnetism).
- It is very important to understand the propagation of waves in different media, its transmission and reception.
- To understand the relation between electric and magnetic fields.
- To gain the knowledge on electromagnetic wave propagations.
- To describe simple models for electromagnetic interaction with media
- To experience the wave propagation in different media.

Course Outcome

After successful completion of the course, the student is expected to

1. Calculate electric and magnetic fields from stationary and dynamic charge and current distributions.
2. Use electromagnetic wave theory and principles in a wide range of applications.
3. Solve such problems in simple geometries using separation of variables and the method of images.
4. Define and derive expressions for the energy both for the electrostatic and magnetostatic fields.
5. Gain confidence in their ability to apply mathematical methods to understand electromagnetic problems to real-life situations.
6. Solve simple electrostatic boundary problems.
7. Describe simple models for electromagnetic interaction with media
8. Choose adequate models and solution methods for specific problems.

UNIT- I

Maxwell Equations: Maxwell's equation - Review of Maxwell's equations. Displacement Current. Electromagnetic scalar and vector potential, Gauge Transformation: Lorenz and Coulomb gauge – Poynting theorem and vector. Electromagnetic (EM) Energy Density.

UNIT -II

EM Wave Propagation in Unbounded Media: Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media - Anisotropic dielectric - Ionized gases.

UNIT -III

EM Wave in Bounded Media: Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law, Reflection & Transmission coefficients, Total internal reflection.

UNIT -IV

Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light

UNIT -V

Wave Guides: Planar optical wave guides, Planar dielectric wave guide, Condition of continuity at interface, Phase shift on total reflection, Phase and group velocity of guided waves, Field energy and Power transmission.

SUGGESTED READINGS

1. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.
2. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
3. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
4. Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill
5. Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning
6. Engineering Electromagnetic, Willian H. Hayt, 8th Edition, 2012, McGraw Hill.
7. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer
8. https://fas.org/man/dod-101/navy/docs/es310/propagat/Propagat.htm
9. https://www.olympus-lifescience.com/en/microscope-resource/primer/java/polarized light/emwave/.
10. https://ocw.mit.edu/courses/physics/8-311-electromagnetic-theory-spring-2004/#:~:text=Electromagnetic%20Theory%20covers%20the%20basic,magnetic%20properties%20of%20matter%2C%20and

SEMESTER V

21PHU503 ELEMENTS OF MODERN PHYSICS 4H - 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To identify the circumstances, in Modern Physics. Enumerate and understand the postulate of relativity.
- To learn about the speed of light as a natural limit to speed.
- To understand the work of Planck, Bohr, Heisenberg, uncertainty principle and the other features of Quantum Mechanics.
- Acquaintance with basic fields of modern physics
- Ability of searching solutions of physical problems in scientific and technical literature.
- Understanding of physical processes and technology

Course Outcome

After successful completion of the course, the student is expected to

1. Recall and apply knowledge in the areas of optics and waves, special relativity and quantum physics (developing the knowledge capability dimension);
2. Conduct relevant experiments, analyse data and report results in written form (developing the technical capability and communication dimensions).
3. Analyse the plank's constant using different experimental technique.
4. Find the wavelength of any laser sources.
5. Differentiate the interference and diffraction properties by the experiments.
6. Understand the theory and practical knowledge of light and other properties.

UNIT-I: RELATIVITY

Invariance of physical laws, constancy of speed of light, relativity of simultaneity, the Lorentz transformation, length contraction, time dilation, the Doppler effect, relativistic motion, relativistic momentum, relativistic energy, the Galileo transformation and Newtonian mechanics as non-relativistic limits.

UNIT-II

Wave-particle duality: Electromagnetic Waves - photoelectric effect, x-ray production, X-ray diffraction, Bragg's law for diffraction. Compton scattering, uncertainty principle, electron waves, nuclear atom and atomic spectra, energy levels and the Bohr model of the atom and continuous spectra.

UNIT- III: QUANTUM MECHANICS

Wave function,Wave Equation - the one-dimensional Schrödinger equation, Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension. Particle in a one dimensional box, potential wells, potentials barriers and tunneling, the harmonic oscillator.

UNIT-IV

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus. Applications of Radioisotopes.

UNIT- V

Laser Based Measurement: Beam Optics: Gaussian beam, Gaussian beam propagation in free space, transmission. Photo-detectors: Basic of photodetectors, different types of photodetectors, their inherent characteristics, response curve, noise. Holography: Holography interferometry, double exposure and real time holography. Laser Applications.

SUGGESTED READINGS

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
3. Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
5. Modern Physics, G.Kaur and G.R. Pickrell, 2014, McGraw Hill
6. Quantum Mechanics: Theory & Applications, A.K.Ghatak & S.Lokanathan, 2004, Macmillan
7. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2004, PHI Learning.
8. Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co. Ltd.
9. Quantum Physics, Berkeley Physics, Vol.4. E.H.Wichman, 1971, Tata McGraw-Hill Co.
10. Basic ideas and concepts in Nuclear Physics, K.Heyde, 3rd Edn., Institute of Physics Pub. Six Ideas that Shaped Physics: Particle Behave like Waves, T.A.Moore, 2003, McGraw Hill.

11. https://www.arsdcollege.ac.in/wp-content/uploads/2020/04/Presentation_1-11_compressed.pdf
12. http://web.sbu.edu/physics/courses/physics-203p.pdf

SEMESTER V

21PHU504B MICROPROCESSOR AND MICROCONTROLLER 3H – 3C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- This paper is intended to give an insight into the theory and applications of digital electronics, design of circuits with digital devices, details of microprocessor and its applications.
- To understand the Architecture of 8085 and 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

Course Outcome:

At the end of the course, the students should be able to:

1. Understand and execute programs based on 8086 microprocessor.
2. Design Memory Interfacing circuits.
3. Design and interface I/O circuits.
4. Design and implement 8051 microcontroller based systems.
5. Interfacing parallel and serial ADC and DAC.
6. Design, fabricate, test and run the programs.

