P.K.R. ARTS COLLEGE FOR WOMEN (AUTONOMOUS),

(Accredited with 'A' grade by NAAC - Affiliated to Bharathiar University, Coimbatore)

GOBICHETTIPALAYAM – 638 476.

RULES AND REGULATIONS
PG PROGRAMMES

SCHOLASTIC COURSES

AND

CO-SCHOLASTIC COURSES

For the candidates admitted from the Academic Year

2022-2023 and onwards

Under CBCS PATTERN

VISION

To make a centre of excellence in higher education by imparting value based quality education to rural women, to empower and make them economically independent, and socially committed to the task of building a strong nation.

MISSION

Empowering the rural women by inculcating the core values of truth and righteousness and by ensuring quality in the teaching-learning process along with co-curricular and extra-curricular activities for their economic independence, social commitment and national development.

GOALS AND OBJECTIVES

- The college had been founded by the tillers of the soil, aimed at providing access to higher education for women students of the rural areas, who do not have the facilities of their urban counterparts.
- To provide quality education to empower the rural women.
- To impart value based education and prepare the women students to uphold the rich cultural heritage and secular ideals of the nation.
- To awaken the social consciousness among students and motivate them to serve society with the motive of establishing an egalitarian system.
- To provide opportunities to develop the overall personality of the students and thus enabling them to face challenges in the competitive global scenario.

CORE VALUES OF THE INSTITUTION

- Education
- Enlightenment
- Discipline
- Service

PROGRAMME EDUCATIONAL OBJECTIVES

1. To provide value-based quality education with theoretical and applied skills for rural women.
2. To facilitate personality development opportunities for students to face life's challenges in today's competitive scenario.
3. To empower rural women and make them economically independent through employability and entrepreneurship.
4. To awaken social consciousness of the students through community engagement for active contribution to the society.
5. To equip the students to become morally, ethically and socially responsible for building a strong nation.

PROGRAMME OUTCOMES

1. **Disciplinary knowledge**: Demonstrate critical and systematic proficiency about the breadth and depth of the basic and emerging trends in the arts and science streams appropriate to the programme.

2. **Communication skills**: Communicate ideas clearly and effectively through verbal and non-verbal forms to specialist and non-specialist audiences with professionalism and multi-disciplinary approach.

3. **Critical thinking, problem solving and analytical reasoning:** Apply appropriate knowledge and skills to identify, formulate, critically analyse and substantially conclude with simple solutions to problems.

4. **Research skills and reflective thinking:** Explore real-time scenarios, analyse and interpret data and information, articulate and support findings with evidences incorporating economic and business practices to reach valid conclusion.

5. **Teamwork and Leadership skills for interpersonal competence:** Ability to interact, communicate and collaborate in a trans-disciplinary context.

6. **Continuous autonomous learning and digital literacy:** Ability to find, evaluate and compose clear information for self-directed learning through conventional and digital media.

7. **Social consciousness with concern for environment**: Capability to synthesise the economic, legal, social, environment, health, safety and cultural dimensions of the society with moral and ethical reasoning and promote equity through sustainable development practices.

GRADUATE ATTRIBUTES

1. Disciplinary knowledge.
2. Communication skills.
3. Critical thinking, problem solving and analytical reasoning.
4. Research skills and reflective thinking.
5. Teamwork and Leadership skills for interpersonal competence.
6. Continuous autonomous learning and digital literacy.

7. Social consciousness with concern for environment.

RULES AND REGULATIONS FOR PG STUDENTS ADMITTED FROM 2021-22 &ONWARDS

P.K.R. Arts College founded in the year 1994 with the vision to make the college a"**Centre of Excellence"** in higher education by imparting value based quality education to rural women, to empower and make them economically independent and socially committed to the task of building a strong nation. Ever since its inception the college took steps to inculcate the core values of truth and righteousness through right kind of teaching and learning methods and grown to leap and bounds.

As per the expectations of UGC on the Autonomous colleges, our college has initiated the following measures for the quality improvement of its functioning:

1. To Re-structure and design the course curricula;
2. To Inculcate research culture amongst the students and teachers;
3. Promote healthy practices such as community service, extension services, projects, etc. for the benefit of the society.

The P.K.R. Arts College for Women follows the UGC, TANSCHE and Bharathiar University guidelines of CBCS pattern in framing Course Scheme and scheme of examinations for the students admitted in various UG and PG Programmes from the Academic year 2017-18 and onwards.

DEFINITION OF TERMS:

Choice Based Credit System (CBCS):

CBCS is a flexible system of learning that permits students to,

- Learn at their own pace

- Choose electives from a wide range of elective courses offered by the departments
- Adopt an inter-disciplinary approach in learning
- Undergo additional courses and acquire more than the required number of credits
- Make best use of the expertise of available faculty

Programme:

The term ***"Programme"*** is used to refer to the Bachelor or Master level of study offered in P.K.R. Arts College for Women. For e.g. B.A. Programme indicates Bachelor of Arts and B.Sc., Programme indicates, Bachelor of Science and M.Sc., Programme indicates, Master of Science.

Branch:

The term ***"branch"*** is used to refer to the subject specialization under the Bachelors or Masters Level of study offered in P.K.R. Arts College for Women. For e.g. B.A. Tamil Literature indicates, the Bachelor of Arts, specializing Tamil Literature and M.Sc., - Mathematics, indicates Master of Science, specializing in Mathematics.

Duration:

- The total study periods of various programmes are:

Undergraduate (Bachelors) programmes : (B.A. or B.Sc or B.Com or BCA or BBA): Three years (Six semesters)

- Postgraduate (Masters) programme (M.A. or M.Sc, M.Com., M.C.A., & M.B.A): Two years (Four semesters)

Curriculum:

The term "Curriculum" indicates the various components of the programme and branchof study.

Course:

The term "Course" is used to refer to the specific subject or the paper of the particularProgramme and branch of study.

Programme Scheme:

Course scheme denotes the course outline or the components of the particularProgrammeand branch of study.

Scheme of examinations:

Scheme of examination indicates the contact hours allotted for each course, the duration of End Semester Examination, marks details for CIA and ESE and the credit score specified for each course.

Syllabus:

The subject content of each course is referred to as "Syllabus".

Semester:

The term "semester" denotes the start and the end of teaching period of the Academicyear. The college adopts two semester pattern of an Academic Year. The duration of each semester is roughly around six months period but not less than 90 working days. The semester is subdivided as (ODD and EVEN) spanning six months (odd semester is from June to November and Even semester is from December to May).

Credit system:

It is a system of assigning weightage to each one of the courses and components of thecurriculum of a programme and branch of study in terms of the weightage of the teachinglearning process of thatparticular course. The weightageis given in terms of credit points.

Credit point:

Credit point is the numerical weightage given to the particular course of study.

Thestudent learner should obtain the mandatory minimum credit points specified for each programmeand branch of study to earn her degree. The student learner may also earn extra credits by the way of completing extra courses (subjects).

Programmes offered:

M.A.	: Tamil Literature
M.A.	: English Language and Literature
M.Sc	: Mathematics
M.Sc	: Physics
M.C.A.	: Computer Applications
M.Com	: Commerce
M.B.A.	: Business Administration

Credits to be earned:

All PG Programmes : 90 credits

(Including AICTE approved M.C.A. and M.B.A. Programmes)

Duration:

Duration for all the PG programmesareTWO (02) years.

COMPONENTS FOR PG PROGRAMMES:

Scholastic Courses:

PartIII : This part consists of

a) Core courses : Theory and Practical

b) Elective courses

(CBCS - Discipline Specific Elective courses / Open Elective Course)

Part IV: Following are the components under Part: IV:

A: Skill Enhancement:

Courses offered by the department - offered during semesters I and III

(ONLY MBA)

B:Ability Enhancement:

i. Cyber Security - offered during semester II

(for students of all PGprogrammes)

Part V: Following are the components under Part V

ii. Proficiency Enhancement**:**

Self Study Course - offered during semester III

Competency Enhancement :

a. Online course / Learning Object Repository (LOR) - to be completed during Semester I – IV by the candidateand,

Certificate Course - to be completed during Semester I – IV by the candidate

(OR)

b. Student Start-up Venture / Internship / Capstone Project & Viva-voce – to be completed during Semester III – IV (ONLY MBA)

Co-Scholastic Courses:

Following THREE categories of CO-SCHOLASTIC COURSES are offered to nurture - choice based skill / ability / proficiency / competency enhancement of an individual in addition to the courses specified under the scheme of examinations.

The categoriesavailable are

a) VALUE ADDED COURSES

b) COURSES WITH CREDIT TRANSFERABILITY

c) EXTRA CREDIT COURSES

ADMISSION NORMS:

The eligibility conditions and the guidelines issued by the Bharathiar University in

admitting students are followed for all the PGprogrammes offered in P.K.R. Arts College for Women.

EXAMINATION AND EVALUATIONS:

Requirement for appearing End Semester Examinations:

Attendance: (as per the norms and guidelines of Bharathiar University)

i) A candidate is eligible to appear for the End Semester examinations in any semester, if:

- She secures not less than 75% of attendance in the number of working days during the semester.
- Her progress has been satisfactory
- Her conduct has been satisfactory

ii) Candidates who earn attendance between 65% and 75% are ineligible to appear for the current semester examinations. However, the Principal may condone the lack of attendance of those students on the following grounds and permit them to write End Semester Examinations, after the payment of condonation fee:

* Prolonged illness
* Major Surgery
* Accident which demands a long rest

The cause of the long period of absence should be informed with supportive documents to the Principal within a week's time and get the leave sanctioned.

iii). Candidates who earn attendance between 55% and 64% are ineligible to appear for the current semester examinations. However, they can write arrear subjects, if any. They are permitted to continue their studies in the next semester; while continuing in the next semester, they have to compensate and earn combined attendance of 75% or more by taking the average of the attendance earned in the current and the previous semester.

iv). Candidates who earn attendance below 55% are not eligible to appear for the current semester examinations and also have to discontinue the course and rejoin in the same semester in the next academic year, if vacancy is available, with proper approval from the BharathiarUniversity and the Principal through the Head of the Department concerned. These candidates are eligible to write arrear subjects, if any.

v). Students having a minimum of 75% of attendance in the Practical classes alonewillbe eligible to submit their record note books and appear for CIA and ESE practical examinations.

vi). Students shall be permitted to appear for the practical examinations only with thesubmissions of bonafide records.

Scheme of examinations:

i) All End Semester Examinations (theory and practical) shall be conducted twice a year,in November / December and in April / May. All failed candidates shall be governed by the regulations and syllabus in force at the time of their subsequent appearances.

ii) Additional supplementary End Semester Examinations in final semester subjects and Special Supplementary End Semester Examinations for students who have failed in only one subject up to III semester (PGProgrammes) are conducted in June / July every year to facilitate the final year students who have failed to score passing minimum to go for higher studies or seek job early.

RULES TO BE FOLLOWED BY STUDENTS DURING EXAMINATION:

1. A candidate entering the examination hall must possess hall-ticket and identity card issued by the Principal,else she will be denied admission to write the examination.
2. Candidates have to occupy their allotted seats 10 minutes before the commencement of examination and maintain discipline and silence inside the examination hall. They have to give due attention to the instructions given by the Hall Superintendent before the commencement and also during the examination.

3. No candidate will be permitted to enter examination hall after 30 minutes from the commencement of examination. Similarly, no candidate will be permitted to leave the exam hall before 30 minutes from the commencement of examination.

4. A candidate who leaves the examination hall will not be permitted to re-enter the hall under any account.

5. Candidates are expected to bring their own pens, pencils, eraser, geometrical instruments, non-programmable calculators etc., and will not be allowed to borrow from others.

6. Candidates should use only blue or black ink or ball-point pen while answering their papers. Only for drawing diagrams or chart, colour pens/sketch pens are allowed.

7. Clark's mathematical table, Statistical table and Compound present value table will be supplied to candidates on request and the same should be returned immediately after use, without any scribbling. However, the candidates will be allowed to use their own mathematical and statistical tables / data sheets/graph sheets which are uncommon and specifically required to answer a particular paper after obtaining permission from Chief/Hall Superintendent. Such sheets or tables with any scribbling will not be permitted.

8. Candidates are prohibited from possessing study material in any form or mobile phone or and any such Electronics/ Communication instruments inside the examination hall.Mere possession of such materials inside the examination hall itself will be considered as the material meant for malpractice and will lead to disciplinary actions.

9. Candidates must verify and satisfy themselves that they have received correct question paper before they start answering for questions. Question paper not relevant should be returned to the hall superintendent at once.

10. Candidates are not allowed to write beyond the time prescribed for the examinations.

11. Rough work, if any, must be done by the candidates on the bottom of the page itself. Candidates can reserve, if necessary, one fourth of the page at the bottom exclusively for the

purpose. No separate answer book for rough work will be supplied to candidates. Rough work carried out of by a candidate will become part and parcel of the answer paper.

12. Candidates are forbidden from asking questions or clarifications of any kind from the fellow student or Hall Superintendent during the examination.
13. Candidates should not detach any sheet from the main answer book or smuggle out additional sheet or main book.
14. Candidates should handover the answer books personally to the Hall superintendent, before leaving the examination hall.
15. Candidates should not write their Register number anywhere else (except in the specified space) on the first page of Answer Book. Writing the name or making any appeal in the answer book or any other identifiable marking will be treated as an attempt to influence the examiner. Hence, any such act will attract disciplinary measures.
16. The students who indulge in any malpractice while writing examination will be immediately referred to the Chief Superintendent for the initiation of appropriate disciplinary action.
17. In case of impersonation, the accused will be handed over to police authorities for investigation and necessary action.
18. In the event of public holiday being declared after the publication of timetable, the examinations will not be postponed or cancelled. The examinations will be conducted as scheduled unless otherwise notified.
19. Any letter or telegram or phone call to a candidate shall not in any case be delivered / informed to the candidate until he/she completes examination.
20. Candidates with disabilities and who could not write examination by themselves shallsubmit a request to the Principal in the beginning of the Academic Year with the support of documentary evidences for alternate arrangements.

Transitory positions:

The candidate who have completed the course of study (TWO YEARS IN CASE OF PG PROGRAMMES) but have arrears will be permittedto take up the examinations only under the regulations in force at the time.

Facility to appear in an examination already passed:

The Candidates who have passed examinations may be permitted to appear again (Onlyonce) for the end semester examinations of that course or courses under the regulations and syllabi in force then, with a view to improve their performance(s). If they do not show improvement, their previous marks shall be the final marks in all records (such candidates should not have applied for their Degree certificate in Convocations held in between). Also such reappearances shall be permitted only once at the examination(s) conducted in the college in the next two semesters only.

Provision to re-total the answer book:

Candidates who desire to have their answer books re-totaled shall apply to the controller of Examinations, remitting the prescribed fees within 10 calendar days from the date of publication of results.Where the marks obtained in the re-totaling are higher than the marks awarded earlier, the Controller of Examinations shall issue the revised mark sheets after withdrawing the previous one.

Provision to appeal for re-evaluation of End Semester Examination Marks:

Candidates who desire to have their answer books revalued shall apply to theController of

Examinations, remitting the prescribed fees within 10 calendar days from the date of publication of results (The date mentioned in the Mark sheet). If the revalued marks are higher to the extent of getting a passing minimum and more than the marks awarded earlier, then the COE shall issue the revised mark sheet after withdrawing the mark sheet issued previously. If the revalued marks are higher than the marks awarded earlier but not to the extent of getting a passing minimum, then the first valuation marks shall be the final marks. The principles of moderation formulated in the Results Passing Board for the respective examination shall be applied for the revaluation cases also.

Transparency system:

Under this system, the photo copy of the answer script written by the student is issuedon request. The procedure is that the candidate who desires to get the Photo copy of heranswerscript shall apply to the COE, remitting the prescribed fee within 10 calendar daysfrom the date (noted in the mark sheet) of publication of results. On a specific day, the candidates who have applied for this facility will be given with the photo copy of the answerscript and would be directed to discuss the issues with the subject expert who is specially appointed for the purpose. The students may scrutinize the answers script, discuss with the subject expert, get clarifications and if they are not convinced with the marks awarded then they may go for applying for revaluation. Such a request shall be made within 3 calendar days. The procedure followed for the revaluation is applied to this category also.

Passing Minimum:

A candidate who secures not less than 50% marks in ESE of various components shallbe declared to have passed the examination in that course (subject).

Classification of successful candidates and grading system:

No candidate shall be eligible for classification or grading unless, the candidate

- Has undergone the prescribed course of study for the prescribed period
- Has passed / completed all the courses (subjects) / components prescribed for the programme
- Has earned the credit points prescribed for the programme.

Part: III

Candidates who have passed all the Part: III examinations in FIRST ATTEMPT within the study period of the respective semester and securing 75% and above in aggregate of Part: III shall be declared to have passed the Part: III examination in first class with distinction. All other candidates who have passed Part: III subjects and securing 60% & above and 50% to 59.9% shall be declared to have passed the Part: III examinations in First and Second class respectively.

GRADING SYSTEM

Based on the guidelines of Bharathiar University on grading system the following gradingSystem for the students admitted from 2017-18 & onwards.

Conversion of Marks to Grade Points and Letter Grade:

RANGE OF MARKS	GRADE POINT	LETTER GRADE	DESCRIPTION
90 - 100	9.0 -10.0	O	Outstanding
80 - 89	8.0 – 8.9	D+	Excellent
75 - 79	7.5 – 7.9	D	Distinction
70 - 74	7.0 – 7.4	A+	Very Good
60 - 69	6.0 – 6.9	A	Good
50 - 59	5.0 – 5.9	B	Average
0 - 49	4.0 – 4.9	U	Reappear
Absent	0.0	AAA	Absent

Classification:

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5 – 10.0	O+	First class – Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First class with Distinction
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A+	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
0 and above but below 5	U	Re-appear

***Applicable for the students who have passed the Part: III examinations in FIRST APPEARANCE within the study period of the respective semesters.**

- Cumulative Grade Point Average (CGPA) and final classifications are to be made for the students who have passed all courses (subjects) / completed all components prescribed for the programme
- Part-III components alone are considered for CGPA.
- Part-IV & Part-V are not to be considered for finding the CGPA or for the classification of Part—III

- The maximum marks per course (subject) are to be fixed at 100. (if it is less or more than 100 it should be converted to 100)

Grade point average – For a semester: (GPA): = $\sum$**CGP / C**

Where C= Credits earned for the course in any semester

G= Grade Point obtained for the course in any semester

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

Cumulative Grade Point Average – For the entire programme: (CGPA) is calculated by using the formula:

$$CGPA = \frac{\sum CGP}{\sum C}$$ Where C= Credit Point GP= Grade Point

$$\textbf{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

CGPA is given only in consolidated mark statement / Grade sheet

Ranking:

- Candidates who have passed all the courses (subjects) or completed all the components prescribed for the programme within the period of study are only eligible for Ranking
- Ranking is based on the marks scored in Part-III subjects only.
- Candidates passing the Part-III subjects in First Attempt within the study period of respective semesters are only eligible for ranking.
- In case of Reappearance, the first appearance mark is only considered for ranking
- Candidates absenting for the courses (subjects) prescribed in Part-III and getting higher marks in the subsequent appearances will not be considered for Ranking.

MALPRACTICE AND PUNISHMENT

Punishment for malpractice committed during End Semester Examinations.

The students, who indulge in any malpractice, while writing examination, will be directed to report to Chief Superintendent. The chief superintendent will review and forward the case to Controller of Examinations and the CoE in turn will submit the details to Examination Committee for the initiation of appropriate disciplinary proceedings.

NATURE OF MALPRACTICE	NATURE OF PUNISHMENT	LEVEL OF PUNISHMENT
Making an appeal in any form inside the answer script	**Warning** may be given and if repeated the examination taken by the candidate will be cancelled	LEVEL: I
Possession of mobile phone / study materials / incriminating materials in any form	The **particular examination** taken by the candidate will be **cancelled**	LEVEL: II
Aiding / Passing / Referring / Copying from mobile phone / study material	The **particular examination** and a**ll t**he **examinations** written already in this semester including Arrear will be **cancelled and** may be permitted to write subsequent semester examinations	LEVEL: III
Insubordinate behavior or threatening the Invigilator	The **particular examination** and a**ll t**he **examinations** written already in this semester will be **cancelled** and also will be **debarred** from appearing for the **ONE subsequent semester examinations**	LEVEL:IV

Inserting previously written answers	The **particular examination** and a**ll t**he **examinations** written already in this semester will be **cancelled** and also will be **debarred** from appearing for the **TWO subsequent semester examinations**	LEVEL: V
Case of **Impersonation**	The **particular examination** and a**ll t**he **examinations** written already in this semester will be **cancelled** and will be**expelled** **From the college and the matter will be referred to the Police if necessary for further action.**	LEVEL: VI

PG PROGRAMME STRUCTURE

CBCS : 2021 – 2022

Category	Components	No. of Courses	Credit(s) / Course	Total Credits	Proposed Semester
Part - III	**Core Courses:** **A) Core and Elective Courses: (Theory/Practical)**	23	1/2/3/4	79	I – IV
	Core : Theory	13	4/3		
	Core : Practical	4	4		
	Core : Elective (CBCS)	3	3		
	Core : Open Elective(CBCS)	1	2		
	Core : Industrial/ Institution Training	1	1		
	B) Projects: Core – Major Project and Viva voce	1	2/3	3	
Part – IV	**A) Ability Enhancement :** i) Cyber Security	1	2	2	II

Part – V	A)**Proficiency Enhancement** **Course:** (Self Study)	1	2	2	III
	A) Competency Enhancement **Courses:** i) Online Course / Learning Object Repository	1	2	4	I – IV
	ii) Certificate Course	1	2		

***Credit Transfer for all courses from UGC SWAYAM MOOC Courses.**

Total: 2500 Marks 90 credits

P.K.R ARTS COLLEGE FOR WOMEN (AUTONOMOUS)GOBICHETTIPALAYAM

PG SCHEME OF EXAMINATIONS 2022-2023

P.K.R ARTS COLLEGE FOR WOMEN(Autonomous)
GOBICHETTIPALAYAM – 638476.

MASTER OF SCIENCE
Course Scheme and Scheme of Examinations
(For students admitted from 2021-22 & onwards)

Category	Component	Course Code	Course Title	Contact Hrs/ week	Exam Duration hrs.	Max.Marks			Credits
						CIA	ESE	Total	
SEMESTER – I									
III	Core: I	21PHP01	Classical Mechanics	5	3	50	50	100	4
III	Core :II	21PHP02	Mathematical Physics	5	3	50	50	100	4
III	Core : III	21PHP03	Quantum Mechanics – I	5	3	50	50	100	4
III	Core : IV	21PHP04	Numerical Methods & MATLAB Programming	5	3	50	50	100	4
III	****	****	Advanced Physics Practical-I	3	-	-	-	-	-
III	****	****	General Electronics Practical-I	3	-	-	-	-	-
III	Core : V Elective: I	21PHP05 A/21PHP0 5B	Essentials of Nanoscience/ Radiation Physics	4	3	50	50	100	3
			TOTAL	**30**				**500**	**19**
SEMESTER – II									
III	Core : VI	21PHP06	Quantum Mechanics – II	5	3	50	50	100	4
III	Core : VII	21PHP07	Advanced Electronics	5	3	50	50	100	4
III	Core : VIII	22PHP08	Introduction to Scientific Research & Solar Energy Research	5	3	50	50	100	3

III	Core : IX	21PHP09	Advanced Physics Practical-I	5	3	50	50	100	4
III	Core : X	21PHP10	General Electronics Practical-I	5	3	50	50	100	4
III	Core : XI Elective: II	21PHP11A/ 21PHP11B	Astronomy &Astrophysics / Experimental Techniques	3	3	50	50	100	3
IV	Ability Enhancement	21AEP01	Cyber Security	2	3	--	100	100	2
			TOTAL	**30**				**700**	**24**
SEMESTER – III									
III	Core : XII	21PHP12	Atomic and Molecular Spectroscopy	5	3	50	50	100	4
III	Core :XIII	21PHP13	Nuclear & Particle Physics	5	3	50	50	100	4
III	Core :XIV	21PHP14	Electromagnetic Field Theory	5	3	50	50	100	4
III	Core : XV	21PHP15	Institutional Training	-	-	100	-	100	1
III	****	****	Advanced Physics Practical-II	4	-	-	-	-	-
III	****	****	General Electronics Practical-II	4	-	-	-	-	-
III	Core : XVI (Open Elective)	****	Offered for students of other PG programmes/ Departments	3	3	50	50	100	2
III	Core : XVII Elective : III	22PHP16 A/22PHP16B	Biomedical Instrumentation/Thin Film Physics and CrystalGrowth	4	3	50	50	100	3
V	Proficiency Enhancement	21PEP01	Laser and its applications (Self –Study)	-	3	-	100	100	2

			TOTAL	**30**				**700**	**20**
SEMESTER – IV									
III	Core :XVIII	21PHP17	Condensed Matter Physics	6	3	50	50	100	4
III	Core : XIX	21PHP18	Thermodynamics and Statistical Mechanics	6	3	50	50	100	4
III	Core : XX	21PHP19	Electronic Communication Systems	6	3	50	50	100	4
III	Core : XXI	21PHP20	Advanced Physics Practical-II	5	6	50	50	100	4
III	Core : XXII	21PHP21	General Electronics Practical-II	5	6	50	50	100	4
III	Core :XXIII	21PHP22	Project Work & Viva Voce	2	3	50	50	100	3
			TOTAL	**30**				**600**	**23**
V	Competency Enhancement	Online Course / Learning Object Repository (LOR)		SEMESTER I – IV					2
		Certificate Course		SEMESTER 1 - IV					**2**
Total Marks & Credits - 2500									**90**

Credit Transfer for all courses from UGC SWAYAM MOOC Courses.

Total Marks: 2500
Total credits: 90

Chair Person
Name, designation
College name – full address

SYLLABUS
(For students admitted from 2021-22 & onwards)
Semester – I

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: I	21PHP01	**CLASSICAL MECHANICS**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	I	50	50	100

Preamble: The aim is to provide the students, the knowledge and understanding of the fundamental concepts in the dynamics of system of particles, motion of rigid body, Lagrangian and Hamiltonian formulation of mechanics

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

COs	CO Statement	Knowledge Level
CO1	recall important terms such as Constraints, Degree of Freedom, Phase Space, angular Momentum and Poissons bracket	K1
CO2	illustrate D'Alembert's principle, Hamilton's Canonical Equation of Motion, Poisson Brackets, Principle of Least Action, Equivalent One body problem, Euler's theorem, Euler's angles, Kepler's Problem - Shapes of orbits	K2
CO3	apply Lagrange's and Hamilton's equation of motion in Linear Harmonic Oscillator, Simple Pendulum, Isotropic Oscillator, HJ method in Harmonic Oscillator	K3
CO4	analyze Inertial/Non inertial frames, Stable and Unstable Equilibrium, The motion of a Symmetric Top under the action of Gravity, Equation of motion in Poisson Bracket form	K4
CO5	evaluate the Hamilton's Variational principle, Canonical Transformations, Generating Function and different forms, Principle Axis of Transformation, Moments and Products of Inertia	K5
CO6	Formulate Effects of Coriolis force on moving bodies.	K6

K1–Remember; K2– Understand; K3–Apply; K4 –Analyze; K5–Evaluate; K6 –Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

PO / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	9	9	9	9	9	3	1

CO2	9	9	9	9	9	3	1
CO3	9	9	9	3	3	3	1
CO4	9	9	9	3	3	3	1
CO5	9	9	3	1	3	1	1
CO6	9	3	3	1	1	1	1
Total Contribution of COs to POs	54	48	42	26	28	14	6
Weighted Percentage of COs Contribution to POs	6.37	6.38	7.22	5.32	6.43	3.70	2.29

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT- I : LAGRANGIAN FORMULATION (12 Hours)

Constraints and Degrees of Freedom-Generalized Coordinates: Generalized Displacement, Velocity, Acceleration, Momentum, force & Potential-Variational technique and Euler Lagrange Differential equation-Hamilton's Variational principle-Lagrange's equation of motion from Hamilton's principle-D'Alembert's principle-Application of Lagrange's equation of motion: Linear Harmonic Oscillator-Simple Pendulum-Isotropic Oscillator.

UNIT - II : HAMILTONIAN FORMULATION (12 Hours)

Phase space – Hamiltonian - Hamilton's Canonical Equation of Motion - Physical Significance of H - Deduction of Canonical Equation from Variation principle - Application of Hamilton's equation of motion: Simple Pendulum, Linear Harmonic Oscillator, and Isotropic Oscillator - Principle of Least Action and Proof - Canonical Transformations - Generating Function and different forms.

UNIT- III : HAMILTON –JACOBI METHOD (12 Hours)

Hamilton Jacobi Method- Solution of Harmonic Oscillator Problem by HJ method-Particle falling freely-Damped Harmonic Oscillator-Poisson Brackets-Definition-Equation of motion in Poisson Bracket form-Jacobi -Poisson Theorem-Angular Momentum and Poisson's Bracket.

UNIT- IV : TWO BODY PROBLEMS (12 Hours)

Equivalent One body problem-General Features of central force motion-Stability of orbits and Conditions for closure- Kepler's Problem - Shapes of orbits-Inertial/Non inertial frames-Rotating Co-ordinate system-Effects of Coriolis force on moving bodies.

UNIT- V : RIGID BODY DYNAMICS (12 Hours)

Euler's theorem-Euler's angles-Angular velocity of a rigid body-Angular momentum of Rigid Body-Moments and Products of Inertia-Principle Axis of Transformation-Torque Free Motion of a Rigid Body-Poinsot Solutions-The motion of a Symmetric Top under the action of Gravity-Stable and Unstable Equilibrium.

Text Books:

1. **Classical Mechanics**, S.L.Gupta, V. Kumar & H. V. Sharma, 2015, PragatiPrakashan, Meerut. (All units)

References Books:

1. **Classical Mechanics**, H. Goldstein, Charles P. Poole, John Safko, 2011**,** Pearson, India.

Web Reference:

1.https://sites.astro.caltech.edu/~golwala/ph106ab/ph106ab_notes.pdf
2.https://www.physics.rutgers.edu/~shapiro/507/book.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: II	21PHP02	**MATHEMATICAL PHYSICS**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	I	50	50	100

Preamble: The aim is to provide the students firm foundation in various mathematical methods developed and used for understanding different Physics phenomena.

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

COs	CO Statement	Knowledge Level
CO1	identify the basic definitions of differential Equations, Polynomials, Functions, Complex Variable and Groups	K1
CO2	summarize the Legendre's Polynomials and Functions, Orthogonality, Functions of a Complex Variable, Vector Space, Basis, Inner Product, Fourier Series, Laplace Transform, Multiplication table, Subgroups, cosets and classes, Schur's lemma, rotation groups	K2
CO3	perform the Special function and complex variables in various theorems and relations	K3
CO4	classify the functions and variables, vector space and groups	K4
CO5	relate the Legendre Polynomial and their derivatives	K5
CO6	Make Fourier Series and Laplace Transform for different problems and create character table of C2v and C3v by using groups	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO- PO MAPPING (COURSE ARTICULATION MATRIX)							
PO COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
CO1	9	9	9	3	3	3	1
CO2	9	9	9	3	3	3	1
CO3	9	9	9	3	3	3	1
CO4	9	9	3	3	3	1	1
CO5	9	3	3	3	1	1	1
CO6	9	3	3	1	1	1	1
Total Contribution of COs to PO s	54	42	36	16	14	10	6
Weighted Percentage of COs Contribution to PO s	6.37	5.58	6.19	3.27	3.21	2.64	2.29

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT-I : SPECIAL FUNCTIONS (12 Hours)

Legendre's Polynomials and Functions- Differential Equations and Solutions-Generating Functions- Orthogonality-Relation between Legendre Polynomial and their Derivatives Recurrence Relations- Bessel's Function-Differential Equation and Solution-Generating Functions-Recurrence Relations- Hermite function.

UNIT-II: COMPLEX VARIABLE THEORY (12 Hours)

Functions of a Complex Variable-Single and Multi valued Functions-Cauchy-Reimann Differential Equation-Analytical Line Integrals of Complex Function-Cauchy's Integral Theorem and Integral Formula-Derivatives of an Analytic Function-Taylor's Variables Residue and Cauchy's Residue Theorem.

UNIT-III: LINEAR SPACE (12 Hours)

Definition of Vector Space-Linear Dependence-Linear Independence-Basis-Dimension of a Vector Space-Representation of Vectors and Linear Operators with respect to Basis-Schmidt Orthogonalization Process-Inner Product.

UNIT- IV:FOURIER SERIES & LAPLACE TRANSFORMS (12 Hours)

Fourier Series-Dirichlet's Theorem-Change of Interval-Complex Form-Fourier Series in the Interval $(0, \infty)$ - Uses of Fourier Series.-Laplace Transform-Definition-Properties-Translation Property-Inverse Laplace Transform-Properties, example problems.

UNIT- V: GROUP THEORY (12 Hours)

Definition of Groups– Multiplication table – Subgroups, cosets and classes – Point and space groups – Homomorphism and isomorphism – Reducible and irreducible representations – Schur's lemma -- The

great orthogonality theorem (qualitative treatment without proof) – Formation of character table of C2v and C3v -- Elementary ideas of rotation groups.

Text Books:

1. **Mathematical Physics,** SathyaPrakash, 2002, Sultan Chand & Sons. [ISBN: 81-7014-925-8] (All Units)
2. **Mathematical methods for Physicists,**Arfken, weber & Harris, 2005, 7th edition, Elsevier Academic Press.
3. **Elements of group theory for Physicists** - A.W. Joshi, -Wiley Eastern, 2002 (Unit – V)

Reference books:

1. **Mathematical Physics**, B.D. Gupta, 3rd Edition, 2006, Vikas Publishing House.
2. **Mathematical Physics**, B.S. Rajput, 17th Edition 2004, PragatiPrakashan, Meerut
3. **Mathematical Physics**, P.K. Chattopadhayay, New Age International, New Delhi.
4. **Mathematical Physics**, P.P. Gupta, Yadav& Malik, KedarnathRamnath, Meerut.

Web Reference:

1.https://pdfcoffee.com/download/mathematical-physics-by-satya-prakash-pdf-50pdf-pdf-free.html
2. https://isidore.co/calibre/get/pdf/4469

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: III	21PHP03	**QUANTUM MECHANICS-I**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	I	50	50	100

Preamble: The aim is to make the students to understand the concepts of Matrix formalism, learn the approximation methods and to know the Orbital and Spin angular momentum.

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

COs	CO Statement	Knowledge Level
CO1	recall the limitations of Classical Physics, wave packets, wave functions, Schrödinger equation, operators and eigen values in quantum mechanical systems	K1
CO2	explain matrix formalisms in quantum mechanics, Schrödinger equation of motion, approximation methods and commutation relations.	K2
CO3	apply Schrödinger equation and approximation methods to solve quantum mechanical systems and to find eigen values of the systems	K3

CO4	Correlate the various approximation methods, equation of motions in Schrodinger, Heisenberg and Interaction pictures	K4
CO5	Validate the matrix representation of angular momentum operators, addition of angular momentum and Clebsch-Gordon co-efficients	K5
CO6	formulate wave functions and operators in matrix form.	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO- PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

PO / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	3	3
CO3	9	9	9	3	3	3	1
CO4	9	9	3	1	1	3	1
CO5	9	3	3	1	1	1	1
CO6	9	3	3	1	1	1	1
Total Contribution of COs to PO s	54	42	36	24	24	20	10
Weighted Percentage of COs Contribution to PO s	6.37	5.58	6.19	4.91	5.51	5.29	3.83

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and PO

SYLLABUS

UNIT- I : INTRODUCTION AND MATRIX FORMALISM (12 Hours)

Inadequacy of classical Physics - Wave packets –Uncertainty relations-Schrodinger wave equation and probabilistic interpretation. Hilbert space – Dirac's bra and ket notation – Operators as matrices – Matrix form of wave functions – Unitary transformation: Change of basis – Properties of unitary transformations – Schrodinger picture – Heisenberg picture – Interaction picture

UNIT- II : SPHERICALLY SYMMETRIC SYSTEMS (12 Hours)

Schrödinger's equation for spherically symmetric potentials – Three dimensional harmonic oscillator – Rigid rotator with free axis – Solution of wave equation and eigen function for the rotator – Rigid rotator in a fixed plane – The Hydrogen atom – φ, θ and r equations and their solutions – Energy eigen values for the hydrogen atom – Degeneracy – The normal state of hydrogen atom

UNIT- III : INDEPENDENT APPROXIMATION METHODS (12 Hours)

Time Independent Perturbation Theory in Non-Degenerate Case-Ground State of Helium Atom-Degenerate Case-Stark Effect in Hydrogen-Variation Method & its Application to Hydrogen Molecule- WKB Approximation.

UNIT-IV:TIME DEPENDENT PERTURBATION THEORY (12 Hours)

Time Dependent Perturbation Theory-First and Second Order Transitions-Transition to Continuum of States-Fermi Golden Rule-Constant and Harmonic Perturbation-Transition Probabilities-Selection Rules for Dipole Radiation-Collision-Adiabatic Approximation

UNIT- V: ANGULAR MOMENTUM (12 Hours)

Orbital Angular Momentum-Spin Angular Momentum-Total Angular Momentum Operators-Commutation Relations of Total Angular Momentum with Components-Ladder Operators-Commutation Relation of Jz with J_+ and J_- Eigen Values of J^2, Jz -Matrix Representation of J^2, Jz, J_+ and J_--Addition of Angular Momenta- Clebsch Gordon Coefficients-Calculation of Clebsch Gordon Coefficients for $j_1=1/2$, $j_2=1/2$.

Text Books:

1. **QuantumMechanics**, Aruldas, 2nd edition, 2013, PHI Learning Pvt. Ltd. [ISBN: 978-81-203-3635-3] (All Units)
2. **Introduction to Quantum Mechanics** –David J Griffiths– Pearson- 2nd edition- 2016. [ISBN: 978-93-325-4289-1]

Reference books:

1. **Quantum Mechanics,** Gupta, Kumar & Sharma, 34th Edition,2017, Jai PrakashNath Publications. (All units)
2. **Advanced Quantum Mechanics,** SatyaPrakash, 2001, KedarNath Ram Nath Co., Meerut.
3. **Quantum Mechanics**, Leonard.I. Schiff, 1968, McGraw Hill 3rd Edition. [ISBN: 0-07-085643-5] (Unit II)
4. **Quantum Mechanics**, V. Devanathan, 2005, Narosa Publishing House, New Delhi.
5. **A textbook of Quantum Mechanics**, P.M. Mathews and Venkatesan, 27th reprint 2002, Tata McGraw Hill publishing company Ltd., New Delhi.