UNIT I: 8085 MICROPROCESSOR

Introduction to microprocessor – Basic components of a microcomputer – I/O devices – Memory – ROM – RAM – Architecture of 8085 – Address bus – Data bus – Control bus – Pin configuration – Registers Arithmetic and logic unit – Flags – Instruction format – Types of instructions – Addressing modes – Assembly language programming – Programmes for addition, subtraction, biggest and smallest from the given list.

UNIT II: THE 8086 MICROPROCESSOR

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT III: 8086 SYSTEM BUS STRUCTURE

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT IV: MICROCONTROLLER

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V: INTERFACING MICROCONTROLLER

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

SUGGESTED READINGS:

1. Fundamental of Microprocessor 8085: Architecture Programming, and Interfacing by V. Vijayendran, 2009, Viswanathan, S., Printers & Publishers Pvt Ltd.
2. Microprocessor and Microcontrollers by Krishna Kant, 2007, Eastern Company Edition, Prentice Hall of India, New Delhi.
3. Microprocessor Architecture Programming and Application with 8085 by R.S. Gaonkar, 2013, Wiley Eastern Ltd., New Delhi.
4. Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design by Yu-Cheng Liu, Glenn A.Gibson, 2007, Second Edition, Prentice Hall of India,.
5. The 8051 Microcontroller and Embedded Systems: Using Assembly and C Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, 2011, Second Edition, Pearson education.
6. Microprocessors and Interfacing, Programming and Hardware, Doughlas V.Hall, 2012, TMH.
7. Advanced Microprocessors and Peripherals by A.K.Ray, K.M.Bhurchandi, 3rd edition, Tata McGrawHill, 2012.
8. https://nptel.ac.in/courses/108/105/108105102/
9. https://nptel.ac.in/courses/117/104/117104072/

SEMESTER V

21PHU504B MEDICAL PHYSICS 3H – 3C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- The objective of the course is to educate and to train students to a competency level sufficient to practice radiation oncology physics independently.
- This prepares the students for clinical practices in radiation therapy (RT) physics through a structured clinical trainings and didactic courses.
- To know the energetic charged particle interactions and transport in matter.
- The program is supervised and mentored by highly qualified clinical practitioners.
- This paper is aimed at giving idea to the students regarding the nature of human body and usage of different radiations for the treatment of body.
- To active participation in clinical research, teaching, and training.

Course Outcomes

After successful completion of the course, the student is expected to

1. Different areas of research in Medical Physics
2. Understand and apply key concepts specific to energy deposition for both ionizing photon interactions and transport in matter
3. Know the energetic charged particle interactions and transport in matter.
4. Understanding the working of a manual optical eye-testing machine
5. Familiarization with the Use of a Vascular Doppler.
6. Realize the real time examples of medical instruments.

UNIT – I

PHYSICS OF THE BODY-I

Basic Anatomical Terminology: Standard Anatomical Position, Planes. Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal. **Mechanics of the body:** Skeleton, forces, and body stability. Muscles and dynamics of body movement. Physics of Locomotors Systems: joints and movements, Stability and Equilibrium. **Energy household of the body:** Energy balance in the body, Energy consumption of the body, Heat losses of the body, Thermal Regulation. **Pressure system of body:** Physics of breathing, Physics of cardiovascular system.

UNIT – II

PHYSICS OF THE BODY-II

Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound. **Optical system of the body:** Physics of the eye. **Electrical system of the body:** Physics of the nervous system, Electrical signals and information transfer.

UNIT - III

LASERS IN MEDICINE AND THERMOGRAPHY:

Theory and production of medical lasers - Laser Tissue interaction mechanism – Applications of lasers in Dermatology, Oncology, Opthalmology - Application of ultrafast pulsed lasers in Medicine - laser blood flow meter. Hazards of lasers and their safety measures - Various types of electromagnetic radiations; UV, Visible, IR, their sources and detectors - Optical properties of tissues – Medical Applications of IR radiations in diagnosis and therapy.

UNIT - IV

RADIATION PHYSICS: Radiation units exposure, absorbed dose, units: rad, gray, relative biological effectiveness, effective dose- Rem & Sievert, inverse square law. Interaction of radiation with matter Compton& photoelectric effect, linear attenuation coefficient. **Radiation Detectors**: ionization (Thimble chamber, condenser chamber), chamber. Geiger Muller counter, Scintillation counters and Solid State detectors, TFT.

UNIT - V

MEDICAL IMAGING PHYSICS: Evolution of Medical Imaging, X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR), NMR imaging, MRI Radiological imaging, Ultrasound imaging, Physics of Doppler with applications and modes, Vascular Doppler. Radiography: Filters, grids, cassette, X-ray film, film processing, fluoroscopy. **Computed tomography scanner**- principle and function, display, generations, mammography. Thyroid uptake system and Gamma camera (Only Principle, function and display)

SUGGESTED READINGS

1. Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978)
2. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
3. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry Lippincot Williams and Wilkins (1990)
4. Physics of the human body, Irving P. Herman, Springer (2007).
5. Physics of Radiation Therapy : F M Khan - Williams and Wilkins, 3rd edition (2003)
6. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
7. Handbook of Physics in Diagnostic Imaging: R.S.Livingstone: B.I. Publication Pvt Ltd.
8. The Physics of Radiology-H E Johns and Cunningham.
9. https://sites.google.com/a/northgeorgia.edu/ngcsu-physics-note-sharing/home/medical
10. http://www.sprawls.org/ppmi2/IMGCHAR/
11. http://www.sprawls.org/ppmi2/

SEMESTER – V

21PHU511 MATHEMATICAL PHYSICS PRACTICAL 4H – 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.
- To apply calculus of variations to diverse problems in physics including isoperimetric problems.
- To find solutions to integral equations using different methods.
- To know the method of contour integration to evaluate definite integrals of varying complexity.
- To familiar with the method of Green's function to solve linear differential equations with inhomogeneous term.
- To understand the concept of linear vector space.