Web Reference:

1. https://ocw.mit.edu› coursesPDF Web result Chapter 5 The Dirac Formalism and Hilbert Spaces (unit 1)
2. https://www.bbau.ac.in › deptPDF
   Web results Matrix representations of wave functions and operators ... (Unit 1)
3. https://www.rpi.edu› lct4PDF
   Web results 4.1 Schrödinger Equation in Spherical Coordinates (unit 2)
4. https://www.google.com/url?sa=t&source=web&rct=j&url=https://ocw.mit.edu/courses/physics/8-06-quantum-physics-iii-spring-2018/lecturE-notes/MIT8_06S18ch4.pdf&ved=2ahUKEwiEg53JzqPzAhU0yzgGHZ1DAyIQFnoECDEQAQ&usg=AOvVaw0uqBxeeJUf3_kKF1uj3SU0 (unit 4 and 5)
5. https://www.google.com/url?sa=t&source=web&rct=j&url=https://0space.org/file/13199/download%3Ftoken%3D3MFpY12s&ved=2ahUKEwi80tXD0KPzAhXOV30KHWSQAgEQFnoECDQQAQ&usg=AOvVaw1R_dXurAqOpeCnFtuREw30 (unit 5)

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: IV	21PHP04	**NUMERICAL METHODS & MATLAB PROGRAMMING**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	I	50	50	100

Preamble: The aim is to provide the students to develop appropriate numerical abilities, prove results for various numerical root finding methods and to code various numerical methods in a modern computer language

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

COs	CO Statement	Knowledge Level
CO1	remember the Differential equation by using various Numerical methods and MATLAB basics,	K1
CO2	explain Newton Raphson Method, Guass elimination Method, Rungekutta method, SimPOn's rule , Trapezoidal rule, Gauss Quadrature , MATLAB fundamentals, in programming and Graphics	K2
CO3	apply various numerical methods and MATLAB Help and Demos , Control flow statements, MATLAB fundamentals, programs and Graphics with 2D and 3D plots.	K3
CO4	correlate Different Techniques in Numerical methods like Giraffe's root square methods and MATLAB programs for various loops MATLAB Built-In Functions	K4
CO5	validate the different methods in Numerical Methods and fundamentals in Basic MATLAB programming and interpretation of 2D and 3D Graphics in MATLAB	K5
CO6	Adapt numerical Methods in many mathematical fields and MATLAB programming in many computerize world,	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO- PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

PO / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	9	9	9	9	9	3	3
CO2	9	9	9	9	9	3	3
CO3	9	9	9	9	3	3	3

CO4	9	9	9	3	3	1	1
CO5	9	9	3	3	1	1	1
CO6	9	9	3	3	1	1	1
Total Contribution of COs to POs	54	54	42	36	26	12	12
Weighted Percentage of COs Contribution to POs	6.37	7.18	7.22	7.37	5.97	3.17	4.59

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT -I : NUMERICAL DIFFERENTIATION (12 Hours)

Finding Roots of a Polynomial-Bisection Method-Newton Raphson Method-Solution of Simultaneous Linear Equation by Gauss Elimination Method (includes inverse of matrices)-Solution of Ordinary Differential Equation by Euler, Runge-Kutta Fourth Order Method for solving first order Ordinary Differential Equations.

UNIT- II : NUMERICAL INTEGRATION(12 Hours)

Newton's cotes formula-Trapezoidal rule-Simpon's 1/3 rule- Simpon's 3/8 rule -Gaussian quadrature method-(2 point and 3 point formulae)-Giraffe's root square method for solving algebraic equation.

UNIT- III : FUNDAMENTALS (12 Hours)

Introduction-MATLAB Features-Desktop windows: Command, Workspace, Command History, Array Editor and Current Directory -MATLAB Help and Demos- MATLAB Functions, Operators and Commands. Basic Arithmetic in MATLAB-Basic Operations with Scalars, Vectors and Arrays-Matrices and Matrix Operations-Complex Numbers- MATLAB Built-In Functions- Saving and loading data – Plotting simple graphs-Illustrative Examples

UNIT- IV : MATLAB PROGRAMMING (12 Hours)

Control Flow Statements: **if, else, else if, switch** Statements-**for, while** Loop Structures-**break** Statement-Input/output Commands-Script "m" Files -Function "m" Files-Controlling Output - Language specific features – Advanced Data objects . Applications – (Programs about Linear Algebra – Curve fitting and Interpolation – Data analysis and Statistics – Numerical Integration – Ordinary differential equations – Nonlinear Algebraic Equations).

UNIT -V : MATLAB Graphics (12 Hours)

2D Plots-Planar Plots, Log Plots, Scatter Plots, Contour Plots- Using subplot to Layout multiple graphs -Multiple Figures, Graph of a Function-Titles, Labels, Text in a Graph- Line Types, Marker types, Colors-3D Graphics-Curve Plots-Mesh and Surface Plots- Handle Graphics – Saving and printing Graphs – Errors - Illustrative Examples.

Text Books:

1. **Numerical methods -** Kandasamy. P, Thilagavathi. K, Volume I and II, 2004, S. Chand and Company Ltd, New Delhi. (Units I & II)
2. **Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers,**RudraPratap, 2003, Oxford University Press. (Units III – V)
3. **MATLAB An Introduction with Applications -** Amos Gilat, 2007, John Wiley & Sons, Inc., U.K. [ISBN: 978-81-26511394-9] (Units III – V)

Reference Books:

1. **Numerical methods in Science and Engineering,** M.K. Venkataraman, 1996, National Publishing Co. Madras.
2. **Engineering and Scientific Computations Using MATLAB**, Sergey E. Lyshevski, 2003, JohnWiley&SonsInc, publication. [ISBN 0-471-46200-4]
3. **Numerical Methods Using Matlab,** John Mathews &Kurtis Fink,2006, Prentice Hall, New Jersey.
4. **Introductory Methods of Numerical Analysis**, S.S. Sastry, 2005, Prentice Hall.
5. **Introduction to MATLAB 7 for Engineers,**William John Palm, 2005, McGraw, Hill Professional.
6. **Introduction to MATLAB 7**, Dolores M. Etter, David C. Kuncicky,2004, Prentice Hall.

Web Reference:

1.http://demo.prahu-hub.com/A2C1ED269A17F/numerical-methods-by-kandasamy-thilagavathy-gunavathy.pdf

2. https://rahulpatel121.files.wordpress.com/2018/07/s-s-sastry-introductory-methods-of-numerical-analysis-2012-phi-learning-pvt-ltd.pdf

3. https://www.researchgate.net/profile/Hazim_Tahir/post/How-can-I-fit-a-curve-to-data-from-a-thermodynamic-model-like-NRTL/attachment/59d63d25c49f478072ea8502/AS%3A273757480914957%401442280277251/download/MATLAB_+An+Introduction+with+Ap+-+Amos+Gilat.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core:V Elective I	21PHP05A	**ESSENTIALS OF NANOSCIENCE**	48	3

Contact hours per week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
First	I	50	50	100

Preamble: The aim is to provide the basic knowledge about basics of nano science and technology and to acquire the knowledge about synthesis methods and characterization techniques and its applications

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

COs	CO Statement	Knowledge Level
CO1	recall the basic concepts of Nano science, Nanotechnology and Nanoscale, Introduction to polymers	K1
CO2	explain the Nano material and its structure, properties, importance and applications.	K2
CO3	apply the fabrication methods to synthesis the new nano particles	K3
CO4	infer the chemical interactions, quantum confinement and emission characteristics of semi- conductor nano crystals	K4
CO5	verify the nanoparticles dimension and justify quantum dot , core shell nano particles and carbon nano tubes	K5
CO6	create the nano particles and nano materials in the field of agriculture and medical, other field to solve the recent problems	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

PO / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	9	9	9	9	9	3	3
CO2	9	9	9	3	3	3	3
CO3	9	9	9	9	3	2	3
CO4	9	9	9	3	3	2	3
CO5	9	9	3	3	2	1	3
CO6	9	9	3	3	3	3	1
Total Contribution of COs to POs	54	54	42	30	23	14	16
Weighted Percentage of COs Contribution to POs	3.33	3.91	6.08	3.86	2.03	1.52	2.22

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT -I : EVOLUTION OF NANOSCIENCE AND NANOTECHNOLOGY (9 Hours)

History of Nanoscience and Nanotechnology – Ancient, Medieval and Modern period – Terms and Definitions – Scale of materials – macro, micro and nanoscale – pioneers and contributors in Nanoscience and nanotechnology – Fabrication methods – Top-down and bottom-up approaches (Principles and types) – Nanoscience and nanotechnology practiced by nature –Inspirations from nature – Natural nanomaterials – Inorganic, organic and biological origin.

UNIT -II : NANOMATERIALS (9 Hours)

Structure , properties and importance of the following Nanomaterials - Metallic nanoparticles – Semiconductor quantum dots, core-shell nanoparticles - carbon based nanomaterials – fullerenes, carbon nanotubes (single walled and multi walled) and graphenes – Supramolecules – Dendrimers, micelles and reverse micelles – Nanoporous Materials. (Synthesis of the nanomaterials not included)

UNIT- III : POLYMERIC NANOMATERIALS (10 Hours)

Introduction to polymers – classification of polymers – types of polymerization processes – Block copolymers - Glass transition temperature of Polymers – Structure, properties and importance of selected synthetic and Biopolymers – Polystyrene, Polyvinyl alcohol, Polystyrene sulphonate, Polyethylene glycol, Polyhydroxyalkanoate, Polylactic acid and Chitosan – Conducting polymers – Introduction, principle of conduction and different types of conducting polymers.

UNIT- IV : PROPERTIES AT THE NANOSCALE – I (10 Hours)

Comparison of properties at bulk and nano – Surface and Volume – Surface energy – Surface stabilization – Surface energy minimization mechanisms – Application of classical thermodynamics 133 to nanomaterials (Small system thermodynamics) – Chemical interactions at Nanoscale.- Primary interactions (Ionic, Covalent and Metallic bonds) – Secondary interactions – Electrostatic interaction, Hydrogen bonding, Van-der waals attraction, hydrophobic effect.

UNIT- V: PROPERTIES AT THE NANOSCALE – II (10 Hours)

Optical properties in metals, semiconductors and insulators- Photoluminescence - Cathode luminescence- Electro luminescence- Fluorescence- Phosphorescence- Surface Plasmon resonance and optical properties in metallic nanoparticles – Quantum confinement and emission characteristics of semiconductor nanocrystals – optical properties of core-shell nanoparticles – Mechanical, thermal and electrical properties of carbon based nanomaterials (CNT &graphenes) – Guest-Host relationship and Molecular recognition in supramolecules.

Text Books

1. **Nanoscience and Nanotechnology -** M. S. RamachandraRaoShubrasingh [ISBN: 978 – 81 – 265 – 4201 – 7]. (Units I, II and III)
2. **Principles of Nanoscience and Nanotechnology -** M. A. ShahTokeerAhmad, Narosa publishing home pvt. Ltd., [ISBN: 978 – 81 – 8487 – 072 – 5]. (Units IV and V)

Reference Books

1. **Nanotechnology,** Er. RakeshRathi, 2009-15, S. Chand and Co. Pvt. Ltd.
2. **Nanotechnology Science Innovations and Oppurtunity,** Lynn E.Foster.

Web Reference:

1. http://www.lkouniv.ac.in
2. http://www.trl.lab.uic.edu
3. http://www.nanosensesri.com
4. http://www.nanoyou.eu
5. http://www.web.pdx.edu

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: VI	21PHP06	**QUANTUM MECHANICS - II**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	II	50	50	100

Preamble: The aim is to make the students understand the Scattering theory, the applications to atomic structures, about the identical particles and their spin and quantum field theory.

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

COs	CO Statement	Knowledge Level
CO1	recite the definitions of scattering amplitude and identical particles	K1
CO2	interpret the scattering process in quantum mechanical system and the application of approximation methods to atomic structure	K2
CO3	apply symmetric and anti symmetric wave functions in central field approximation and apply approximation methods to find scattering amplitude and scattering cross section	K3
CO4	justify probability and current densities and negative energy states from relativistic wave equations	K4
CO5	quantize classical and quantum mechanical equations of motions.	K5
CO6	construct symmetric and anti symmetric wave functions	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	3	9	3	3

CO2	9	9	9	3	9	3	3
CO3	9	3	3	3	3	3	1
CO4	3	3	3	1	3	1	1
CO5	1	1	1	1	1	1	1
CO6	1	1	1	1	1	1	1
Total Contribution of COs to POs	32	26	26	12	26	12	10
Weighted Percentage of COs Contribution to POs	3.77	3.45	4.47	2.45	5.97	3.17	3.83

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and Pos

SYLLABUS

Unit –I : SCATTERING THEORY (12 Hours)

Scattering Amplitude - Expression in terms of Green's Function - Born Approximation and its Validity - Partial Wave Analysis - Phase Shifts – Scattering by Coulomb and Yukawa Potential

Unit –II : APPLICATION TO ATOMIC STRUCTURE (12 Hours)

Central Field Approximation - Thomas Fermi Model –Hartree's Self Consistent Model – HartreeFock Equation - Alkali Atoms - Doublet Separation –Intensities - Complex Atoms - Coupling Schemes

Unit –III: RELATIVISTIC WAVE EQUATION (12 Hours)

Klein Gordon Equation - Plane Wave Equation - Charge and Current Density - Application to the study of Hydrogen Like Atoms - Dirac Relativistic Equation for a Free Particle - Dirac Matrices - Dirac Equation in Electromagnetic Field - Negative Energy States.

Unit –IV: IDENTICAL PARTICLES AND SPIN (12 Hours)

Identical particles – Symmetric and anti-symmetric wave functions – Construction of symmetric and antisymmetric wave functions – Pauli's exclusion principle – Physical significance – Pauli's spin operator – Commutation relations

Unit –V: QUANTUM FIELD THEORY (12 Hours)

Quantization of Real Scalar wave Field – Quantization of Complex Scalar wave Field - Quantization procedure for particles - Classical Lagrangian Equation -Classical Hamiltonian Equation - Field Quantization of the Non - Relativistic Schrodinger Equation - Creation, Destruction and Number Operators.

Text Book :

1. **QuantumMechanics** -Aruldas, 2nd edition, 2013, PHI Learning Pvt. Ltd. [ISBN: 978-81-203-3635-3] (All Units)
2. **Quantum Mechanics** -Leonard.I. Schiff, 1968, McGraw Hill 3rd Edition. [ISBN: 0-07-085643-5] (Unit II)
3. **Introduction to Quantum Mechanics** – David J Griffiths, Pearson- 2nd edition- 2016. [ISBN: 978-93-325-4289-1]

Reference Books

1. **A Text Book of Quantum Mechanics**-P.M. Mathews & K. Venkatesan-Tata McGraw Hill 29th Reprint 2002
2. **Quantum Mechanics**-Devanathan-Narosa Publishing-New Delhi, 2005
3. **Quantum Mechanics**-A.K. Ghatak and S. Loganathan- McMilan India 4th Edition, 1999
4. **Introduction to Quantum Mechanics** – David J Griffiths- Addison Wesley – 2nd edition

Web Reference:

1. http://juser.fz-juelich.de/record/20885/files/A2_Bluegel.pdf&ved=2ahUKEwienuaa4aPzAhUcIbcAHUdQANMQFnoECAMQAQ&usg=AOvVaw0CEdb862rnJdihdmzyWiAf(unit 1)
2. http://scipp.ucsc.edu/~dine/ph216/atomic_physics.pdf&ved=2ahUKEwjEgJC-4aPzAhWvILcAHRglDcEQFnoECAMQAQ&usg=AOvVaw1PQGGLKpoQ6xni51I0riXN (unit 2)
3. https://www.cmi.ac.in/~govind/teaching/rel-qm-rc13/rel-qm-notes-gk.pdf&ved=2ahUKEwiZ1erj4aPzAhUc4zgGHX6KAGsQFnoECAMQAQ&usg=AOvVaw0-SNbiYJFpgVJHTdXhyqsW(unit 3)
4. https://www.feynmanlectures.caltech.edu/III_04.html(unit 4)
5. https://www.britannica.com/science/quantum-field-theory(unit 5)

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: VII	21PHP07	**ADVANCED ELECTRONICS**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	II	50	50	100

Preamble: The aim is to make the students to understand the concept of semiconductor devices, to gain knowledge about fabrication and characteristics of Integrated Circuits and to learn the concepts of advanced level of digital electronics.

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

COs	CO Statement	Knowledge Level
CO1	recall the logic gates, basic types of transistors, counters ,shift registers and flip-flops	K1
CO2	elucidate to make integrated circuits, JFET,MOSFET,SCR, optoelectronic devices by chronologically order	K2
CO3	examine basic laws of Boolean algebra, De- Margan's theorem and types of flip- flops, A/D converter, D/A converter	K3
CO4	analyze the results of integrated circuits and non-linear analog system	K4
CO5	verify the opto electronic devices such as photo register, photo diode, photo transistor and field effect transistors.	K5
CO6	create a new design of synchronous counters by using of flip-flop, karnaugh map	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	9	3	3
CO3	9	9	9	9	9	3	3
CO4	9	9	9	9	9	3	3
CO5	9	9	9	9	3	3	1
CO6	9	9	3	3	3	1	1

Total Contribution of COs to POs	54	54	48	48	36	22	20
Weighted Percentage of COs Contribution to POs	6.37	7.18	8.26	9.83	8.27	5.82	7.66

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

Unit -I: SEMICONDUCTOR DEVICES (12 hours)

Field effect transistors – JFET bias line and load line – MOSFET construction and Symbols – FET as a Voltage Variable Resistor-Common Source Amplifier at High Frequencies-Common Drain Amplifier at High Frequencies-Silicon Controlled Rectifier (SCR) Characteristics-SCR Power Control- Tunnel Diode -Optoelectronics: Photo Resistor-Photo Diode-Photo Transistor-LED-Photo Voltaic Effect-Solar Cells.

Unit–II: INTEGRATED CIRCUITS-FABRICATION AND CHARACTERISTICS (12 hours)

Integrated circuit technology – Basic monolithic circuits – Epitaxial growth – Masking and etching – Diffusion of impurities – Transistor for monolithic circuits – Monolithic diodes – Integrated resistors-Integrated capacitors – Monolithic circuit layout – Additional isolation methods – LSI and MSI – Metal semiconductor contact.

Unit –III: INTEGRATED CIRCUITS AS ANALOG SYSTEM BUILDING BLOCKS (12 hours)

Linear analog systems: Basic Op.Amp. applications – Sign changer – Scale changer – Phase shifter – Summing amplifier – Voltage to current converter – Current to voltage converter – DC voltage follower – Differential DC amplifier – Stable AC coupled amplifier – Analog integration and differentiation – Electronic analog computation

NONLINEAR ANALOG SYSTEMS: Comparator – Sample and hold circuits – D/A converter: Binary weighted resister and ladder type – A/D converter: Successive type and Dual-slop converters

Unit –IV: (12 hours)

FLIP-FLOPS: S-R, Clocked S-R, D, J-K, T, Master-Slave J-K flip-flops – Their state diagrams and characteristic equations – Edge triggering in flip-flops

LOGIC GATES: OR, AND, NOT, NOR and NAND gates, Exclusive OR gate – NAND and NOR as Universal gates.

BOOLEAN ALGEBRA AND MINIMIZATION TECHNIQUES: Basic laws of Boolean algebra – De Morgan's theorems – Adder, Subtractor, Comparator, Decoder / Demultiplexer - Sum of products and Product –of-sums - Karnaugh map (up to four variables only) –Don't care

Unit- V: SYNCHRONOUS COUNTERS (12 hours)

Design of Synchronous Counters: Design of MOD-3, MOD-6 ,and MOD-10 counters using JK Master-slave flip-flops only – Register – 4 bit shift Register – Serial-in serial-out, Serial-in Parallel-out, Parallel-in Serial-out and Parallel-in Parallel-out – Design of four bit self-correcting ring counter using D-flip-flop

Text Book :

1. **Principles of Electronics** -V.K.Mehta, Rohit Mehta, S.Chand and Company Pvt Ltd,[ISBN: 81-219-2450-2].(Unit I)
2. **Modern Physics** -R.Murugeshan, (2013), S.Chand and CompantPvt Ltd.
3. **Integrated electronics** - Jacob Millman, Christos Halkias, Chetan D Parikh, Second Edition, Tata McGraw hill.(Unit II & III)
4. **Digital Circuits and Design** -S.Salivahanan, S.Arivazhagan, Third Edition, Vikas Publishing house Pvt Ltd.(Unit IV & V)

Reference Books

1. **Handbook of Electronics**, Gupta and Kumar.
2. **Digital Fundamentals**, Floyd-UBS 1600.
3. **Digital Principles and Applications**, Malvino& Leach, McGraw Hill.
4. **Applied Electronics**, R S Sedha.

Web Reference:

1. http://web.pdx.edu/~pmoeck/books/Tipler_Llewellyn.pdf
2. https://dokumen.tips/documents/integrated-electronics-jacob-millman-and-christos-hallkiaspdf.html

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: VIII	22PHP08	Introduction to Scientific Research& Solar Energy Research	60	3

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	II	50	50	100

Preamble: This would intend to present an outline offundamental research process, a guide to formulating ethical proposals and to give idea about intellectual property rights.Additionally, it would provide comprehensive knowledge of solar cells and solar energy.

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

COs	CO Statement	Knowledge Level
CO1	Describe the concept of research, defining and formulating the research problem	K1
CO2	Narrate the significance of report writing	K2
CO3	Seek different applying technique behind solar cell and creates innovative ideas.	K3
CO4	Explore the causes and relationship between IPR and ethics of research	K4

CO5	Create new innovation on the basis of Solar energy and its applications	K5
CO6	Incorporate the creative ideas in solar energy research proposals	K6

K1 – Remember;K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	9	9
CO2	9	9	3	9	3	9	9
CO3	9	9	3	3	9	9	9
CO4	9	3	3	3	3	3	3
CO5	9	3	3	3	1	3	3
CO6	9	3	3	3	3	3	9
Total Contribution of COs to POs	45	36	24	30	22	36	42
Weighted Percentage of COs Contribution to POs	5.31	4.78	4.13	6.14	5.05	9.52	16.09

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

Research Introduction to Scientific & Solar Energy Research

UNITI **(12 Hours)**

Motivation and objectives – Research methods vs. Methodology- Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research.

Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, search databases, web as a source, searching the web, identifying gap areas from literature and research database, development of working hypothesis.

UNITII (12 Hours)

Scientific Writing: Significance of Report Writing, Goals and Objectives, Structure of documents, importance of clear title,abstract or summary, introduction, methods, Results and Discussion, Illustrations and aidsNumbers and statistics, Tables and Figures, Language and grammar, writing proposals andinstructions,makingpresentations,Formattingdocuments,Draftsandrevisions,Editing,Writingpopular science /journal article.

UNIT III (12 Hours)

Ethical aspects of the Research work: Scientific ethics, axiology and ethical values of Science, ethics of the researcher, personal code of conduct, internal code of conduct, conduct guidelines, ethical standards of publication, scientific fraud and malpractice: study of historical and contemporary cases.

IPR- intellectual property rightsand patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS).

Unit –IV: Introduction to Energy Sources and solar (12 Hours)

Energy sources – Types of energy sources -solar energy and its uses -Solar radiation at the Earth's Surface - Solar constant.

Fundamentals of solar PV cells and systems : semiconductors as basis for solar cells materials and properties, P-N junction, I-V and QE curves of solar cells -Solar cells for direct conversion of solar energy to electric energy - Solar cell parameter - Efficiency - Single crystal silicon solar cells - Polycrystalline silicon solar cells .

Unit- V: (12 Hours)

Applications of Solar Energy:

Solar water heating - space heating and space cooling - solar photo voltaics - agricultural and industrial process heat, solar lighting system- street and home light- principles of solar cooking – advantage and disadvantage of solar cooking.

Text Books :

1. ResearchMethodology:Methods&Techniques,C.R.KothariNewAge ernationalPublishers,NewDelhi.(2004) ISBN (13): 978-81-224-2488-1]
2. ResearchMethodology, R.PannerselvamPrenticeHallof IndiaPvt. Ltd (2014),[ISBN-978-81-203-4946-9]
3. Non-Conventional Energy Sources- B.H.Khan, 2006, Tata McGraw Hill. [ISBN 0-07-060654-4]
4. Non-Conventional Energy Sources and Utilisation- Er. R. K. Rajput, (2014) S.Chand&Company Pvt. Ltd, [ISBN 81-219-3971-2].
5. Non-Conventional sources of Energy- G.D.Rai, Khanna Publishers, New Delhi. [ISBN: 81-7409-073-8]
6. The Development of Intellectual Property Rightsin India Dr. Dilip Kumar & Rahul, Amity school of communication (2017)[ISBN-978-93-84312-04-6]

Reference Books

1. EffectiveTechnicalCommunication,M.AshrafRizvi,TataMcGraw–Hill, New Delhi,2005
2. Renewable Energy, Godfrey Boyle, Oxford University Press in association with the open University 2004, [ISBN: 9780199261789]
3. Principles of Solar Engineering F. Kreith and J.F. Kreider, 1978, Tata McGraw Hill.
4. Solar Energy, M.P.Agarwal, 1983 S. Chand and Co., New Delhi.
5. Solar Energy, S.P.Sukhatme, 1996, Tata McGraw Hill. [ISBN: 0-07-462453-9]

Web Reference:

1. http://oro.open.ac.uk › ...
2. Renewable energy. 2nd edition - Open Research Online
3. https://www.ebooknetworking.net/ebooks/principles-of-solar-engineering.html
4. http://mguniversity.ac.in/syllabus/ug_sec/VI%20Semester%20Skill%20Enhancement%20Courses.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part-III	Core : IX	21PHP09	**ADVANCED PHYSICS PRACTICAL-I**	120	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	I& II	50	50	100

Preamble: The aim is to provide the students better practical knowledge of general Physics experiments, learn about handling of experiments and to know about different equipment used

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

COs	CO Statement	Knowledge Level
CO1	identify the basic concepts of experiments related to theories in Modern Physics recognize various commands and formulae in MATLAB	K1
CO2	illustrate the working principles of various experimental setups	K2
CO3	use different experimental setup to study various physical properties of solids and liquids apply the formulae to calculate the output values for various experiments implement the procedures of solving physical problems to write and process the MATLAB programs	K3

CO4	compare and contrast the various methods of determination of various physical constants and values correlate the relations between theoretical values and experimental observations	K4
CO5	observe the output values of the physical process using required experimental setups assess rectify the errors if any in the execution of MATLAB programs	K5
CO6	design the desired circuit to carry out the required experiment and justify the observed values rewrite the MATLAB program based on the requirements of the specific problem	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO- PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

PO COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	3	3	9	9	1
CO4	9	9	3	3	3	3	1
CO5	9	9	3	3	3	3	1
CO6	3	3	0	3	0	3	0
Total Contribution of COs to POs	48	48	27	30	33	36	9
Weighted Percentage of COs Contribution to POs	5.66	6.38	4.64	6.14	7.58	9.52	3.44

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS		
S.No	**Course Content**	**Instructional Hours**
1	Young's Modulus-Elliptical Fringes (Cornu's Method)	120
2	Young's Modulus-Hyperbolic Fringes (Cornu's Method)	
3	Viscosity of a Liquid-Mayer's Oscillating Disc	
4	Stefan's Constant	
5	Rydberg's Constant-Solar Spectrum	
6	Thickness of Wire by Air Wedge and Diffraction	
7	Determination of Audio Frequencies-Bridge Method	
8	Thermionic Work Function	
9	Thermal Conductivity-Forbe's Method	
10	Electronic Charge 'e' by Millikan's Oil Drop Method	
11	Electronic Specific Charge 'e/m' by Thomson's Method	
12	Thermistor-Temperature Coefficient and Band Gap Energy	
13	Determination Specific Heat of a Liquid-Ferguson's Method	
14	Biprism on Optical Bench-Determination of Wavelength	
15	He-Ne Laser –Measurement of Wavelength using reflectancegrating.	
16	Babinet's Compensator	
17	LG Plate-Resolving Power	
18	Thickness of the wire by diffraction	
19	Fabry-Perot Interferometer-Study of Fine Structure	
20	Geiger Muller Counter-Determination of Half Life of 'In'	
21	MATLAB Programming-Roots of a Quadratic Equation & Solution of a System of Linear Equations	
22	MATLAB Programming – Solution of Ordinary Differential Equations	
23	MATLAB Programming -Runge-Kutta Method	
24	MATLAB Programming -Newton-Raphson Method	

25	MATLAB Programming-Mean, Median & Standard Deviation	
26	MATLAB Programming-Curve Fitting & Interpolation	
27	MATLAB Programming-Matrix Summation, Subtraction and Multiplication	
28	MATLAB Programming-Matrix Inversion and Solution of Simultaneous Equations	
29	He-Ne Laser – Measurement of refractive index of liquids.	
30	He-Ne Laser – Power distribution measurement.	
31	He-Ne Laser – Thickness of Wire	

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: X	21PHP10	**GENERAL ELECTRONICS PRACTICAL - I**	120	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	I & II	50	50	100

Preamble: The aim is to provide the students better practical knowledge of general Physics experiments, learn about handling of experiments and to know about different equipment used

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

COs	CO Statement	Knowledge Level
CO1	demonstrate and explain basic electrical and electronic components and different types of circuits recognize various commands and formulae in MATLAB	K1
CO2	interpret the working principles of the electronic circuits express the applications of diodes, OP-AMP, BJT, SCR, FET and UJT	K2
CO3	use CRO and AFO to analyze and study various waveforms and its amplitude and frequency controls apply the circuit equations to calculate the output values for various electronic circuits relate the electronic circuit analysis to write and process the MATLAB program.	K3
CO4	compare and contrast the various circuits for the specific application correlate the relations between theoretical values and experimental observations construct various electronic circuits using diodes, OP-AMP, BJT, SCR, FET and UJT	K4
CO5	measure the output values of the constructed circuits using required tools assess rectify the errors if any in the execution of MATLAB programs	K5

CO6	design the desired circuit based on the parameters and properties of the various electronic components rewrite the MATLAB program based on the requirements of the specific problem	K6

K1 – Remember;K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create;

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

PO / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	3	3	9	9	1
CO4	9	9	3	3	3	3	1
CO5	9	9	3	3	3	3	1
CO6	3	3	0	3	0	3	0
Total Contribution of COs to POs	48	48	27	30	33	36	9
Weighted Percentage of COs Contribution to POs	5.66	6.38	4.64	6.14	7.58	9.52	3.44

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and Pos

SYLLABUS
ANY FIFTEEN(15) EXPERIMENTS ONLY
EXAMINATION AT THE END OF SECOND SEMESTER

S.No	Course Content	Instructional Hours
1	Design of Regulated and Dual Power Supply.	120
2	Basic Logic Gates-Digital IC’s	
3	Parameters of Op-Amp	
4	Design of Wave Form Generators- using Op-Amp.	
5	Design of Phase-Shift Oscillator- Op-Amp	

6	Design of Wein's Bridge Oscillator- Op-Amp	
7	Design of Active Filters- Op-Amp	
8	Design of Differential Amplifier- Op-Amp	
9	Sign Changer, Scale Changer, Adder and Subtractor- Op-Amp	
10	Design of UJT Relaxation Oscillator	
11	CRO-Differentiating, Integrating, Clipping and Clamping Circuits, Square Wave Testing	
12	SCR-Characteristics and an Application	
13	Source Follower	
14	Amplifier-Inverting, Non-Inverting, Voltage Follower- Op-Amp	
15	Characteristics of FET	
16	Digital IC's- Counters	
17	Schmitt Trigger using discrete components and OP-AMP/ Timer 555	
18	D/A converter using Op. Amp	
19	MATLAB Programming-Charging of a Capacitor in an RC Circuit with three Time Constants	
20	MATLAB Programming- Full Wave Rectifier-Determination of (a) Peak-to-Peak Value of Ripple Voltage, (b) DC Output Voltage (c) Discharge Time of the Capacitor (d) Period of Ripple Voltage	
21	MATLAB Programming- Plot of Voltage and Current of an RLC Circuit under Steady State Conditions	
22	MATLAB Programming- NPN Transistor-Plotting Input & Output Characteristics	
23	MATLAB Programming-Frequency Response of a Low Pass Op-Amp Filter Circuit	
24	MATLAB Programming-Diode-Plot of Forward Characteristics & Load Line Plot - Estimation of Operating Point.	

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: XI Elective: II	21PHP11A	**ASTRONOMY & ASTROPHYSICS**	48	3

Contact hours per week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
First	II	50	50	100

Preamble: The aim is to provide the students deeper knowledge and understanding of astronomy, learn information about stars and galaxies and to know about the destruction of stars.

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

COs	CO Statement	Knowledge Level
CO1	outline the history of astronomy, stars, galaxies, components of the Sun and stellar evolution	K1
CO2	explain the concepts in highlights of Einstein's special and general theory of relativity, fusion reaction mechanism, classification of galaxies and stages of stars	K2
CO3	classify concepts of astronomy, calculating the distance between stars, components of the Sun, galactic astronomy and stages of stars	K3
CO4	categorize the classification of galaxies and stars	K4
CO5	evaluate the science behind observation of universe	K5
CO6	elaborate the hypothesis behind the geo and helio centric theories, calculating the distance between the stars and its composition, types of galaxies and to formulate the lives and death of stars	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate;K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	3	3	9	9	9
CO2	9	9	3	3	9	9	9
CO3	9	9	3	3	9	9	9
CO4	9	9	1	1	9	9	3

CO5	9	3	1	1	9	9	1
CO6	9	3	1	1	9	9	1
Total Contribution of COs to POs	54	42	12	12	54	54	32
Weighted Percentage of COs Contribution to POs	3.33	3.04	1.25	1.71	4.77	5.86	4.44

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and Pos

SYLLABUS

UNIT- I: HISTORY OF ASTRONOMY (9 Hours)

Introductory History of Astronomy-Ptolemy's Geocentric Universe-Copernicus' Heliocentric Universe- Tycho Brahe and Galileo's Observations- Kepler's Laws of Planetary Motion-Newtonian Concept Of Gravity-Highlights of Einstein's Special and General Theory Of Relativity-Curved Space Time-Evidence of Curved Space Time-Bending Of Light-Time Dilation

UNIT- II: STARS & GALAXIES (9 Hours)

Stars and Galaxies-Distances-Trigonometric Parallax-Inverse Square Law-Magnitude of Stars-Apparent Magnitude-Absolute Magnitude and Luminosity-Color and Temperature- Composition of Stars-Velocity, Mass and Sizes of Stars-Types of Stars- Temperature Dependence-Spectral Types-Hertzsprung - Russell (HR) Diagram-Spectroscopic Parallax

UNIT –III: SUN AND ITS COMPOSITION (10 Hours)

The Sun-Its Size and Composition- Sun's Interior Zones-Sun's Surface-Photosphere-Chromosphere-Corona-Sun's Power Source-Fusion Reaction Mechanism.

UNIT IV : GALACTIC ASTRONOMY (10 Hours)

Milky Way Hubble classification of galaxies-Spiral galaxies, Elliptical galaxies, Irregular galaxies, Dwarf galaxies; Masses of galaxies-Rotation curves of galaxies; Dark matter

UNIT –V: LIVES AND DEATH OF STARS (9 Hours)

Stellar Evolution-Mass Dependence-Giant Molecular Cloud-Protostar-Main Sequence Star-Subgiant, Red Giant, Supergiant-Core Fusion-Red Giant (Or) Supergiant- Planetary Nebula (Or) Supernova-White Dwarfs-Novae And Supernovae- Neutron Stars-Pulsars-Black Holes-Detecting Black Holes

Text Book :

1. **Lectures on Astronomy, Astrophysics, and Cosmology** - Luis A. Anchordoqu, Department of Physics, University of Wisconsin-Milwaukee, U.S.A (Dated: Spring 2007).
2. **Lecture Notes of Department of Physics** - University of Wisconsin-Milwaukee

3. **Astrophysics of the Solar System**- K.D. Abhayankar, University press (India) Pvt Ltd, January 24, 2017. [ISBN: 9788173719694].
4. **An Introduction to Planetary Physics - The terrastial Planets**, William M. Kaula, 1968, Wiley, NewYork, Space Science text series.
5. **Astrophysics of the Sun**- HaroldZirin, Cambridge University Press, 23 June 1988.

Web Reference:

1. www.astronomynotes.com(All Units)

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – III	Core: XIElective: II	21PHP11B	**EXPERIMENTAL TECHNIQUES**	48	3

Contact hours per week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
First	II	50	50	100

Preamble: The aim is to provide the students knowledge about the techniques behind various measuring instruments and to handle the various electronic measuring instruments.

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

COs	CO Statement	Knowledge Level
CO1	recall the errors in measurements, transducers, Amplifiers, Electronic Measuring Instruments and Wave Analyzers	K1
CO2	explain the types of transducer, the working of Amplifiers, Electronic Measuring Instruments and Wave Analyzers	K2
CO3	apply the different types of transducers, amplifiers, electronic Measuring Instruments	K3
CO4	analyze the applications of various electronic measuring instruments	K4
CO5	evaluate appropriate methods for analyzing electronic waves and Conditioning of signals	K5
CO6	design amplifiers, filters, Electronic Measuring Instruments and Wave Analyzers	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	3	3	9	9	9
CO2	9	9	3	3	9	9	9
CO3	9	9	3	3	9	9	9
CO4	9	9	1	1	9	9	3
CO5	9	3	1	1	9	9	1
CO6	9	3	1	1	9	9	1
Total Contribution of COs to Pos	54	42	12	12	54	54	32
Weighted Percentage of COs Contribution to POs	3.33	3.04	1.25	1.71	4.77	5.86	4.44

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and Pos

SYLLABUS

UNIT- I: MEASUREMENT OF ERRORS (9 Hours)

Accuracy, precision, resolution, sensitivity -absolute and relative errors-Types of errors -gross error, systematic error and random error.

STANDARDS OF MEASUREMENTS: Classification of standards, time and frequency standards, electrical standards.

UNIT- II: ELECTRICAL TRANSDUCER CLASSIFICATION (9 Hours)

Active and Passive transducers- selecting a good transducer – requirements of an electrical transducer – transducer types- resistive, inductive, capacitive and Piezoelectric transducer-Digital displacement transducers – thermistors.

UNIT –III: AMPLIFIERS AND SIGNAL CONDITIONING (10 Hours)

Instrumentation amplifiers-Isolation amplifiers-Chopper amplifiers-Voltage to frequency converters-Frequency multipliers-logarithmic amplifiers, S/H Circuits Active filters-Low pass, High pass, Band pass and Band stop filters.

UNIT - IV: ELECTRONIC MEASURING INSTRUMENT (10 Hours)

Q-meter-Vector impedance meter Digital frequency meter -Digital voltmeter -Phase meter-RF power and voltage measurement -Power factor meter -Vector voltmeter. Display and Recording: X-Y Recorders-Magnetic Tape recorders-Storage Oscilloscope- cathode ray oscilloscope.

UNIT - V: ANALYSIS (10 Hours)

Wave Analyzers-Audio frequency Wave analyzer-Harmonic distortion analyzers-Resonant harmonic distortion analyzer-Heterodyne harmonic distortion analyzer-Fundamental suppression harmonic distortion analyzer-Spectrum analyzer.