Course Outcome

After successful completion of the course, the student is expected to

1. Understand variation principle and apply it to calculate the physical variables.
2. Acquire basic concept of Hamiltonian, Hamilton's principle and Hamiltonian equation of motion, Poisson and Lagrange brackets.
3. Learn elementary group theory, i.e., definition and properties of groups, subgroups, Homomorphism, isomorphism, normal and conjugate groups, representation of groups, Reducible and Irreducible groups.
4. Learn the theory of probability, Random variables and probability distributions, Expectation values and variance. Various examples of probability distributions used in physics.
5. Gain the knowledge on Cartesian Tensors and its applications .
6. Understand the concept of Matrices and their problems associated with physical concepts.

ANY 8 EXPERIMENTS

1. Evaluate the Beta and Gamma function using C program.
2. Write the C Program to Print Square of Each Element of 2D Matrix.
3. Calculate the addition and subtraction of 2 matrices.
4. Write the C Program to Add two Complex Numbers.
5. Write C functions to add and multiply two complex numbers.

6. Program to find Transpose of Given Square Matrix.
7. Evaluate Subtraction of two matrices in C.
8. Write the C Program to perform complex number multiplication.
9. Write the C program to calculate sum of Upper Triangular Elements.
10. Write the C Program to Check whether entered matrix is magic square or not?
11. Find Inverse of a 3 X 3 Matrix using C program.
12. Write C Program to Compute Cross Product of Two Vectors.
13. Write a C Program Friend & Operator: Vector.
14. Check if a Number is Positive or Negative Using if...else.
15. Write a C Program to find the Factorial of a Number.

SUGGESTED READINGS

1. Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
2. Scilab by example: M. Affouf, 2012, ISBN: 978-1479203444
3. Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN: 978-6133459274

SEMESTER – V

21PHU512 ELECTROMAGNETIC WAVE PROPAGATION PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective

- Understand and working of polarimeter.
- Understand the resolving power of different optical instruments.
- To experience the practical difficulties to find the physical constant values.
- To apply the theoretical knowledge into the experiments and find the solutions.
- Students will be observe the readings practically.
- Students will experience the phenomena of reflection, refraction, etc.,

Course Outcomes

After successful completion of the course, the student is expected to

1. Gain knowledge on various theories of light.
2. Acquire skills to identify and apply formulas of optics and wave physics.
3. Understand the properties of light like reflection, refraction, interference, and diffraction etc.,
4. Understand the applications of diffraction and polarization.
5. Determine the different optical properties by using various apparatus.
6. Know the importance of optical materials in the industrials.

Any 8 experiments

1. To determine the specific rotation of sugar solution using Polarimeter.
2. To analyze elliptically polarized Light by using a Babinet's compensator.
3. Determination of wavelength of the monochromatic source using Young's double slit method.
4. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
5. To verify the Stefan`s law of radiation and to determine Stefan's constant.
6. To determine the Boltzmann constant using V-I characteristics of PN junction diode.
7. To verify the law of Malus for plane polarized light.
8. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
9. Charging and discharging of a capacitor
10. Verification of Faraday's law of electromagnetism
11. Determination of Planck's constant

SUGGESTED READINGS

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SEMESTER V

21PHU513 ELEMENTS OF MODERN PHYSICS PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- To identify the circumstances, in Modern Physics. Enumerate and understand the postulate of relativity.
- To learn about the speed of light as a natural limit to speed.
- To understand the work of Planck, Bohr, Heisenberg, uncertainty principle and the other features of Quantum Mechanics.
- Acquaintance with basic fields of modern physics
- Ability of searching solutions of physical problems in scientific and technical literature.
- Understanding of physical processes and technology

Course Outcome

After successful completion of the course, the student is expected to

1. Recall and apply knowledge in the areas of optics and waves, special relativity and quantum physics (developing the knowledge capability dimension);
2. Conduct relevant experiments, analyse data and report results in written form (developing the technical capability and communication dimensions).
3. Analyse the plank's constant using different experimental technique.
4. Find the wavelength of any laser sources.
5. Differentiate the interference and diffraction properties by the experiments.
6. Understand the theory and practical knowledge of light and other properties.

Any 8 Experiments

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light;
3. maximum energy of photo-electrons versus frequency of light
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. I-V characteristics of LED
6. I-V characteristics of photocell

7. Plank's constant using color filters.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunneling effect in tunnel diode using I-V characteristics.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating.

SUGGESTED READINGS

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011,Kitab Mahal.

SEMESTER V

21PHU514A MICROPROCESSOR AND MICROCONTROLLER PRACTICAL 3H - 1C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective

- This paper gives introduction to microcontroller and embedded systems.
- To learn the architecture of embedded systems, their classification and application.
- To learn about the microprocessors and the organization of microprocessor based systems.
- To acquire knowledge of microcontrollers and their role in 1/0 port programming and their interface with peripherals.
- To know the Input/output operations and manipulation for arithmetic and logical operations.
- To know the basics of embedded system development and product development with a brief introduction to Arduino.