Text Book :

1. **Electrical & Electronics Measurement &Instrumentation**, A.K. Sawhney, DhanpatRai and sons. (All Units)
2. **Modern Electronic Instrumentation**, H. S. Kalsi, 2010, 3rd Edition - Tata McGraw Hill.

Reference Books

1. **Modern Electronic Instrumentation and Measurement Techniques**, A.O. Hefnick and W.D. Cooper., Prentice Hall India Publications.
2. **Introduction to Instrumentation and Control**, A.K. Ghosh-Prentice Hall India Publications

Web Reference:

1. https://www.academia.edu/8140873/A_K_Sawhney_A_course_in_Electrical_and_Electronic_Measurements_and_Instrumentation
2. https://pdfcoffee.com/h-s-kalsi-electronic-instrumentation-3e-pdf-free.html
3. http://fmcet.in/ECE/EC2351_uw.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
Part – IV	Ability Enhancement	21AEP01	**CYBER SECURITY**	24	2

Contact hours per week: 2

Year	Semester	Internal Marks	External Marks	Total Marks
First	II	-	100	100

Preamble: The aim is to provide the students, the basics of cyber security and the security threats in day-to-day activities.

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

COs	CO Statement	Knowledge Level
CO1	Recall the basic concepts of information security and its types	K1
CO2	Gain knowledge on cyber space issues and cyber security measures	K2

CO3	Identify various risks and threats in cyber space	K3
CO4	Apply security measures to prevent ourselves from threats in social media	K4
CO5	Compare various social media, security issues and measures	K5
CO6	Propose a secured cyber platform for people to connect each other for their social and professional concerns	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	3	9	9
CO5	9	9	3	3	3	9	3
CO6	9	9	3	3	3	3	3
Total Contribution of COs to POs	54	54	42	42	36	48	42
Weighted Percentage of COs Contribution to POs	4.47	5.04	5.0	5.8	5.4	8.1	9.3

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and Pos

SYLLABUS

UNIT - I: INFORMATION SECURITY (5 Hours)

History of Information Security - Need for Security-**Types of Security:** Physical Security –Network Security –Personal Security –Operation Security –Communication Security - Information Security Threats.

UNIT -II: INTRODUCTION TO CYBER SECURITY (5 Hours)

Cyber Security: Objectives- Roles- Differences between Information Security and Cyber Security. **Cyber Security Principles:** Confidentiality- Integrity – Availability

UNIT -III: RISKS & VULNERABILITIES (5 Hours)

Risk Meaning: Risk Management –Problems of Measuring Risk -Risk Levels-Risk Analyzes-Risk Assessment –Response to Risk Terminology- **Threats:** Components of Threats-Types of Threats-**Vulnerabilities:** Computing System Vulnerabilities –Hardware Vulnerabilities-Software Vulnerabilities-Data Vulnerabilities-Human Vulnerabilities.

UNIT - IV: SOCIAL MEDIA (5 Hours)

Introduction to social media: What, Why –Pros and cons- Security issues in social media: Mail-Facebook-Whatsapp-Twitter-Preventive and control measures.

UNIT –V: CASE STUDY (4 Hours)

Impact of social media: Education -Business- Banking-Mobile –Human Life- Present generation-Indian scenario.

Web References:

1. https://m.youtube.com/watch?v=o6pgd8gLFHg
2. https://m.youtube.com/watch?v=3rl4ZjZpcHU
3. https://blog.barkly.com/10-fundamental-cybersecurity-lessons-for-beginners
4. https://5social media security risk and how to avoid them.html
5. https://10 cyber security twitter profiles to watch.html
6. https://cyber security in banking 4 trends to watch in 2017.html
7. https://gmail hacking security tips-indian cyber security solutions.html
8. https://why social media sites are the new cyber weapons of.html
9. EBook:A complete guide to Staying Ahead in the Cyber Security Game

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XII	21PHP12	**ATOMIC AND MOLECULAR SPECTROSCOPY**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Second	III	50	50	100

Preamble: The aim is to provide the students, the skills and capability for formulating and analyzing chemical compounds using Atomic and Molecular Spectroscopy

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level
CO1	outline the Atomic Spectra and Study the microwave spectra	K1
CO2	explain the concepts in Atomic and Molecular Spectroscopy	K2
CO3	apply the concepts to understand the properties of molecules	K3
CO4	analyze the properties of atoms and molecules using different types of Spectroscopy	K4
CO5	choose appropriate spectroscopy to analyze atoms and molecules	K5
CO6	develop spectrum of molecules of different types by applying the concepts	K6

K1 – Remember;K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate ; K6- Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	3	3	3
CO3	9	9	3	3	3	1	3
CO4	9	9	3	3	3	1	3
CO5	9	3	3	1	3	1	1
CO6	9	3	3	1	1	1	1
Total Contribution of COs to POs	54	42	30	26	22	16	20
Weighted Percentage of COs	6.37	5.58	5.16	5.32	5.05	4.23	7.66

Contribution to Pos							

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and Pos

SYLLABUS

UNIT –I: ATOMIC SPECTROSCOPY (12 Hours)

Atoms in External Magnetic Fields -Normal Zeeman Effect-Anomalous Zeeman Effect-Magnetic Moment of Atom -Lande's g Formula- Paschen Back Effect- Stark Effect-Hyperfine Structure of Spectral Lines - Spectra of Hydrogen and Alkali Atoms

MICROWAVE SPECTROSCOPY-Experimental Methods-Theory of Microwave Spectra of Linear, Symmetric Top Molecules -Hyperfine Structure

UNIT - II: IR SPECTROSCOPY (12 Hours)

Practical Aspects-Theory of IR Rotation Vibration Spectra of Gaseous Diatomic Molecules-Applications-Basic Principles of FTIR Spectroscopy.

Raman Spectroscopy: Classical and Quantum Theory of Raman Effect- Rotation Vibration Raman Spectra of Diatomic and Polyatomic Molecules-Applications-Laser Raman Spectroscopy

UNIT –III: FLUORESCENCE & PHOSPHORESCENCE SPECTROSCOPY(12 Hours)

Electronic Excitation of Diatomic Species-Vibrational Analysis of Band Systems of Diatomic Molecules-Deslander's Table-Intensity Distribution-Franck Condon Principle- Rotational Structure of Electronic Bands-Resonance and Normal Fluorescence - Intensities of Transitions-Phosphorescence-Population of Triplet State -Experimental Methods-Applications of Fluorescence and Phosphorescence

UNIT –IV: NMR SPECTROSCOPY (12 Hours)

Quantum Mechanical and Classical Description - Bloch Equations - Relaxation Processes-Experimental Technique-Principle and Working of High Resolution NMR Spectrometer- Chemical Shift

UNIT - V: ESR SPECTROSCOPY (12 Hours)

Basic Principles-Experiments-ESR Spectrometer-Reflection Cavity and Microwave Bridge-ESR Spectrum-HyperfineStructure.

Text books:

1. **Molecular Structure and Spectroscopy**- G.Aruldhas, 2011, PHI Learning Private Limited.

Reference Books:

1. **Fundamentals of Molecular Spectroscopy** - C. N. Banwell, 1994, Tata McGraw Hill Publishing Company Limited.

Web Reference:

1. https://books.google.co.vi/books?id=z08q2SyROjoC&printsec=frontcover&source=gbs_ge_summary_r&cad=0
2. http://www3.tellabs.com/cgi-bin/content/view.php?data=fundamentals_of_molecular_spectroscopy_banwell_solutions_book_mediafile_free_file_sharing&filetype=pdf&id=9e219833ce89228ea665a996607beea8
3. https://www.prsu.ac.in/backend/web/theme/tender/5860.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XIII	21PHP13	**NUCLEAR & PARTICLE PHYSICS**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Second	III	50	50	100

Preamble: The aim is to provide the students, the concepts of Nucleus and elementary particles and to develop skills to find the binding energy, spin and parity values for various elements.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall the properties of nucleus, radioactive decay, fusion, fission reaction mechanism and elementary particles	K1
CO2	explain the concepts of nuclear theories, decay process of particles, nuclear models, fusion reactors and nuclear models	K2
CO3	classify the concepts of nuclear composition, forms of interactions inside the nucleus and models of a nucleus	K3
CO4	Analyse the classification of nuclear composition, nuclear force, properties of radioactive decays, selection rules, magic numbers, thermal reactors and for particle physics	K4

CO5	evaluate the nuclear properties, decay process, nuclear reaction mechanisms and basic conservation laws	K5
CO6	elaborate the hypothesis behind particle physics, forms of interactions and radioactive decay, nuclear energy levels and nuclear models	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze;
K5 – Evaluate ; K6- Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

Pos / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	3	3	3
CO3	9	9	3	3	3	1	3
CO4	9	9	3	3	3	1	3
CO5	9	3	3	1	3	1	1
CO6	9	3	3	1	1	1	1
Total Contribution of COs to Pos	54	42	30	26	22	16	20
Weighted Percentage of COs Contribution to Pos	6.37	5.58	5.16	5.32	5.05	4.23	7.66

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT I: NUCLEAR PROPERTIES: (12 Hours)

Nuclear Structure- Distribution of Nuclear Charge-Nuclear Mass-Mass Spectroscopy-Mass Spectrometer-Theories of Nuclear Composition (proton-electron, proton-neutron)- Tensor Force-Static Force-Exchange Force- Nuclear energy levels - Nuclear angular momentum, parity, isospin – Nuclear magnetic dipole moment – Nuclear electric quadropole moment - Ground state of deuteron.

UNIT II: RADIOACTIVE DECAYS - ALPHA DECAY(12 Hours)

Properties of α Particles-Gamow"s Theory of α Decay-Geiger Nuttal Law- α Ray Energies-Fine Structure of α Rays- α Disintegration Energy-Long Range α Particles.

BETA DECAY: Properties of β Particles-General Features of β Ray Spectrum-Pauli"sHypothesis-Neutrino Hypothesis-Fermi"s Theory of β Decay-Forms of Interactions and Selection Rules.

GAMMA DECAY: Absorption of γ Rays by Matter-Interaction of γ Rays with MatterMeasurement of γ Ray Energies-Internal Conversion.

UNIT III: NUCLEAR REACTIONS AND NUCLEAR MODEL (12 Hours)

Reciprocity theorem– Breit-Wigner formula – Resonance theory – Liquid drop model – Shell model -- Evidences for shell model -- Magic numbers -- Harmonic oscillator – Square-well potential -- Spin-orbit interaction – Collective model of a nucleus.

UNIT IV: FISSION AND FUSION REACTOR (12 Hours)

Characteristics of fission – Mass distribution of fragments – Radioactive decay processes – Fission cross-section – Energy in fission – Bohr-Wheeler's theory of nuclear fission – Fission reactors – Thermal reactors – Homogeneous reactors – Heterogeneous reactors – Basic fusion processes -- Characteristics of fusion – Solar fusion – Controlled fusion reactors.

UNIT V: PARTICLE PHYSICS (12Hours) Nucleons, leptons, mesons, baryons, hyperons, hadrons, strange particles - Classification of fundamental forces and elementary particles – Basic conservation laws – Additional conservation laws: Baryonic, leptonic, strangeness and isospin charges/quantum numbers – Gell-mann--Nishijima 23 formula - Invariance under charge conjugation (C), parity (P) and time reversal (T) – CPT theorem -- Parity nonconservation in weak interactions – Eight-fold way and supermultiplets – SU(3) symmetry and quark model.

Text Books:

1. **Nuclear Physics - An Introduction**, S. B. Patel, 2009, New Age, New Delhi.(Unit II,III)
2. **Nuclear Physics** - D.C. Tayal, 2001, Himalaya Pub. House, New Delhi. (Unit I-V)

Web Reference:

1. https://www.rac.ac.in/assets/download/Syllabus.php?filename=Njc=
2. http://idhayacollegekum.org/syllabus/physics/PG/sem4/NUCLEAR%20AND%20PARTICLE%20PHYSICS.pdf
3. http://www3.tellabs.com/cgibin/content/view.php?data=nuclear_physics_tayal&filetype=pdf&id=986f50b41754af3cf0045be6ac81807a

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XIV	21PHP14	**ELECTROMAGNETIC FIELD THEORY**	60	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	III	50	50	100

Preamble: The aim is to provide the students, the theory for the fields produced by stationary and moving charges and charged systems and hence the propagation of electromagnetic fields.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recap the basics of electrostatics, magnetostatics and Maxwell's equation	K1
CO2	recognize the principles behind electrostatics in macroscopic media and Electromagnetic potentials	K2
CO3	apply different formulae in the field of electrostatics, magneto statics and relativistic electrodynamics	K3
CO4	infer innovative ideas in the field of electromagnetic theory	K4
CO5	examine the effectiveness of different laws in electromagnetic problems with the help of electrodynamic potentials	K5
CO6	Originate new theories and innovations based on electromagnetic field theory	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	3	3	3
CO3	9	9	3	3	3	1	3
CO4	9	9	3	3	3	1	3
CO5	9	3	3	1	3	1	1
CO6	9	3	3	1	1	1	1
Total Contribution of COs to POs	54	42	30	26	22	16	20
Weighted Percentage of COs Contribution to POs	6.37	5.58	5.16	5.32	5.05	4.23	7.66

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and PO

SYLLABUS

UNIT I: ELECTROSTATICS (12 Hours)

Coulomb's law-Gauss law-differential and integral representation-Electric field-Electric potential-Method of images-Multipole expansions.

UNIT II: ELECTROSTATICS IN MACROSCOPIC MEDIA (12 Hours)

Potential and Field due to an Electric Dipole-Dielectric Polarization-External Field of a Dielectric Medium-Gauss' Theorem in a Dielectric-Electric Displacement Vector D-Linear Dielectrics-Relations connecting Electric Susceptibility χ_e, Polarization P, Displacement D and Dielectric Constant-Boundary Conditions of Field Vectors-Molecular Field-ClausiusMosotti Relation for Non-Polar Molecules-Electrostatic Energy and Energy Density.

UNIT III : MAGNETOSTATICS(12 Hours)

Biot-Savart Law - Statement-Lorentz Force Law - Definition of B-Divergence and Curl of B Magnetic Scalar Potential (derivation of expression only)-Equivalence of Small Current Loop and Magnetic Dipole-Magnetic Vector Potential (derivation of expression only).

UNIT IV: ELECTROMAGNETICS (12 Hours)

Equation of Continuity-Displacement Current-Derivation of Maxwel's Equations - Physical Significance - Poynting Vector - Momentum in EM Field - Electro Magnetic Potentials-Maxwell's Equations in terms of EM Potentials - Lorentz Gauge-Coulomb Gauge - Boundary Conditions at Interfaces.

UNIT V: RELATIVISTIC ELECTRODYNAMICS (12 Hours)

Four Vectors-Transformation Relation for Charge and Current Densities for Electromagnetic Potentials-Covariance of Field Equations in terms of Four Vectors-Covariant Form of Electric and Magnetic Field Equations-Covariance of Electromagnetic Field Tensor-Covariant Form of Lorentz Force Law.

Text books:

1. **Electromagnetic Theory, Chopra &Agarwal-** , 2016, K. Nath&Co,Educational Publishers,6th Edition. [ISBN: 978-81-924088-9-7] (Unit I-V)
2. **Electromagnetic Theory & Electrodynamics** - SathyaPrakash, 2004, KedarNath Ram Nath& co, Publishers New Edition.(Unit II, III, V)

Web Reference:

1. https://jemajodelevo.weebly.com/uploads/1/3/4/3/134394711/9f676172e37.pdf
2. https://indico.cern.ch/event/817381/contributions/3412315/attachments/1835901/3178259/Lectures.pdf
3. https://rcub.ac.in/econtent/ug/bsc/4sem/BSc%20Sem%20IV%20Physics%20Electromagnetic%20Theory.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XV	21PHP15	**INSTITUTIONAL TRAINING**	**-**	**1**

Contact hours per week: -

Year	Semester	Internal Marks	External Marks	Total Marks
First	III	100	-	100

Preamble: To provide the students a deeper knowledge in Institutional training – creating a opportunity for the students

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	Identify the problems & solutions related to Institutional Training, Article ship Training.	K1
CO2	Explain the principles involved in concerned Mini projects &Summarizethe processes in various Industries.	K2
CO3	Solve the problems in concerned project works &alsoProduce excellent project report for both Institutional Training & Mini projects.	K3
CO4	Examine different types of problems,principles,Experimental techniques& applications of concerned project works.	K4
CO5	Design new machines, principles & applications for future generations& evaluate different issues related to Science & Technology.	K5
CO6	Invent new technology and use it in variour application	K6

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and PO

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	9	9	9
CO5	9	9	9	9	3	3	3
CO6	9	3	3	3	3	3	3

Total Contribution of COs to POs	54	48	48	48	42	42	42
Weighted Percentage of COs Contribution to POs	4.47	4.48	5.7	6.6	6.3	7.09	9.31

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and PO

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XVI	Open Elective	**ENVIRONMENTAL PHYSICS**	**45**	**2**

Contact hours per week: 3

Year	Semester	Internal Marks	External Marks	Total Marks
First	III	50	50	100

Preamble: he aim is to provide the students to gain knowledge and understanding the Environmental Pollution and ControlTechniques.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall the basic terms involved in Environmental Pollution and Pollution Control Techniques	K1
CO2	outline the basic Principles involved in Pollution Control Techniques & Conservation of renewable &non renewable energy resources	K2
CO3	apply Pollution Control Techniques to reduce pollution	K3
CO4	Analysethe different types of Pollution	K4
CO5	evaluate control measures for different types of pollution	K5
CO6	create new techniques to control Pollution	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	3	3	3
CO3	9	9	3	3	3	1	3
CO4	9	9	3	3	3	1	3
CO5	9	3	3	1	3	1	1
CO6	9	3	3	1	1	1	1
Total Contribution of COs to POs	54	42	30	26	22	16	20
Weighted Percentage of COs Contribution to POs	6.3	5.5	5.1	5.3	5.0	4.2	7.6

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT I **(9 hours)**

Introduction - Environmental pollution – Sources of pollution – types of pollutants – Carbon Monoxide, Nitrogen Oxides, Sulphurdioxide – Particulates – Toxic Chemicals in the Environment - Effects of pollution – Preventive Measures of pollution.

UNIT II **(9 hours)**

Types of pollution – Air Pollution ,Causes and its effects – Water pollution ,Causes and its Effects -Soil Pollution , Causes and its Effects , Thermal pollution ,Causes and its effects ,Noise pollution - Causes and its Effects.

UNIT III **(9 hours)**

Pollution Control Techniques - Solid Waste Management - Solid Waste Disposal – Solid Waste Ocean Dumping – Solid Waste Management by Bio Technology – Organic Waste Management by composting process.

UNIT IV **(9 hours)**

Waste Water Treatment – Water quality Parameters – Sludge Treatment – Reverse Osmosis – Water

Reuse and Recycling – Domestic Water Treatment- Disinfection methods- UV Treatment and Ozonolysis.

UNIT V **(9 hours)**

Natural Energy Sources – Renewable Energy Sources – Solar Energy , Natural gases ,Wind Energy and Tidal Energy – Non Renewable Energy Sources – Coal , Minerals and Petroleum products.

Text Books :

1. **Environmental Chemistry** (7thEdition by A.K. DE) New Age International Publishers.
2. **Environmental Studies** Published by Bharathiar University.
3.