Course Outcome

After successful completion of the course, the student is expected to

1. Embedded systems including its generic architecture, design and classifications, Embedded processors and microcontrollers.
2. Organization of intel microprocessor 8085, its architecture, pin diagram, timing diagram, instruction set and programming in assembly language.
3. Organization of Intel 8051 microcontroller, its architecture, instruction set, programming and its memory organization, timing diagram.
4. Programming with and without interrupt service request.
5. Interfacing parallel and serial ADC and DAC.
6. Student shall be able to design, fabricate, test and run the programs.

Any 6 experiments

1. 8-bit addition and 8-bit subtraction using 8085 microprocessor.
2. 8-bit multiplication and Division using 8085 microprocessor.
3. Conversion from decimal to hexadecimal system using 8085 microprocessor.
4. Conversion from hexadecimal to decimal system using 8085 microprocessor.
5. 16-bit addition using 8085 microprocessor.
6. Musical tone generator.
7. To find sum of series
8. To find the sum of first n natural numbers
9. To find the factorial of a number

10. To find the square root of the number.

SUGGESTED READINGS

1. Fundamental of Microprocessor 8085: Architecture Programming, and Interfacing by V. Vijayendran, 2009, Viswanathan, S., Printers & Publishers Pvt Ltd.
2. Microprocessor and Microcontrollers by Krishna Kant, 2007, Eastern Company Edition, Prentice Hall of India, New Delhi.
3. Microprocessor Architecture Programming and Application with 8085 by R.S. Gaonkar, 2013, Wiley Eastern Ltd., New Delhi.

SEMESTER V

21PHU514B MEDICAL PHYSICS PRACTICAL 3H - 1C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective

- The objective of the course is to educate and to train students to a competency level sufficient to practice radiation oncology physics independently.
- This prepares the students for clinical practices in radiation therapy (RT) physics through a structured clinical trainings and didactic courses.
- To know the energetic charged particle interactions and transport in matter.
- The program is supervised and mentored by highly qualified clinical practitioners.
- This paper is aimed at giving idea to the students regarding the nature of human body and usage of different radiations for the treatment of body.
- To active participation in clinical research, teaching, and training.

Course Outcomes

After successful completion of the course, the student is expected to

1. Different areas of research in Medical Physics.
2. Understand and apply key concepts specific to energy deposition for both ionizing photon interactions and transport in matter.
3. Know the energetic charged particle interactions and transport in matter.
4. Understanding the working of a manual optical eye-testing machine.
5. Familiarization with the Use of a Vascular Doppler.
6. Realize the real time examples of medical instruments

Any 6 experiments

1. Understanding the working of a manual Hg Blood Pressure monitor and measure the Blood Pressure.
2. Understanding the working of a manual optical eye-testing machine and to learn eye-testing procedure.
3. Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/breadboard.
4. Correction of Hypermetropia/Hyperopia (long sightedness) using a combination of lenses on an optical bench/breadboard.
5. To learn working of Thermoluminescent dosimeter (TLD) badges and measure the background radiation.
6. Familiarization with Geiger-Muller (GM) Counter and to measure background

radiation.

7. Familiarization with Radiation meter and to measure background radiation.
8. Familiarization with the Use of a Vascular Doppler.

SUGGESTED READINGS

1. Basic Radiological Physics, Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
2. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
3. Physics of Radiation Therapy: F M Khan - Williams and Wilkins, 3rd edition (2003)
4. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
5. Handbook of Physics in Diagnostic Imaging: Roshan S. Livingstone: B. I. Publications Pvt Ltd.
6. The Physics of Radiology-H E Johns and Cunningham.

SEMESTER – VI

21PHU601 CLASSICAL AND QUANTUM MECHANICS 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Learning Objectives

- To know how to impose constraints on a system in order to simplify the methods tobe used in solving physics problems.
- To know what central, conservative and central-conservative forces mathematically understand the conservative theorems of energy, linear momentum and angular Momentum.
- To know the importance of concepts such as generalized coordinates and constrained motion.
- To establish that Kepler's laws are just consequences Newton's laws of gravitation and that of motion.
- The main objective of this course is to make students aware about the basic formulations in quantum mechanics. There are many different types of representations of state and operators that are very useful in studying the subject deeply.
- To give an insight into the classical methods of physics.
- To understand the basic principles of classical mechanics.

Course Learning Outcome

1. Students learn about Lagrangian and Hamiltonian formulation of Classical Mechanics.
2. Students learn about motion of a particle under central force field.
3. Students will be able to appreciate the beauty of quantum mechanics.
4. Students will know all types of representations of operators and ways to apply them in different problems.
5. An appreciation of the influence of classical mechanics and relativity on modern scientific development.
6. Understand the role of uncertainty in quantum physics, and use the commutation relations of operators to determine whether or not two physical properties can be simultaneously measured

Unit I: Lagrangian and Hamiltonian Dynamics

Lagrange's equation for conservative and Non- conservative System-Applications of Lagrange's equation- Hamilton's principle- Lagrange's Equation from Hamilton's Principle – Lagrange's equation from variational principles –Advantages-conservation theorem -Hamilton equations of motion –Cyclic coordinates and Conservation theorems- Hamilton equations from variational Principle-The principle of Least action.

Unit –II: The Two body Central Force Problem

Conservative central forces-Classification of Orbits- The Virial Theorem- The Kepler problem; Inverse Square law of Forces-Rutherford scatterings -Scattering in a central force field.

Unit-III: Particle properties of waves

Planck's blackbody radiation - de Broglie waves – photoelectric effect – Compton Effect - Wave properties of particles: particle diffraction – Davison and Germer experiment – Heisenberg's uncertainty principle - wave packet - phase and group velocities.