Web Reference:

1. http://pdf.wri.org/environmentalpollution_bw.pdf
2. https://www.researchgate.net/publication/323944189_Environmental_Pollution_Causes_and_Consequences_A_Study
3. https://www.slideshare.net/VivekJain68/waste-management-70027829
4. http://www.tezu.ernet.in/denvsc/IDC/Waste%20Management.ppt
5. https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=522265&Lab=NRMRL
6. https://www.slideshare.net/pallabipriyadarsini25/solid-waste-management-ppt

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XVII Elective III	22PHP16A	**BIOMEDICAL INSTRUMENTATION**	60	3

Contact hours per week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
First	III	50	50	100

Preamble: The aim is to provide the students, the working principles of medical instruments and Physics behind the instruments.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall ultrasonic resonance, Magnetic intensity, brain ,the central nervous system,Transducer, and Doppler Ultrasound.	K1
CO2	discuss electroencephalogram, ENT and ophthalmic instruments, Magnetic Resonance and Imaging	K2
CO3	apply the components of a typical laser system in ophthalmology.	K3

CO4	analyze the Recording of ECG waves, opthamology , ultrasound technology, magnetic resonance phenomena , magnetic relaxation and MRI parameters.	K4
CO5	evaluate the techniques behind ultrasonography, ultrasound scanning, retinoscopy and Keratometer.	K5
CO6	modifythe characteristics of the normal ECG and transducer design.	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	3	3	9	9	9
CO2	9	9	9	1	9	9	9
CO3	9	9	3	1	9	9	9
CO4	9	9	1	1	9	9	9
CO5	3	3	1	1	3	3	3
CO6	3	3	1	1	3	3	3
Total Contribution of COs to POs	42	42	18	08	42	42	42
Weighted Percentage of COs Contribution to POs	3.33	3.04	6.08	4.61	3.18	2.60	3.33

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT I: ELECTROPHYSIOLOGICAL MEASUREMENTS (12 Hours)

Cell potential genesis – Nernst relation – cell in resting state – action potential from a cell – the resultant externally recorded action potential.

Electrocardiography(ECG): Electrocardiographic planes – Einthoven triangle – bi polar and uni-polar limb lead frontal plane ECG measurements – ECG leads – precordial leads – relationship between various leads – recording of ECG waves and measurements (block diagram).

UNIT II: ELECTROENCEPHALOGRAM (12 Hours)

The brain and the central nervous system – the brain and its parts – cell potential and action – the

characteristics of the normal ECG – the input electrodes – electrode construction and connections – EEG recording instruments (explanation with block diagram) – EEG wave analysis – a typical EEG machine specifications and requirements.

UNIT III: ENT AND OPHTHALMIC INSTRUMENTS (12 Hours)

Audiometry – Bekesy audiometer system – instruments used in opthamology - opthalmoscope – retinoscopy – Keratometer – intra ocular pressure – ultra sound in ophthalmology – components of a typical laser system in ophthalmology.

UNIT IV (12 Hours)

Ultrasonography – advantages – B scan – ultrasound scanning – ultrasonic system – probes for ultrasound – Doppler ultrasound (basic aspects) – transducer design – demodulation methods.

UNIT V: MAGNETIC RESONANCE AND IMAGING (MRI)(12 Hours)

Magnetic intensity – magnetic resonance phenomena – the magnets – magnetic relaxation and MRI parameters – pulse sequences.

Introduction to Industry 4.0- Need – Reason for adopting industry 4.0- Skills required for industry 4.0- Impact of industry

Text Books:

1. **A Text book of Medical Instruments**, S.Anandhi, 2005, New Age International (P) Ltd., Publishers, 1st Edition.(Units I-V)

Reference books:

1. **Encyclopedia of medical devices and instrumentation**, John G. Webster et.al, Wiley-Interscience, Second Edition.
2. **Medical Physics and Bio medical Engineering,** B. H. Brown et, al. Institute of Physics Publishing Bristol and Philadelphia.
3. **Design and Development of Medical Electronic Instrumentation**, David Prutchi, Michael Norris, Wiley - Interscience.
4. **Bio medical instrumentation**, M. Arumugam, 2002, Anuradha Publications. [ISBN**:** 818772112X]

Web Reference:

1. https://pdfroom.com/books/a-textbook-of-medical-instruments-s-ananthi-new-age-2005-ww/7jgkRPbmdMV
2. https://iopscience.iop.org/article/10.1088/0967-3334/21/4/701
3. https://biblioseb.files.wordpress.com/2018/03/wiley-encyclopedia-of-medical-devices-and-instrumentationvol-3.pdf
4. https://www.researchgate.net/publication/3246222_Design_and_Development_of_Medical_Electronic_Instrumentation_-_Book_review

Category	Course	Course	Course Title	Contact	Credit

	Type	Code		Hours	
III	Core : XVII Elective III	22PHP 16B	**THIN FILM PHYSICS AND CRYSTAL GROWTH**	60	3

Contact hours per week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
First	III	50	50	100

Preamble: The aim is to provide the students to gain knowledge and understanding the Environmental Pollution and ControlTechniques.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall the nature of thin films, deposition and Growth Process of crystals	K1
CO2	explain the concepts of different Deposition techniques, stages of film growth and various characterization Techniques of crystals	K2
CO3	apply the required deposition technique of thin films and growth technique of crystals	K3
CO4	analyze the thickness of the film and the growth and structure of a crystal,	K4
CO5	evaluate the defects and impurities in films and crystals, deposition parameters and grain size of thin films, Growth Techniques of crystal	K5
CO6	Prepare a thin film, grow a crystal	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	3	3

CO4	9	9	9	3	3	1	1
CO5	9	3	3	3	3	1	1
CO6	9	3	3	3	3	1	1
Total Contribution of COs to POs	54	42	42	36	36	24	24
Weighted Percentage of COs Contribution to POs	3.33	3.04	6.08	4.61	3.18	2.60	3.33

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT I: PREPARATION OF THIN FILM: (12 Hours)

Nature of Thin Film-Deposition Technology-Distribution of Deposit-Resistance Heating- Thermal Evaporation-Flash Evaporation.

UNIT II: DEPOSITION TECHNIQUES (12 Hours)

Electron Beam Method-Cathodic Sputtering-Glow Discharge Sputtering-Low Pressure Sputtering-Reactive Sputtering-RF Sputtering-Chemical Vapour Deposition-Chemical Deposition.

UNIT III: THIN FILM GROWTH PROCESS (12 Hours)

Epitaxy-Thin Film Structure-Substrate Effect-Epitaxial Deposit - Film growth-five stages- Nucleation theories-Incorporation of defects and impurities in films Deposition parameters and grain size-structure of thin films.

FILM THICKNESS: Mass Methods-Optical Method-Photometry-ElliPOmetry-Interferometry-Other Methods- Substrate Cleaning.

UNIT IV: CRYSTALLIZATION PRINCIPLES AND GROWTH TECHNIQUES(12 Hours)

Solution growth-Low and high temperatures solution growth-Slow cooling and solvent evaporation methods-Constant temperature bath as a crystallizer. Principle of gel technique-Various types of gel - Structure and importance of gel-Methods of gel growth and advantages-Melt technique- Czochralski growth- Vapor-phase growth-Physical vapor deposition-Chemical vapor deposition.

UNIT V: CHARACTERIZATION TECHNIQUE(12 Hours)

X-ray Diffraction (XRD)-power and single crystal-Fourier transform infrared analysis-FT-Raman analysis-Elemental dispersive x-ray analysis (EDA–X)-scanning electron microscopy (SEM)-UV-VIS Spectrometer-Photo luminance (PL)

Introduction to Industry 4.0- Need – Reason for adopting industry 4.0- Skills required for industry 4.0- Impact of industry.

Text Books:

1. **Thin Film Fundamentals**, A. Goswami, 2008, New Age, New Delhi. (Units I – III)

2. **Elementary Crystal Growth**, K. Sangawal, 1994, Shan Publisher, UK. (Unit – IV)
3. **Crystal Growth and Processes**, P. SanthanaRagavan, P.Ramasamy, 2000, KRU Publications, Kumbakonam. (Unit IV, V)
4. **Crystal Growth Process**, J. C. Brice, 1996, John Wiley Publications, New York.

Reference books:

1. **Hand book of Thin Films Technology**, L.I. Maissel and R. Clang, 1970, McGraw Hill.
2. **Thin Films Process**, J. L. Vossen and W. Kern, 1978, Academic Press.
3. **The Materials Science of Thin Films**, M. Ohring, 1992, Academic Press.
4. **Instrumental Methods of Analysis**, M. William and D. Steve, 1986, CBS publishers, New Delhi.
5. **Instrumental Methods of Analysis**, H.H. Williard, L.L. Merritt, M.J. Dean, and F.A. Settle, Sixth Edition, 1986, CBS Publishers and distributors, New Delhi.

Web Reference:

1. https://books.google.co.in/books/about/Thin_Film_Fundamentals.html?id=K0e-8Nh9zSYC
2. http://www.issp.ac.ru/ebooks/books/open/Advanced_Topics_on_Crystal_Growth.pdf
3. https://www.acadpubl.eu/hub/2018-119-12/articles/2/489.pdf
4. https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/SCY2.pdf
5. https://arshadnotes.files.wordpress.com/2018/02/the_materials_science_of_thin_films.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
V	Proficiency Enhancement	21PEP01	**LASER AND ITS APPLICATIONS (SELF –STUDY)**	-	**2**

Contact hours per week: -

Year	Semester	Internal Marks	External Marks	Total Marks
First	III	-	100	100

Preamble: The Aim is to provide the students knowledge about Lasers, types of lasers available,itsapplications,in medical am=nd industrial lines and train them to fabricate new models of lasers.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall the basic terms involved in the lasers	K1

CO2	Explain the fundamental properties and conditions of different lasers	K2
CO3	apply the laser applications in material processing	K3
CO4	Analyze the different types of surface treatments, laser deposition of thin film, integrated circuit fabrication	K4
CO5	Evaluate the needed method for the preparation of thin film.	K5
CO6	Create a new technique for sample fabrications	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	3	3
CO2	9	9	9	9	3	3	3
CO3	9	9	9	3	3	3	3
CO4	9	3	3	3	1	3	3
CO5	3	3	3	1	1	3	3
CO6	3	3	1	1	0	1	1
Total Contribution of COs to POs	42	36	34	26	17	16	16
Weighted Percentage of COs Contribution to POs	3.47	3.36	4.0	3.6	2.5	2.7	3.5

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT I: FUNDAMENTALS OF LASERS

Electromagnetic radiation – energy levels – Interaction of radiation and matter – fluorescence, absorption, stimulated emission.

LASER MATERIALS: population inversion – optical pumping- excitation by electron collisions – resonant transfer of energy – resonant cavity.

UNIT II: PROPERTIES OF LASER LIGHT

Line width – collimation – spatial profiles of laser beams – temporal behavior of Laser output – Q switched operation – mode locked operation – cavity dumping – coherence – radiance – focusing properties of Laser radiation – power.

UNIT III: GAS LASER

He-Ne Laser – ionized gas laser – Molecular Laser (CO2) — Solid state lasers: Neodymium YAG Lasers- glass Lasers- Ruby Lasers.

UNIT IV: SEMI CONDUCTOR LASER

semiconductor laser properties – Diode structures – diode doped solid state laser – Organic dye lasers – chemical lasers – X ray lasers – Tunable lasers.

UNIT V: APPLICATIONS

Interferometric distance measurement – velocity measurements – measurement of wire diameter – measurement of surface finish – particle diameter measurement – laser applications in material processing – laser welding – surface treatment – drilling, cutting and marking – laser deposition of thin film – integrated circuit fabrication.

Text Books:

1. **Laser Systems and Application**, V.K.Jain, 2013, Narosa Publisher. (All Units)
2. **Laser and Non-Linear Optics**, B.B.Laud, 2011, New age Int. publisher, 3rd Edition.

Reference books:

1. **Semiconductor LasersI-Fundamentals**, Edited by Eli Kapon, 1999, Academic press.
2. **Solid state Lasers: A graduate text**, Walter Koechner Michael Bass, 1937, Springer.
3. **Laser & Optical Fibre Communications**, P.sarah, 2008, I.K.Int publisher.
4. **Laser Physics**, S. Mohan, V. Arjunan, M. Selvarani, M. Kanjanamala, 2012, MJP Publishers.

Web Reference:

1. https://spie.org/Documents/Courses/OP-TEC/Course_2_Laser_Systems_and_Applications_2nd_Edition_2016.pdf
2. https://www.academia.edu/42707790/Lasers_and_Non_Linear_Optics
3. http://www.ime.cas.cn/icac/learning/learning_3/201907/P020190717575056933547.pdf
4. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/FIBER%20OPTICAL%20COMMUNICATIONS.pdf
5. https://ehs.msu.edu/_assets/docs/laser/laser-fundamentals-pt1-springer-2005.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XVIII	21PHP17	**CONDENSED MATTER PHYSICS**	**90**	**4**

Contact hours per week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
First	IV	50	50	100

Preamble: The aim is to provide students knowledge and understanding the Crystal structure and crystal defects and to advance skills for analyzing Heat capacity of the electron ga**s** and Magnetism

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	remember the Crystal, lattice, Reciprocal lattice, Defects, Hall effect, Semiconductors, Superconductor and magnetic materials.	K1
CO2	Describe the concept of Reciprocal, various defects and different types of materials.	K2
CO3	calculate the reciprocal value of BCC and FCC thermal conductivity of metals by suitable methods.	K3
CO4	analyze various various theories in Semiconductor, Dielectric, Superconductor and magnetic materials	K4
CO5	classify the defects and dislocations in crystals and identify the defects by various methods.	K5
CO6	create new types of semiconductor, Superconductor and magnetic materials	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	3	3
CO2	9	9	9	9	3	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	3	3	3	3
CO5	9	9	3	3	1	1	1
CO6	9	3	3	3	9	9	3

Total Contribution of COs to POs	54	48	42	36	22	22	16
Weighted Percentage of COs Contribution to POs	6.37	6.38	7.22	7.37	5.05	5.82	6.13

Level of correlation: 0 – No correlation;1 – Low correlation;3 – Medium correlation;9- High correlation between COs and POs

SYLLABUS

UNIT I: RECIPROCAL LATTICES (18 Hours)

Vector development of reciprocal lattice – Properties of the reciprocal lattice – Reciprocal lattice to bcc lattice and fcc lattice.

UNIT II: CRYSTAL DEFECTS (18 Hours)

Classification of defects - Points defect - The Schottky defect - The Frenkel defect -colour centers - F center - other colour centers - Production of colour centers by X rays and practice irradiation – Defect and energy state.Dislocations - Slip and plastic deformation - Shear strength of single crystals - Edge dislocation - Screw dislocation - Stress field around an edge dislocation.

UNIT III :LATTICE VIBRATIONS, SEMICONDUCTORS &FREE ELECTRON THEORY(18 Hours)

Vibrations of One Dimensional Diatomic Linear Lattice -Acoustic and Optical Branches Phonon State- Energy levels and density of orbitals – Motion in magnetic fields – Hall effect – Thermal conductivity of metals – Nearly free electron model –Electron in a periodic potential – Semiconductors – Band gap – Effective mass – Intrinsic carrier concentration.

UNIT IV: DIELECTRICS, FERROELECTRICS AND SUPERCONDUCTIVITY (18 Hours)

Macroscopic electric field – Local electrical field at an atom –Polarizability – Clausius- Mossotti equation – Ferroelectric crystals – Polarization Catastrophe – Ferroelectric domains.Occurrence of Superconductivity – Meissner effect – Thermodynamics of Superconducting transition – London equation – Coherence length – BCS theory – Flux Quantization – Type-I and Type-II Superconductors –Josephson tunneling effect- DC and AC Josephson effect – SQUID.

UNIT V: MAGNETISM (18 Hours)

Quantum theory of Paramagnetism – Paramagnetic susceptibility of conduction electrons – Hund's rules- Kondo effect. Ferroelectric order – Curie point and the exchange integral – Temperature dependence of saturation magnetization – Magnons – Thermal excitation – Ferromagnetic order – Antiferromagnetic order – Antiferromagnetic Magnons – Ferromagnetic domains – Origin of domains – Coercive force and hysteresis.

Text Books:

1. **Introduction to Solid State Physics,** Kittel. C. 2005, 8th Edition, Willey India (P) Ltd., New Delhi.(Units III, IV & V)
2. **Fundamentals of Solid State Physics,**Saxena. B.S., R. C. Gupta and P. N. Saxena, 2012, 16th edition, PragatiPrakashan, Meerut.(Units I & IV)
3. **Solid State Physics,** S. L. Guptha, V. Kumar, Ninth Edition, K. Nath& Co, Meerut.[ISBN:978-81-924088-7-3]

Reference books:

1. **Solid State Physics,** A.J. Dekkar, revised edition, 2000, Macmillan India Ltd., New Delhi.
2. **Principles of Solid State,**Keer. H.V. 1st edition, 2002, New age international, New Delhi.
3. **Solid State Physics,**Pillai S.O., 2005, 4th Edition, New Age International Publishers Ltd.

Web Reference:

1. https://www.wiley.com/en-us/Introduction+to+Solid+State+Physics%2C+8th+Edition-p-9780471415268
2. https://www.researchgate.net/publication/307976662_Fundamentals_of_Solid_State_Physics
3. http://vnit.ac.in/chem/wp-content/uploads/2018/10/PG-Course_Book-2016.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XIX	21PHP18	**THERMODYNAMICS AND STATISTICAL MECHANICS**	**90**	**4**

Contact hours per week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
First	IV	50	50	100

Preamble: The aim is to provide students a deeper knowledge and understanding of Thermodynamics, particle distribution and statistics

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall the laws and principles in Thermodynamics and Statistical Mechanics	K1
CO2	explain the link between statistics and thermodynamics, classical and quantum statistics and its applications	K2
CO3	apply principles to explain Black body radiation, Gibbs paradox and Phase transition	K3
CO4	categorize different type of statistics based on application	K4

CO5	select appropriate statistics for the distribution of particles	K5
CO6	predict the proper statistics to explain various phenomena in Thermodynamics	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	0	0	0
CO2	9	9	9	9	3	0	0
CO3	9	9	9	9	3	3	9
CO4	9	1	9	1	1	3	9
CO5	1	1	9	1	0	3	3
CO6	1	1	9	1	0	3	0
Total Contribution of COs to POs	38	30	45	30	7	12	21
Weighted Percentage of COs Contribution to POs	4.48	3.98	7.74	6.14	1.60	3.17	8.04

Level of correlation:0 – No correlation;1 – Low correlation;3 – Medium correlation;9- High correlation between COs and POs

SYLLABUS

UNIT I: Thermodynamics and Radiation (18 Hours)

Second law of thermodynamics- Entropy and Second law of thermodynamics- Entropy and Disorder- Thermodynamic Potential and Reciprocity relation- Thermodynamic Equilibria- Chemical Potential- Blackbody radiation- Planck's Radiation law.

UNIT II: BASIC CONCEPTS OF STATISTICAL PHYSICS (18 Hours)

Phase space- Concept of ensemble- Micro canonical ensemble-Canonical ensemble- Grand Canonical ensemble- Density distribution in phase space- Liouvilles theorem- Postulate of equal apriori probability- Statistical equilibrium- Thermal equilibrium- Mechanical equilibrium-Particle equilibrium-Connection between Statistical and thermodynamic quantities.

UNIT III:CLASSICAL DISTRIBUTION LAW (18 Hours)

Microstates and Macro states-Classical Maxwell-Boltzmann distribution law- Evaluation of constants, α and β- Maxwell's law of Distribution of velocities- Principle of equi-partition of energy- Gibbs paradox- Partition function and its correlation with thermodynamics quantities.

UNIT IV:QUANTUM STATISTICS (18 Hours)

Indistinguishability and quantum statistics- Statistical weight and apriori probability- Identical particle's and symmetry requirements- Bose Einstein's Statistics- Fermi Dirac Statistics- Results of three statistics- Thermodynamic interpretation of parameter's α and β- Blackbody radiation and Planck radiation- Specific heat of solids: Dulong and Petit's law- Einstein's Theory- Debye theory.

Unit V: APPLICATION OF QUANTUM STATISTICS (18 Hours)

Energy and pressure of ideal Bose Einstein gas- Bose Einstein condensation- Liquid helium- Energy and pressure of ideal Fermi Dirac gas- Free electron model and electronic emission- Onsager relations- Fluctuation in Energy, Pressure, Volume & Enthalpy- Using model-Bragg William Approximation- Using One dimensional model .

Text Books:

1. **Statistical mechanics,** Gupta & Kumar, 2003, Pragatiprakashan, Meerut. (All Units)

Reference books:

1. **Elements of Statistical Mechanics**, Miss Kamal Singh, S.P.Singh, 1999, S.Chand& Company Ltd

Web Reference:

1. https://ocw.mit.edu/courses/physics/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/
2. https://core.ac.uk/download/pdf/44144078.pdf
3. https://cds.cern.ch/record/988948/files/0521841984_TOC.pdf
4. http://www0.unsl.edu.ar/~cornette/ME/An-Introduction-to-Statistical-Mechanics-and-Thermodynamics.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XX	21PHP19	**ELECTRONIC COMMUNICATION SYSTEMS**	**90**	**4**

Contact hours per week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
First	III	50	50	100

Preamble: The aim is to provide the students good understanding of radar systems and types of modulation used in electronic communication systems and the operation of different types of microwave devices.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall the propagation and properties of light, Antennas, Signals and Optical fibre	K1
CO2	discuss the types of Antenna, the microwave generators, Radar Systems, Types of Modulation	K2
CO3	apply Light propagation in Sky ,Ground Wave Propagation and Ionosphere, Radar in Radar Systems, Signals in Modulation, Interpret the application of optical fibres	K3
CO4	analyze the Working of Directional High frequency Antennas, Klystron, Magnetron, Travelling Wave Tubes, MASER, and Optical Fibre Propagation	K4
CO5	evaluate the Grounded Antenna, Ungrounded λ/2 Antenna, and Mathematical representation of FM, Step and Graded Index Fibres, Fibre Losses and Dispersion	K5
CO6	predict the rule for reducing Noise and Signal Loss in Antenna transmission	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	3
CO3	9	9	9	9	9	3	3
CO4	9	9	9	3	3	3	3

CO5	9	9	3	1	1	1	3
CO6	9	9	3	1	1	1	1
Total Contribution of COs to Pos	54	54	42	32	32	26	22
Weighted Percentage of COs Contribution to POs	6.37	7.18	7.22	6.55	7.35	6.87	8.42

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

UNIT I: ANTENNAS & WAVE PROPAGATION (18 Hours)

Terms and Definition -Effect of Ground on Antenna-Grounded λ/4 Antenna Ungrounded λ/2 Antenna Antenna Arrays-Broadside and End Side Arrays-Antenna Gain-Directional High Frequency Antennas-Sky Wave Propagation-Ionosphere-Ground Wave Propagation

UNIT II: MICROWAVES (18 Hours)

Microwave Generation-Multicavity Klystron -Reflex Klystron-Magnetron-Travelling Wave Tubes (TWT) -MASER.

UNIT III: RADAR SYSTEM (18 Hours)

Elements of a Radar System-Radar Equation-Radar Performance Factors-Radar Transmitting Systems-Radar Antennas-Duplexers-Radar Receivers and Indicators-Pulsed Systems-Other Radar Systems

UNIT IV: COMMUNICATION ELECTRONICS (18 Hours)

Analog and Digital Signals –Modulation –Types of Modulation-Amplitude modulation theory – Frequency spectrum of the AM wave –Representation of AM –Power relations in the AM wave – Generation of AM –Basic requirements-Description of frequency and phase modulation – Mathematical representation of FM –Frequency spectrum of the FM wave -Effects of noise on carrier.

UNIT V: OPTICAL FIBRES (18 Hours)

Propagation of Light in an Optical Fibre-Acceptance Angle-Numerical Aperture-Step and Graded Index Fibres-Optical Fibre as a Cylindrical Wave Guide-Wave Guide Equations-Wave Equations in Step Index Fibres-Fibre Losses and Dispersion-Applications.

Text Books:

1. **Electronic Communication System**, George Kennedy & Davis, 1989, Tata McGraw Hill 4th edition.[ISBN:978-0-07-107782-8] (Units I - IV)
1. **Optical fiber and fiber optic communication systems**, S. K. Sarkar, 2007, S. Chand Publication. (Unit – V)

References books:

2. **Electronic Communications,**Sanjeeva Gupta, 2002, Khanna Publishers.

Web References:

1. https://soaneemrana.org/onewebmedia/ELECTRONICS%20COMMUNICATION%20SYSTEM%20BY%20GEORGE%20KENNEDY.pdf
2. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/FIBER%20OPTICAL%20COMMUNICATIONS.pdf

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XXI	21PHP20	**ADVANCED PHYSICS PRACTICAL-II**	**135**	4

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	III & IV	50	50	100

Preamble: The aim is to provide the students better practical knowledge of general Physics experiments, learn about handling of experiments and to know about different equipments used.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	remember the formulae and properties for different experiments	K1
CO2	be aware of principles and characteristics of various experiments	K2
CO3	seek different applying conditions and procedure in each experiment	K3
CO4	explore the causes for each experiments and relationship between different formulae	K4
CO5	assess and compare the effectiveness of each experiment	K5
CO6	develop new innovation on the basis of existing experiment	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO- PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

PO COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	9	9	9	9	9	9	3

CO2	9	9	9	9	9	9	3
CO3	9	9	3	3	9	9	1
CO4	9	9	3	3	3	3	1
CO5	9	9	3	3	3	3	1
CO6	3	3	0	3	0	3	0
Total Contribution of COs to Pos	48	48	27	30	33	36	9
Weighted Percentage of COs Contribution to POs	5.66	6.38	4.64	6.14	7.58	9.52	3.44

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS

S.No	Course Content	Instructional Hours
1	e/m-Magnetron Method	**135**
2	Compressibility of a Liquid-Ultrasonic Method	
3	Arc Spectra-Constant Deviation Spectrograph-Copper, Iron & Brass	
4	Michelson Interferometer- λ, dλ and Thickness of Mica Sheet	
5	Susceptibility-Guoy and Quincke‟s Method	
6	Hall Effect and its application	
7	e/m-Zeeman Effect	
8	B-H Curve-Solenoid	
9	B-H Curve-Anchor ring	
10	Double Slit-Wavelength Determination	
11	G.M Counter-Characteristics	
12	Kelvin‟s Double Bridge-Determination of Very	
13	LowResistance& Temperature Coefficient of Resistance He-Ne Laser determination	

14	Matlab Programming-Radioactive Decay	
15	Matlab Programming-Numerical Integration	
16	Matlab Programming-Double Integration	
17	Matlab Programming-Solution of Ordinary Differential Equations	
18	Matlab Programming-Computer Simulation of Equations of Motion for a System of Particles	
19	Matlab Programming-Computer Simulation of 1-D and 2-D Lattice Vibrations	
20	Matlab Programming-Computer Simulation of Kronig-Penney Model	
21	Matlab Programming-Numerical simulation of Wave-Functions of Simple Harmonic Oscillator	
22	Matlab Programming-Simulation of Wave Functions for a Particle in Critical Box	
23	Matlab Programming-Solution of Diffusion Equation	

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XXII	21PHP21	**GENERAL ELECTRONICS PRACTICAL-II**	**135**	**4**

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
First	III & IV	50	50	100

Preamble: The aim of this course is to provideknowledge on the applications of Operational amplifier and to gain the practical hands on experience of programming the microprocessor and also gain knowledge on interfacing of different peripherals to microprocessor

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	recall the working principle of Operational Amplifier, IC 555 and microprocessor	K1
CO2	elucidate the functioning of circuits constructed using operational amplifier and IC 555	K2
CO3	perform analog to digital conversion and digital to analog conversion using operational amplifier perform interfacing for waveform generator, stepper motor, 7 segment LED display Hex keyboard musical tone generator using microprocessor	K3

CO4	analyze the mathematical operations performed by circuits constructed using operational amplifier	K4
CO5	determine the frequency of astablemultivibrator and output voltage in simultaneous adder and subtractor execute programs using microprocessor	K5
CO6	construct the circuits to perform mathematical operations, measurement of temperature and light intensity using operational amplifier	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	3	3	9	9	1
CO4	9	9	3	3	3	3	1
CO5	9	9	3	3	3	3	1
CO6	3	3	0	3	0	3	0
Total Contribution of COs to POs	48	48	27	30	33	36	9
Weighted Percentage of COs Contribution to POs	5.66	6.38	4.64	6.14	7.58	9.52	3.44

Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs

SYLLABUS
ANY TEN(10) EXPERIMENTS ONLY
EXAMINATION AT THE END OF SECOND SEMESTER

S.No	Course Content	Instructional Hours
1	Op-Amp: Simultaneous Addition & Subtraction	135
2	Op-Amp: V to I & I to V Converter	
3	Op-Amp: Circuits Using Diodes-Half Wave, Full Wave, Peak Value, Clipper, Clamper	

4	Op-Amp: Log and Antilog Amplifier	
5	Op-Amp Comparator-Zero Crossing Detector, Window Detector, Time Marker	
6	Op-Amp: Instrumentation Amplifier-Temperature Measurement	
7	Op-Amp: Instrumentation Amplifier-Light Intensity-Inverse Square Law	
8	IC 555 Timer Application-Monostable, Linear &Astable	
9	A/D Converters-Any One Method	
10	D/A Converters-Binary Weighted Method	
11	Microprocessor: LED Interfacing	
12	Microprocessor: Stepper Motor Interfacing	
13	Microprocessor: Traffic Control Simulation	
14	Microprocessor: ADC Interface-Wave Form Generation	
15	Microprocessor: Hex Keyboard Interfacing	
16	Microprocessor: Musical Tone Generator Interface	
25	MATLAB Programming-Mean, Median & Standard Deviation	
26	MATLAB Programming-Curve Fitting & Interpolation	
27	MATLAB Programming-Matrix Summation, Subtraction and Multiplication	
28	MATLAB Programming-Matrix Inversion and Solution of Simultaneous Equations	
29	He-Ne Laser – Measurement of refractive index of liquids.	
30	He-Ne Laser – Power distribution measurement.	
31	He-Ne Laser – Thickness of Wire	

Category	Course Type	Course Code	Course Title	Contact Hours	Credit
III	Core : XXIII	21PHP22	PROJECT WORK & VIVA VOCE	**50**	**3**

Contact hours per week: 2

Year	Semester	Internal Marks	External Marks	Total Marks
2022	III	50	50	100

Preamble: The aim is to provide the student to acquire knowledge on synthesis, fabrication and evaluation on basis of day to day life scenario and to understand the Importance of undergone project.

CO Statement: After completion of the course, the learners will be able to

Cos	CO Statement	Knowledge Level (RBT)
CO1	remember the facts about concerned project and its availability in environment	K1
CO2	be aware of principles that are interconnected to their individual project like material science, thin films, solar cells	K2
CO3	seek different applying technique and create innovative ideas on basis of project studies	K3
CO4	explore the causes and reason behind applied techniques of the project	K4
CO5	evaluate the results made from the project and analyse the usage of project in daily life	K5
CO6	develop further more innovations in the existing project based on innovative ideas	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO – PO Mapping

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	3	9
CO2	9	9	9	9	3	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	3	9	3	3	1
CO5	9	3	1	3	1	3	1

CO6	3	3	1	3	1	1	1
Total Contribution of COs to POs	48	42	32	42	20	16	18
Weighted Percentage of COs Contribution to Pos	3.97	3.92	3.8	5.8	3.0	2.70	3.99
Level of correlation: 0 – No correlation; 1 – Low correlation; 3 – Medium correlation; 9- High correlation between COs and POs							

(i) Value-added Courses:

Course Code	Course Name	Category	L	T	P	Credit
21PHVAP1	**MATERIAL SCIENCE**	Value added	-	40	-	-

Preamble

The aim of the objectives is to provide basic knowledge and skill of Material Science.

SYLLABUS

UNIT I **(10 Hours)**

Material Science– Properties of Engineering Material– Selection of Materials for Engineering Applications.

UNIT II: MAGNETIC MATERIALS(10 Hours)

Different types of Magnetic Materials –Diamagnetism and Paramagnetism – Ferromagnetism – Domain theory of ferromagnetism - Hard and Soft magnetic materials.

UNIT III : MODERN ENGINEERING MATERIALS(10 Hours)

Polymer – Ceramics – Super Strong Materials – Cermets– High temperature materials– Thermoelectric Materials– Electrets– Nuclear Engineering materials.

UNIT IV : NEW MATERIALS (10 Hours)

Metallic glasses – Fiber reinforced plastics – Metal matrix composites – Optical Materials– Materials for optical sources and detectors– Fiber Optic materials and their applications.

UNIT V **(10 Hours)**

Display Materials – Acoustic Materials and their applications– SAW materials– Biomaterials.

Text Books

1. Materials science- M Arumugam, Anuradha agencies.

References Books

1.Materials Science and Engineering - V. Raghavan, Prentice Hall of India,

Course Code	Course Name	Category	L	T	P	Credit
21PHVAP2	**PROBLEM SOLVING FOR NET/SLET**	Value added	-	40	-	-

Preamble

The aim of the objectives is to provide basic skills to solve Problems on Physics.

SYLLABUS

UNIT I

VECTOR CALCULUS (10 Hours)

Product of vectors – Gradient – Divergence & Curl – Integration of vectors: Linear integration of vectors, Surface integration of vectors, Volume integration of vectors, Linear dependency of vectors, Orthogonal curvilinear co-ordinates.

UNIT II

MATRICES (08 Hours)

Eigen values & Eigen vectors – Cayley-Hamilton theorem – Rank of a matrix – Diagonalisation of a matrix – Linear transformation – Applications.

UNIT III

COMPLEX ANALYSIS(08 Hours)

Function of complex variables – Complex analytic function – Power series: Expansion of Complex function – Singularity of Complex function – Residue of a Complex function.

UNIT IV

DIFFERENTIAL EQUATIONS(08 Hours)

Differential equation of first order and first degree – Linear second order differential equation – Legendre differential equation – Bessel differential equation – Hermite differential equation – Lagauerre differential equation.

UNIT V

TENSOR ANALYSIS(08 Hours)

Basic review of tensors – Algebra of tensors – Fundamental tensors – Chrystoffel symbols – Co-variant, contra-variant and mixed tensors.

Text Books

1) Mathematical Physics (revised), H K Dass, S. Chand (2008), ISBN 8121914698, 9788121914697.
2) Mathematical Physics(revised), SatyaPrakash, Sultan Chand & Sons (2014), ISBN 8180549283, 978-8180549281

References Books

1) Mathematical Physics, Kalkani S.L - 3rd Edition 2009, ISBN **9789386478238**.
2) Mathematical Physics, B.D Gupta- Vikas publishing house–4th Edition 2009, ISBN 8125930965, 9788125930969.
3) Mathematical Physics, Rajput B.S. –Pragatiprakashan -23rd Edition-2011

E-Reference:

1. https://nptel.ac.in>courses

c)Extra Credit Course(s):

Courses offered by the department for ADVANCED LEARNERS

Course Code	Course Name	Category	L	T	P	Credit
	ADVANCED INSTRUMENTATION	**Core**				

Course Objective: By undergoing the Statistical Mechanics, one should be able to acquire deeper knowledge on Statistical Mechanics

SYLLABUS

UNIT I **(10 Hours)**

ERRORS AND MEASUREMENTS

Measurement, Instruments-static characteristics of instruments, estimation of static errors and reliability, dynamic characteristics of instruments.

UNIT II **(10 Hours)**

TRANSDUCERS

Classifications of transducers-displacement measurement, strain measurement-stress strain relations, resistance strain gauges, Fibre – Optic strain gauges.

UNIT III **(10 Hours)**

PRESSURE MEASUREMENTS

Definition- Pressure units and their conversions, comparison with known dead weights, Force-Summing devices, secondary transducers, vacuummeasurement.

UNIT IV **(10 Hours)**

TEMPERATURE MEASUREMENTS

Temperature scale, change in dimensions, electrical properties, thermoelectricity, fibre-optic sensors, Quartz thermometer, change in velocity of sound propagation, radiation pyrometers, thermowells.

UNIT V **(10 Hours)**

OTHER FORMS OF MEASUREMENTS

Acceleration and force measurement, Tachometers, Torque measurement, flow measurement, level measurement, signal conditioning, display devices and recordingsystems

Text Books

1. Introduction to Measurements and Instrumentation – Arun K Gosh, 4th Edition, 2012, PHI Learning Private Limited (Unit 1, 2, 3, 4 & 5)

Course Code	Course Name	Category	L	T	P	Credit
	ADVANCED QUANTUM MECHANICS	**Core**				

Course Objective: The aim is to make the students to understand the concepts of wave mechanics, Schrödinger equation, 1D and 3D energy eigen value problems, symmetry and conservation laws and approximation methods and theories for the study of chemical bondings.

SYLLABUS

UNIT I (10 Hours)

Wave Mechanical concepts: Wave nature of particles – the uncertainty principle – the principle of superposition – wave packet – time-dependent schrodinger equation - interpretation of wave function – ehrenfest's theorem – time-independent schrodingerequation - stationary states – admissibility conditions of the wave function.

Unit II (10 Hours)

One Dimensional Energy Eigen Value Problems: Square well potential with rigid walls - Square well potential with finite walls – square potential barrier – Alpha emission – Bloch waves in periodic potential – Kronig-Penney square-well periodic potential – linear harmonic oscillator: Schrodinger method and operator method.

Unit III (10 Hours)

Three Dimensional Energy Eigen Value Problems: Particle moving in a spherically symmetric potential – system of two interacting particles – rigid rotator – hydrogen atom – hydrogenic orbits – the free particle – three-dimensional square-well potential – the deuteron.

Unit IV (10 Hours)

Symmetry and Conservation laws: Symmetry transformations- Translation in space: conservation of linear momentum - Translation in time: conservation of energy - Rotation in space: conservation of angular momentum – space inversion: parity conservation – time reversal.

Unit V (10 Hours)

Chemical bonding: Born-Oppenheimer approximation – Molecular orbital method – MO treatment of hydrogen molecule ion – Electronic configuration of diatomic molecules – Valence bond method the valence bond treatment of H_2.

Text Books

1. **Quantum Mechanics,** G. Aruldhas, 2nd Edition,2009, PHI Learning. (All units)
2. **Advanced Quantum Mechanics,** SatyaPrakash, 2001, KedarNath Ram Nath Co., Meerut.

Reference Books

1. **Quantum Mechanics**, Leonard I. Schiff, 1968, McGraw-Hill Book Company.
2. **Quantum Mechanics**, V. Devanathan, 2005, Narosa Publishing House, New Delhi.
3. **A textbook of Quantum Mechanics**, P.M. Mathews and Venkatesan, 27th reprint 2002, Tata McGraw Hill publishing company Ltd., New Delhi.

Course Code	Course Name	Category	L	T	P	Credit
	STATISTICAL MECHANICS	**Core**				

Course Objective: By undergoing the Statistical Mechanics, one should be able to acquire deeper knowledge on Statistical Mechanics

SYLLABUS

UNIT I **(10 Hours)**

THE FUNDAMENTALS OF STATISTICAL PHYSICS

Objective of statistical mechanics: macrostates, microstates, phase space and ensembles- Density of states- Density distribution in phase space- Ergodic hypothesis- Postulate of equal a priori probability and equality of ensemble average and time average- Boltzmann's postulate of entropy- Classical ideal gas- Entropy of ideal gas: Gibbs' paradox- Liouville's theorem.