Unit – IV: Operator and Postulates of Quantum Mechanics

The wave function – probability density – probability stream (current) density - dynamical operators – linear and hermitian operators – commuting and non-commuting operators – Hamiltonian – angular momentum operators-The Schrodinger's wave equation – time dependent form – linearity and superposition – Schrodinger equation: steady state form - eigenvalues and eigenfunctions.

Unit – V: Exactly solvable problems

Free states: Particle in a box – step potential – barrier potential – quantum tunnelling – square well free states. Bound states: infinite potential well – degeneracy –quantized states – normalized wave functions – expectation values - Harmonic oscillator – energy eigenvalues and eigen functions – zero point energy.

SUGGESTED READINGS

1. Concept of Modern Physics by Arthur Baiser, Shobi tMahajan, S.Rai Choudhury, 6th
2. Edn, McGraw Hill Education Pvt Ltd, New Delhi.
3. Classical Mechanics, Upadyaya, Himalayan Publishing House, 1989, New Delhi.
4. A Text Book of Quantum Mechanics by P.M.Mathews & K.Vengatesan, Tata McGraw Hill, New York.
5. Modern Quantum Mechanics by J.J.Sakurai, 1999, Addition Wisley.
6. Principles of Quantum Mechanics, S R.Shankar, 2007, II Ed, Springer.
7. https://nptel.ac.in/courses/115105098/
8. https://nptel.ac.in/courses/122106034/

SEMESTER VI

21PHU602 SOLID STATE PHYSICS 4H - 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective:

- This course integrates theory of Solid State Physics with experimental demonstrations in the Physics Lab.
- The course will provide a valuable theoretical introduction and an overview of the fundamental applications of the physics of solids.
- It includes theoretical description of crystal and electronic structure, lattice dynamics, and optical properties of different materials (metals, semiconductors, dielectrics, magnetic materials and superconductors), based on the classical and quantum physics principles.
- To calculate thermal and electrical properties in the free-electron model.
- To gain a basic knowledge of crystal systems and spatial symmetries.
- To know what phonons are, and be able to perform estimates of their dispersive and thermal properties.
- Apply the concept of band theory to explain the behavior of conductors.

Course Outcomes

After successful completion of the course, the student is expected to

1. Account for interatomic forces and bonds.
2. Have a basic knowledge of crystal systems and spatial symmetries.
3. Account for how crystalline materials are studied using diffraction, including concepts like form factor, structure factor, and scattering amplitude.
4. Know what phonons are, and be able to perform estimates of their dispersive and thermal properties.
5. Calculate thermal and electrical properties in the free-electron model.
6. Explain superconductivity using BCS theory
7. Outline the importance of solid state physics in the modern society.

Unit I - CRYSTAL STRUCTURE

Classification of matter: solids – liquids – amorphous – Properties and comparison – Crystal structures: Unit cell - Basis - Primitive cell - Translational vectors - lattice with basis - Types of lattice - Bravais lattice – simple cubic – body centered cubic and face centered cubic – Hexagonal close packed - diamond structure – point groups – space groups – Symmetry – Types of Symmetry - Miller indices – Reciprocal lattice – Wigner-Seitz cell and conventional cell - Brillouin zones.

Unit II - ELEMENTARY LATTICE DYNAMICS

Ionic cohesive energy – Covalent – Metallic Vander Waals and hydrogen bonded crystals – Vibrational modes –one, two and three dimensional lattices – Thermal conductivity – Elastic constants – Phonon dispersion relation – Localised modes.

Unit III MAGNETIC PROPERTIES OF MATTER

Ferro electric crystals – Classification of polarization – Catastrophe – Landau theory of phase transition – Second order transition – First order transition soft optical phonons – Anti ferro electricity – Ferro electric domains – Piezoelectricity – Ferro electricity. Dia – paramagnetism – Quantum theory of para magnetism. Curie Neil temperature – Magnetism and susceptibility – Ferro-magnetic domains – Magnons – Applications of magnetic materials.

Unit IV- SUPERCONDUCTIVITY

Occurrence of Superconductivity – Destruction of superconductivity by magnetic fields – Meissner effect - Heat capacity – Energy gap - Isotope effect – Thermodynamics of the superconducting transistors – Types of Superconductors - London equation – Coherence length – BCS theory of superconductivity – Qualitative treatment of DC and AC Josephson effect – Applications of Superconductors.

Unit V - ELEMENTARY BAND THEORY

Transport properties – electronic specific heat – electrons in a periodic potential – energy band – Bloch's theorem, Kronig – Penney's theorem – Band Structure – Carrier concentrations – Intrinsic semi-conductor – Impurity states – Semiconductor states – Electrical conductivity, mobility – Magnetic field effects – Cyclotron resonance and Hall effect.

SUGGESTED READINGS

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
3. Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
4. Solid State Physics, Rita John, 2014, McGraw Hill
5. Solid State Physics, M.A. Wahab, 2011, Narosa Publications.
6. http://www.physics.udel.edu/~bnikolic/teaching/phys624/lectures.html
7. https://www.youtube.com/watch?v=RImqF8z91fU.
8. https://courses.lumenlearning.com/boundless-chemistry/chapter/band-theory-of-electrical-conductivity/

SEMESTER VI

21PHU603A NANO MATERIALS AND APPLICATIONS 4H - 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objective:

- This course covers the different classes of nanomaterials that have been developed in recent years in light of various technological applications.
- In order to understand the behavior of these nanomaterials, quantum phenomena and the limitations of basic physical laws that are important at the nanometer length scale are introduced and developed.
- In particular, properties that exhibit size effects (including electronic, magnetic, photonic, and mechanical) at the nanometer length scale will be presented so that nanomaterials becoming increasing relevant to modern technologies can be better understood.
- The course will cover recent breakthroughs and assess the impact of this burgeoning field.
- Specific nanofabrication topics include epitaxy, beam lithographies, self- assembly, biocatalytic synthesis, atom optics, and scanning probe lithography.
- The course consists of topics in fundamental nanoscale science, plus an overview of areas in nanotechnology.

Course Outcome

After successful completion of the course, the student is expected to

1. Explain the fundamental principles of nanotechnology and their application to biomedical engineering.
2. Apply engineering and physics concepts to the nano-scale and non-continuum domain.
3. Identify and compare state-of-the-art nanofabrication methods
4. perform a critical analysis of the research literature.
5. Design processing conditions to engineer functional nanomaterials.
6. Evaluate current constraints, such as regulatory, ethical, political, social and economical, encountered when solving problems in living systems.

UNIT - I

FUNDAMENTALS: Introduction–Historical development of nanomaterials - Nanoscale architecture; Length scales in physics, Classification of nanomaterials. Introduction to Nanostructures : Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods) - Carbon Nanotubes (CNT)- Graphenes- Fullerenes- Nano Peapods- Quantum Dots -Semiconductor Nanoparticles- Metal-based Nanostructures -Nanowires - Nanostructures including dendrimers

UNIT – II

SYNTHESIS METHODS OF NANO MATERIALS

Top down and Bottom up approach - Nucleation and growth of nanosystems. Chemical routes: Sol-gel Process - Electrochemical methods - hydrothermal. Vapor growth: chemical vapor deposition - physical vapor deposition – sputtering - laser ablation - metallo-organic chemical vapor deposition. Epitaxial growth

Mechanical methods: ball milling, mechanical attrition.

UNIT-III

Novel Properties of Nanomaterials: Size and shape dependent optical, emission, electronic, transport, photonic, refractive index, dielectric, mechanical, magnetic properties.

UNIT - IV

CHARACTERIZATION: X-Ray Diffraction - Fourier Transform Infrared spectroscopy - Raman spectroscopy - UV-visible spectroscopy - Optical Microscopy - Scanning Electron Microscopy- Transmission Electron Microscopy- Atomic Force Microscopy.

UNIT – V

APPLICATIONS:

Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS) - bio-sensing - Biological/bio-medical applications- High strength nanocomposites.

SUGGESTED READINGS

1. C.P.Poole, Jr. Frank J.Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.). S.K. Kulkarni,
2. Nanotechnology: Principles & Practices (Capital Publishing Company) K.K. Chattopadhyay and A. N. Banerjee,
3. Introduction to Nanoscience and Technology (PHI Learning Private Limited).
4. Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroscio, 2011, Cambridge University Press.
5. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
6. Mark C. Hersam (2006), "MSE 376 Nanomaterials,"

https://nanohub.org/resources/1914.
7. https://nanohub.org/resources/7313.
8. https://ocw.mit.edu/courses/mechanical-engineering/2-674-micro-nano-engineering-laboratory-spring-2016/lecture-notes/MIT2_674S16_Lec7Nano.pdf
9. https://nptel.ac.in/courses/118/104/118104008/
10. Cambridge University Press.
11. Richard Booker, Earl Boysen, Nanotechnology, John Wiley and Sons.
12. https://nptel.ac.in/courses/118102003/
13. https://nptel.ac.in/courses/118104008/

SEMESTER VI

21PHU603B BIOLOGICAL PHYSICS 4H - 4C

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives:

- The course aims to provide students with a foundation in the basic concepts of Biophysics.
- Biophysics is an interdisciplinary science that employs and develops theories and methods of the physical sciences for the investigation of biological systems.
- Topics will include canonical and non-canonical structures of nucleic acids, structure of proteins, enzymes etc.
- Fundamental concepts that underlie biomolecular interactions will be discussed and biophysical methods that are employed for the structural analysis of these systems will be introduced at an elementary level.
- To Understand the concept of life of molecules.
- The physical quantities such as temperature, energy, enthalpy, entropy, and free energy will be employed to understand why a biological system choses particular state at conditions under study.

Course Outcome

After successful completion of the course, the student is expected to

1. Demonstrate knowledge of the fundamental concepts in physics and chemistry that underlie biological processes.
2. Define the structural characteristics of nucleic acids and proteins
3. Examine parameters that variously determine their stability and function(s).
4. Describe the principles that govern biomolecular interactions
5. Appreciate how established methods of research and enquiry are employed to analyze the different aspects of these interactions.
6. Understand the concept of life of molecules.

UNIT -I

Overview: The boundary, interior and exterior environment of living cells. Processes: exchange of matter and energy with environment, metabolism, maintenance, reproduction, evolution. Self-replication as a distinct property of biological systems. Time scales and spatial scales. Universality of microscopic processes and diversity of macroscopic form. Types of cells. Multicellularity. Allometric scaling laws.

UNIT- II

Molecules of life: Metabolites, proteins and nucleic acids. Their sizes, types and roles in structures and processes. Transport, energy storage, membrane formation, catalysis,

replication, transcription, translation, signaling. Typical populations of molecules of various types present in cells, their rates of production and turnover. Energy required to make a bacterial cell. Simplified mathematical models of transcription and translation, small genetic circuits and signaling pathways. Random walks and applications to biology. Mathematical models to be studied analytically and computationally.

UNIT -III

The complexity of life: At the level of a cell: The numbers of distinct metabolites, genes and proteins in a cell. Complex networks of molecular interactions: metabolic, regulatory and signaling networks. Dynamics of metabolic networks; the stoichiometric matrix. Living systems as complex organizations; systems biology. Models of cellular dynamics. The implausibility of life based on a simplified probability estimate, and the origin of life problem.

UNIT -IV

At the level of a multicellular organism: Numbers and types of cells in multicellular organisms. Cell types as distinct attractors of a dynamical system. Stem cells and cellular differentiation. Pattern formation and development. Brain structure: neurons and neural networks. Brain as an information processing system. Associative memory models. Memories as attractors of the neural network dynamics.

UNIT -V

Nanobiomaterials And Biocompatibility: Surface and Bulk Properties of Bio materials – Nanobiomaterials –NanoCeramics – Nanopolymers – Nano Silica – Hydroxy apatite – Carbon Based nanomaterials Surface modification – Textured and Porous Materials – Surface immobilized biomolecules – Cell-biomaterial interactions – immune response – In Vitro and In Vivo assessment of tissue compatibility.

SUGGESTED READINGS

1. Physics in Molecular Biology; Kim Sneppen & Giovanni Zocchi (CUP 2005)
2. Biological Physics: Energy, Information, Life; Philip Nelson (W H Freeman & Co, NY, 2004)
3. Physical Biology of the Cell (2nd Edition), Rob Phillips et al (Garland Science, Taylor & Francis Group, London & NY, 2013)
4. An Introduction to Systems Biology; Uri Alon (Chapman and Hall/CRC, Special Indian Edition, 2013)
5. Evolution; M. Ridley (Blackwell Publishers, 2009, 3rd edition)
6. http://www.physics.drexel.edu/~brigita/COURSES/BIOPHYS_2011-2012/
7. https://www.easybiologyclass.com/biophysics-free-online-classes-lecture-notes-references-study-materials/

SEMESTER-VI

21PHU611 CLASSICAL AND QUANTUM MECHANICS PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Learning Objectives

- To know how to impose constraints on a system in order to simplify the methods tobe used in solving physics problems.
- To know what central, conservative and central-conservative forces mathematically understand the conservative theorems of energy, linear momentum and angular Momentum.
- To know the importance of concepts such as generalized coordinates and constrained motion.
- To establish that Kepler's laws are just consequences Newton's laws of gravitation and that of motion.
- The main objective of this course is to make students aware about the basic formulations in quantum mechanics. There are many different types of representations of state and operators that are very useful in studying the subject deeply.
- To give an insight into the classical methods of physics.
- To understand the basic principles of classical mechanics.

Course Learning Outcome

1. Students learn about Lagrangian and Hamiltonian formulation of Classical Mechanics.
2. Students learn about motion of a particle under central force field.
3. Students will be able to appreciate the beauty of quantum mechanics.
4. Students will know all types of representations of operators and ways to apply them in different problems.
5. An appreciation of the influence of classical mechanics and relativity on modern scientific development.
6. Understand the role of uncertainty in quantum physics, and use the commutation relations of operators to determine whether or not two physical properties can be simultaneously measured

Any 8 experiments

1. To determine the coupling coefficient of coupled pendulums.
2. To determine the coupling coefficient of coupled oscillators.
3. To determine the coupling and damping coefficient of damped coupled oscillator.
4. To study population models e.g. exponential growth and decay, logistic growth, species competition, predator-prey dynamics, simple genetic circuits.
5. To study rate equations for chemical reactions e.g. auto catalysis, bistability.

6. To study examples from game theory.
7. Computational visualization of trajectories in the Sinai Billiard.
8. Computational visualization of trajectories Electron motion in mesoscopic conductors as a chaotic billiard problem.
9. Computational visualization of fractal formations of Deterministic fractal.
10. Computational visualization of fractal formations of self-similar fractal.
11. Computational visualization of fractal formations of Fractals in nature – trees, coastlines, earthquakes.
12. Computational Flow visualization - streamlines, pathlines, Streaklines.

Suggested Readings

1. Nonlinear Dynamics and Chaos, Steven H. Strogatz, Levant Books, Kolkata, 2007
2. Understanding Nonlinear Dynamics, Daniel Kaplan and Leon Glass, Springer.
3. An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge Univ. Press, 2002
4. Fluid Mechanics, 2nd Edn, L.D.Landau & E.M. Lifshitz, Pergamon Press, Oxford, 1987
5. Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN: 978-6133459274

SEMESTER – VI

21PHU612 SOLID STATE PHYSICS PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives:

- The course is to understand the basic knowledge on magnetic properties of materials.
- To understand the various parameters of the Hysteresis loop
- Acquire the knowledge of semiconducting and dielectric materials.
- To comprehend the concepts of superconductivity and magnetic properties of solids.
- To verify the dielectric constant of a material by experimentally.
- To understand the importance of new materials in modern technology.

Course Outcome:

After successful completion of the course, the student is expected to

1. Basic practical knowledge on magnetic materials.
2. Understand the basic idea about the dielectric Properties of Solids
3. Experience the behavior of Hysteresis loop of a crystal.
4. Measure the suceptability of magnetic materials.
5. Verify the dielectric constant of a material by experimentally.
6. Understand the importance of new materials in modern technology.

ANY SIX EXPERIMENTS

1. Measurement of susceptibility - Quinck`s Tube Method – Ferromagnetic solution
2. Measurement of susceptibility - Quinck`s Tube Method – Paramagnetic solution
3. Measurement of susceptibility – Guoy's tube method – Ferromagnetic solution
4. Measurement of susceptibility – Guoy's tube method – Paramagnetic solution
5. Determination of Dielectric constant – Four probe method
6. Study of Hall effect
7. Study seeback's effect
8. To determine the refractive index of a dielectric layer using SPR technique.
9. To study the PE Hysteresis loop of a Ferroelectric Crystal.
10. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
11. To measure the resistivity of a semiconductor (Ge) crystal with temperature (up to 150^{o}C) by four-probe method and to determine its band gap.

12. To determine the Hall coefficient of a semiconductor sample.

SUGGESTED READINGS

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

SEMESTER VI

21PHU613A NANO MATERIALS AND APPLICATIONS PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objective

- To provide knowledge of the Nanoscience and related fields.
- To make the students acquire an understanding the Nanoscience and Applications
- To help them understand in broad outline of Nanoscience and Nanotechnology.
- The course will cover recent breakthroughs and assess the impact of this burgeoning field.
- Specific nanofabrication topics include epitaxy, beam lithographies, self- assembly, biocatalytic synthesis, atom optics, and scanning probe lithography.
- The course consists of topics in fundamental nanoscale science, plus an overview of areas in nanotechnology.

Course Outcome

After successful completion of the course, the student is expected to

1. Understand the methods synthesis of nanomaterials
2. Understand their application and the impact of nanomaterials on environment
3. Apply their learned knowledge to develop Nanomaterials.
4. Bring new materials to the socity.
5. Gain knowledge on different spectroscopic techniques.
6. Apply their learned knowledge to develop the new devices.

Any 8 experiments

1. Synthesis of metal nanoparticles by chemical route.
2. Analysis of XRD spectra of a sample
3. Synthesis of iron oxide nanoparticles by chemical route.
4. Analysis of FTIR spectra of a sample
5. Analysis of UV- VIS of a sample
6. Synthesis of metal nanoparticles by green synthesis method.
7. Prepare a thin film of semiconductor.
8. Analysis of Photo Luminescence of a sample
9. Analysis of Zeta- potential of a sample
10. Intensity ratio analysis of Raman Spectra
11. Study the resistivity of the prepared thin film

SUGGESTED READINGS

1. C.P.Poole, Jr. Frank J.Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.). S.K. Kulkarni,
2. Nanotechnology: Principles & Practices (Capital Publishing Company). K.K. Chattopadhyay and A.N. Banerjee,
3. Introduction to Nanoscience & Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

SEMESTER VI

21PHU613B BIOLOGICAL PHYSICS PRACTICAL 4H - 2C

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives:

- The course aims to provide students with a foundation in the basic concepts of Biophysics.
- Biophysics is an interdisciplinary science that employs and develops theories and methods of the physical sciences for the investigation of biological systems.
- Topics will include canonical and non-canonical structures of nucleic acids, structure of proteins, enzymes etc.
- Fundamental concepts that underlie biomolecular interactions will be discussed and biophysical methods that are employed for the structural analysis of these systems will be introduced at an elementary level.
- To Understand the concept of life of molecules.
- The physical quantities such as temperature, energy, enthalpy, entropy, and free energy will be employed to understand why a biological system choses particular state at conditions under study.

Course Outcome

After successful completion of the course, the student is expected to

1. Demonstrate knowledge of the fundamental concepts in physics and chemistry that underlie biological processes.
2. Define the structural characteristics of nucleic acids and proteins
3. Examine parameters that variously determine their stability and function(s).
4. Describe the principles that govern biomolecular interactions
5. Appreciate how established methods of research and enquiry are employed to analyze the different aspects of these interactions.
6. Understand the concept of life of molecules.

Any 7 Experiments

1. Measurement of the skin temperature by thermistor
2. Estimation of relative humidity
3. Continual spectrum of visible light
4. Measurement of concentration in colored solution
5. Measurement of human hair thickness by microscope
6. Blood pressure measurement
7. Estimation of audibility threshold by audiometer
8. Recording and analysis of ECG signals

9. Verification of Beers and Lambert's Law
10. Absorption spectrum of Blood/Chlorophyll.
11. PH Value of Amino acids.
12. Study of DNA melting

SUGGESTED READINGS

1. Introduction to Biophysics - by P. Narayanan.New Age P.
2. Medical Instrumentation - by Khandpur, TMH
3. Laboratory Manuals of Biophysics Instruments - by P.B. Vidyasagar
4. Biophysics -by VatsalaPiramal, Dominant Publisher and Distributors, New Delhi-110002
5. Textbook of Biophysics - by R.N. Roy 6. Photosynthesis - by Hall and Rao.

SEMESTER VI

21PHU691	**PROJECT**	**6H - 4C**

Instruction Hours / week: L: 6 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End semester Exam: 3 Hours

Course Objectives

- The aim of the B.Sc. project work is to expose the students to preliminaries and methodology of research in Theoretical Physics and Experimental Physics.
- Students get the opportunity to participate in some ongoing research activity and development of a laboratory experiment.
- To explain the physics problem and its solution in both words and appropriately specific equations to both experts and non-experts.
- To understand the objective of a physics laboratory experiment, properly carry out the experiments, and appropriately record and analyze the results.
- To use computers in data acquisition and processing and how to use available software as a tool in data analysis.
- To think creatively about scientific problems and their solutions.
- To design experiments, and to constructively question results they are presented with, whether these results are in a newspaper, in a classroom, or elsewhere.

Course Outcomes (COs)

After successful completion of the course, the student is expected to

1. Complete an independent research project, resulting in research outputs in terms of publications in journals and conference proceedings.
2. To apply his/her knowledge and skills to carry out advanced tasks and projects.
3. Apply their knowledge to develop the instruments.
4. Verify the basic principles and laws experimentally as a project.
5. Demonstrate knowledge of contemporary issues in their chosen field of research.
6. Demonstrate an ability to present and defend their research work.
7. Successfully pursue career objectives in graduate school or professional schools, in a scientific career in government or industry, in a teaching career, or in a related career.
8. Think creatively about scientific problems and their solutions.
9. Design experiments, and to constructively question results they are presented with, whether these results are in a newspaper, in a classroom, or elsewhere.
10. Explain the physics problem and its solution in both words and appropriately specific equations to both experts and non-experts.