UNIT II **(10 Hours)**

THEORY OF ENSEMBLES

Classification of ensembles- Micro canonical, Canonical and Grand canonical ensembles - Partition function of canonical ensemble- Thermo dynamical quantities by partition function - expression of entropy- Helmholtz free energy- fluctuation of internal energy- chemical potential of ideal gas.

UNIT III **(10 Hours)**

QUANTUM STATISTICS

Introduction- Postulates of quantum statistical mechanics- Density matrix- Ensembles in Quantum statistical mechanics- Quantum Liouville theorem- Maxwell law of distribution of velocities- Ideal quantum gases- Bosons- Fermions- BE, FD, MB distributions using GCE partition functions.

UNIT IV **(10 Hours)**

APPROXIMATE METHODS

Classical Cluster expansion- Quantum Cluster expansion- Virial equations of states, Ising model in one, two, three dimensions- exact solutions

UNIT V **(10 Hours)**

PHASE TRANSITIONS

Photon gas- Equation of state- Bose-Einstein condensation- Equation of state of ideal gas - Specific heat from lattice vibration- phase transitions- first and second order phase transitions critical points- Landau’s theory- Phonon gas- Theory of Super fluidity- Liquid helium.

Text Books

1. B.B. Laud, Fundamentals of Statistical Mechanics, New Age International Publishers.
2. Kerson Huang, Statistical Mechanics, John Wiley & Sons.
3. C. Kittel, Elementary Statistical Physics, John Wiley & Sons.
4. R.P. Feynman, Statistical Mechanics, Addison Wesley.
5. R.K. Pathria, Statistical Physics, Pergamon, Oxford.
6. F. Reif, Statistical and Thermal Physics, McGraw Hill.

Course Code	Course Name	Category	L	T	P	Credit
	PLASMA PHYSICS					

Course Objective: The aim is to provide the students, understand the model plasma phenomena in the universe and explore the physical processes which occur in the space environment .

SYLLABUS

UNIT I **(10 Hours)**

FUNDAMENTAL CONCEPTS ABOUT PLASMA

Kinetic pressure in a partially ionized - mean free path and collision cross section- mobility of charged particles - Effect of magnetic field on the mobility of ions and electrons - Thermal conductivity - Effect of magnetic field - Quasi neutrality of plasma - Debye shielding distance.

UNIT II **(10 Hours)**

MOTION OF CHARGED PARTICLES IN ELECTRIC AND MAGNETIC FIELD

Particle description of plasma – Motion of charged particle in electrostatic field- Motion of charged particle in uniform magnetic field - Motion of charged particle in electric and magnetic fields - Motion of charged particle in inhomogeneous magnetic field- Motion of charged particle in magnetic mirror confinement - motion of an electron in a time varying electric field

UNIT III **(10 Hours)**

PLASMA OSCILLATIONS AND WAVES

Introduction, theory of simple oscillations - electron oscillation in a plasma - Derivations of plasma oscillations by using Maxwell's equation - Ion oscillation and waves in a magnetic field - thermal effects on plasma oscillations - Landau damping - Hydro magnetic waves - Oscillations in an electron beam

UNIT IV **(10 Hours)**

PLASMA DIAGNOSTICS TECHNIQUES

Single probe method - Double probe method - Use of probe technique for measurement of plasma parameters in magnetic field - microwave method - spectroscopic method - laser as a tool for plasma diagnostics – X ray diagnostics of plasma - acoustic method – conclusion

UNIT V **(10 Hours)**

APPLICATIONS OF PLASMA PHYSICS

Magneto hydrodynamic Generator - Basic theory - Principle of Working - Fuel in MHD Generator - Generation of Microwaves Utilizing High Density Plasma

Text Books

1. **Plasma Physics - Plasma State of Matter** - S.N. Sen, PragatiPrakashan, Meerut
2. **Principles of Plasma Diagnostics** - I. H. Hutchinson
3. **Introduction to Plasma Physics** - F.F.Chen, Plenum Press, London
4. **Plasma Diagnostic Techniques** - R.H. Huddlestone& S.L. Leonard

a) List of elective courses for Semester - I:

Course Code	Semester	Course	Hours per Week	Credits
21PHP05A /21PHP05B	I	Essentials of Nanoscience/ Radiation Physics	4	3

a) List of elective courses for Semester - II:

ɒurse Code	Semester	Course	ours per Week	Credits
21PHP11A/ 21PHP11B	II	Astronomy &Astrophysics / Experimental Techniques	4	3

b) List of elective courses for Semester – III:

Course Code	Semester	Course	Hours per Week	Credits
22PHP16A/ 22PHP16B	III	Biomedical Instrumentation/ Thin Film Physics and Crystal Growth	4	3

c) Courses for Skill Enhancement:

Course Code	Semester	Course	Hours per Week	Credits
NA	NA	NA	0	0

d) Courses for Ability Enhancement:

Course Code	Semester	Course	Hours per Week	Credits
21AEP01	II	Cyber Security	2	2

e) Course for Proficiency Enhancement:

Course Code	Semester	Course	Hours per Week	Credits
21PEP01	III	Laser and its applications (Self – Study)	Self Study No instructional Hours	2

f) Courses for Competency Enhancement:

Semester	Course	Hours per Week	Credit
I - IV	Online Course / Learning Object Repository (LOR)	Self-Paced with Faculty mentoring and Support SEMESTER I – IV	**2**
	Certificate Course		**2**

Total Marks: 2500

Total Credits: 90 credits

Chair Person
Name, designation
College name – full address

SYLLABUS WAS PREPARED AND FINALISED AS MENTIONED BELOW:

Category	Component	Course Code	Course Title	Faculty name
	SEMESTER - I			
III	Core : VIII	22PHP08	Introduction to Scientific Research & Solar Energy Research	Dr.V.Radhika
III	Core : XVII Elective : III	22PHP16A/ 22PHP16B	Biomedical Instrumentation Thin Film Physics and CrystalGrowth	Dr.V.Radhika

Curriculum Structure and syllabus for the M.Scprogramme are prepared and verified in line with the guidelines of CDC.

Prepared by

Approved by
Dr.V.Radhika
Head & Associate Professor
Physics

DISTRIBUTION OF MARKS AND QUESTION PAPER PATTERN

FOR SCHOLASTIC COURSES UNDER PART III, IV AND V

OF ALL PG PROGRAMMES – 2021 and onwards

For Scholastic Courses:

S.No.	CATEGORY	TOTAL MARKS	DISTRIBUTION OF MARKS		PASSING MINIMUM FOR (ESE)		OVERALL PASSING MINIMUM FOR (CIA & ESE)
			CIA *	ESE **	CIA *	ESE **	
1.	**Theory / Practical / Project (Both CIA and ESE)** Core / Allied / Any category Open Elective	100	50	50	25	25	50
2.	**100% INTERNAL (ONLY CIA / NO ESE)** Skill Enhancement	100	50	--	50	--	50
3.	**100% EXTERNAL (ONLY ESE)** Ability Enhancement Proficiency Enhancement	100	--	100	--	50	40
4.	**Projects**	100	50	50	25	25	50

***Bloom's Taxonomy based assessment pattern.**

**** ONLY CIA indicates 100% CIA course, ONLY ESE indicates 100% ESE appearance, BOTH indicates CIA and ESE components WITH MANDATED appearance for CIA to take up the ESE.**

1. For Courses - Theory / Practical / Project - (Both CIA and ESE) - Core / Any category

Open Elective :

1.1 <u>For THEORY Courses (BOTH CIA AND ESE):</u>

1.1.1 <u>Distribution of Marks:</u>

<table>
<tr><th>SPLIT – UP</th><th>COMPONENTS</th><th>K LEVEL</th><th colspan="2">MARKS</th><th>TOTAL MARKS</th></tr>
<tr><td rowspan="5">CIA</td><td rowspan="3">Assignments: A student is expected to submit three assignments (includes one e-assignment) on any topic relevant to her course as directed by her course instructor based on the assignment schedule provided at the beginning of the semester for every course. Marks will be awarded based on concept clarification and justification on the task. Average marks of the three assignments are considered in this case. A student can score a maximum of 10 marks from assignments.(All assignments – online submission of e-assignment)</td><td>K4</td><td>10</td><td rowspan="3">Average of 3 assignments

30/3 = 10</td><td rowspan="5">50</td></tr>
<tr><td>K5</td><td>10</td></tr>
<tr><td>K6</td><td>10</td></tr>
<tr><td>Seminar :A student shall handle a seminar on any topic relevant to her course as directed by her course instructor for which marks shall be awarded based on concept clarification and justification on the task. A student can score a maximum of 5 marks for her seminar.</td><td>K3</td><td colspan="2">5</td></tr>
<tr><td>Others : A student will be evaluated during the semester on her participation in class, case studies presentation, field work, field survey, group discussion, term paper, participation in workshop/conference, presentation of papers in conferences, surprise / informed quizzes from the respective courses that maybe conducted online / offline with simple multiple choice questions, report / content writing, etc.Average marks in these activities will fetch her a maximum of 5 marks.</td><td>K1 – K6</td><td colspan="2">5</td></tr>
<tr><td>CIA I and CIA II tests: A student will be evaluated during the semesterin Two CIA tests that would be conducted as per the</td><td>K1 – K6</td><td colspan="2">20</td></tr>
</table>

SPLIT – UP	COMPONENTS	K LEVEL	MARKS	TOTAL MARKS
	schedule approved by the academic head. **Average of the two tests** will be considered in this category.			
	Model Exam: A student has to appear for the MODEL EXAM that would be conducted as per the schedule approved by the academic head. Appearance for MODEL EXAM is mandatory for ESE appearance.		10	

Appearance for at least one CIA component is mandatory.

1.1.2. CIA, Model Exam and ESE Question paper pattern with K-levels:

i) For CIA Tests – 1 Hour test:

SECTIONS / No. of Questions	K LEVEL	MARKS	TOTAL MARKS
Section A: *5 Questions* **(5 X 1 = 5)** *(No Choice)*	K1 - 3 questions K2– 2 questions or K1 - 2 questions K2– 3 questions	5	**25**
Section B: *5 Questions* **(5 X 3 = 15)** Both options of same level *(Either / or Type Questions)*	K3– 3 Questions K4 – 2 Questions or K3– 2 Questions K4 – 3 Questions	15	
Section C : *1 Question* **(1 X 5 = 5)** Both options of same level *(Either / or Type Question)*	K4 / K5/K6 – 1 Question	5	

i) For Model Exam and ESE – 3 Hours exam:

SECTIONS / No. of Questions	K LEVEL	MARKS	TOTAL MARKS

SECTIONS / No. of Questions	K LEVEL	MARKS	TOTAL MARKS
Section A: *10 Questions* **(10 X 1 = 10)** Two questions from all the 5 units *(No Choice)*	K1 - 5 Questions (1,3,5,7,9) K2 - 5 Questions (2,4,6,8,10)	10	**50**
Section B: *5 Questions***(5 X 3 = 15)** One question from all the 5 units / both options from same unit and level *(Either / or Type Questions)*	K3 – 3 Questions K4 – 2 Questions	15	
Section C : *5 Questions* **(5 X 5 = 25)** One Question from every unit / both options from same level *(Either / or Type Questions)*	K4 – 1 question K5 – 3 questions K6 – 1 question Q.No.20 - Compulsory	25	

1.2. <u>For Practical Courses (BOTH CIA and ESE):</u>

i) For CIA:

SPLIT – UP	COMPONENTS	K LEVEL	MARKS	TOTAL MARKS
CIA	Conduct of Experiments / Observations *(Minimum 10 experiments to be conducted/practical course/semester)*	K1 – K6 levels	10	50
	Periodical Lab Tests (Average of TWO) : 15 Marks **(3 HOURS)**		35	
	Model Test : 20 Marks **(3 HOURS)**			
	Record Work #		5	

CIA & MODEL exam Question paper patterns are not defined.

ii) For ESE:

SPLIT – UP	COMPONENTS	K LEVEL	MARKS	TOTAL MARKS

ESE **(3 HOURS)**	**Experiment / Activity: 1** Algorithm/Steps/Procedure/Logic Input/Execution/Observations/Output/Result	K1 – K6 levels	10 10	50
	Experiment / Activity: 2 Algorithm/Steps/Procedure/Logic Input/Execution/Observations/Output/Result		10 10	
	Record Work #		10	

Record work is MANDATED for appearance in the ESE. Failing to submit will disqualify the candidate from appearing for the ESE.

- There shall be change in the components measured depending on the nature of the course and is left to the discretion of the department.

2. For THEORY COURSES that are 100% INTERNAL (ONLY CIA / NO ESE - 50 Marks):

2.1. CIA Mark Split-up and CIA Question Paper pattern with K-levels:

SPLIT – UP	COMPONENTS	K LEVEL	MARKS	TOTAL MARKS
CIA	**Test I :**2 questions **2 X 5 = 10**1 Hour Either / or type Questions *Both options from the same level*	K1, K2,K3, K4,K5,K6 Any level can be used	10	50
	Test II :2 questions **2 X 5 = 10** 1 Hour Either / or type Questions *Both options from the same level*		10	
	Test III : 5 questions **5 X 5 = 25**2 Hours (To be conducted as Model Exam) One question from each unit *(*Either / or type*)* *Both options from the same unit / same level*		25	
	Assignment 1 **X 5 = 5** (One assignment - Meaning, definition and concept clarification from various sources)	K1 – K6 levels	5	

Note : 100% CIA ONLY, NO ESE.

3. For THEORY COURSES that are 100% EXTERNAL (NO CIA / ONLY ESE- 50 Marks):

3.1. ESE Question Paper pattern with K-levels:

SPLIT – UP	COMPONENTS	K LEVEL	TOTAL MARKS
ESE **(3 HOURS)**	**Section A** 5 Questions **5 X 10 = 50** One question from each unit *(*Either / or type*)* *Both options from the same unit / same level*	K1, K2,K3, K4,K5,K6 Any level can be used	50

Note : NO CIA, 100% ESE ONLY.

4. For THEORY COURSES that are 100% EXTERNAL (NO CIA / ONLY ESE- 100 Marks):

4.1. ESE Question Paper pattern with K-levels:

SPLIT – UP	COMPONENTS	K LEVEL	TOTAL MARKS
ESE **(3 HOURS)**	**Section A** 5 Questions **5 X 20 = 100** One question from each unit *(*Either / or type*)* *Both options from the same unit / same level*	K1, K2,K3, K4,K5, K6 Any level can be used	100

Note : NO CIA, 100% ESE ONLY.

5. For evaluation of Project (ESE) under Part III:

Departments encouraging project work may adopt the following structure for evaluation of reports else, they shall define their own rubrics as per need.**The project reports** are evaluated at the end of semester jointly by the **Internal & External Examiners** as appointed by CoE.

Following components shall be used for evaluation:

SPLIT - UP	COMPONENTS (K1 – K6 LEVELS)		TOTAL MARKS
CIA	Regularity	15	50
	Review / Presentation	15	
	Knowledge about the organisation / theme of study	20	
ESE*	Nature of Work / Logic behind the study	10	50
	Learning Outcome	20	
	Viva – Voce	20	

* **ESE Viva-Voce for projects will be jointly conducted by internal and external examiners.**

- There shall be change in the components measured depending on the nature of the course and is left to the discretion of the department.

GUIDELINES FOR SCHOLASTIC COURSES

S.No.	Particulars
1	**Credit transferability for courses**
2	**For Courses under Part- III**
	2.1. Institutional training / Articleship Training / Mini Project / Apprenticeship Training :
	2.2. Open Elective :
3	**For Courses under Part- IV**
	3.1. Skill Enhancement
	3.2. Ability Enhancement
4	**For Courses under Part- V**
	4.1. Proficiency Enhancement

	4.2. Competency Enhancement

1. <u>Credit transferability for courses</u>:

In lieu with the direction of the University Grants Commission (UGC) for universities and colleges to use the Massive Open Online Courses (MOOC) available on the HRD Ministry's 'Swayam' platform for credit transfer, students who complete a course in their curriculum (the courses approved by Swayam board, are ready to be offered in the July semester 2020 AND ONWARDS) are permitted to transfer their credit and can be exempted from appearing the particular course in their curriculum. The score obtained will be accounted for CGPA calculation. The credits earned can be transferred under PART-III/PART-IV/PART-V of ANY SEMESTER with due recommendation of the Chairperson of the Board and approval from the CoE.

2. <u>For courses under PART III :</u>

Score obtained in these courses WILL BE ACCOUNTED FOR CGPA CALCULATION.

<u>2.1. Open Elective:</u>

Open elective courses are core courses offered DURING SEMESTER III under Part: III for students of other PG programmes, where a student can choose any course offered under this category from other than her parent department. Notification is handled on advice of the academic head and enrollment for the course is done on first come first serve basis depending upon the available strength. The course is taught and is administered by the norms pertaining to the department which offers the course. Adherence to the scheme, syllabus, distribution of marks and question paper pattern as found in the curriculum of the parent department is MANDATORY. Score obtained in this course will be accounted for CGPA calculation. Following is the list of courses available for the students of the PG programme.

List of open elective courses offered for the students admitted in PG programmes from the academic year 2021-22 and onwards

Course Code	Department	Course	Evaluation	Credit
21TAPOE02	Department of English	**தேர்வுநோக்கில்தமிழ்இலக்கியம்**	Both CIA and ESE	2
21ENPOE02	Department of Tamil	English for Career Development		
21MAPOE02	Department of Mathematics	Mathematical Aptitude forCompetitive Examinations		
21PHPOE02	Department of Physics	Environmental Physics		
21CAPOE02	Department of Computer Science	Green Computing		
21CGPOE02	Department of Commerce	Net Banking and Practice		
21BAPOE01	Department of Management	Agri- Entrepreneurship		

3. For courses under PART IV :

Score obtained in these courses WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

3.1 Skill Enhancement (ONLY MBA) :

3.2. Ability Enhancement (COMMON FOR ALL PG):

Course Code	Semester	Course	Evaluation	Credits
21AEU01	II	Cyber Security	NO CIA 100% ESE	2

On successful completion of these courses, students will be able to demonstrate skills necessary for tackling challenges in today's digitalized world. They are also taughtrelating to the main stream of study and hence, ensure job readiness after completion of the PG programme.

4.For courses under PART V :

Score obtained in these courses WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

4.1 Proficiency Enhancement:

Course Code	Semester	Course	Evaluation	Credits
21PEP01	III	Laser and its applications (Self –Study)	NO CIA 100% ESE	2

These courses are provided to enhance the academic proficiency of a student. No lecture hours are provided and therefore, these are SELF STUDY courses and the students are expected to prepare the courses on the prescribed syllabi by their own. Students have to appear for the ESE that would be conducted as per the curriculum specification of each department and scoring a passing minimum is mandatory for completion of the PG programme.

4.2. CompetencyEnhancement :

Competency enhancement activities are conducted by the college / department between semesters I and IV. Evaluation is done under Part: V for 4 credits and credits are awarded based on submission of proofs for completion of the components mentioned therein. Obtaining a grade is MANDATORY for completion of thePG programme.

<table>
<tr><th>Semester</th><th>Course</th><th>Course Completion</th><th>Credit</th></tr>
<tr><td rowspan="5">I - IV</td><td>Online course / Learning Object Repository*</td><td rowspan="2">Self-paced,Upon personal choice and as guided by faculty mentor

Can be completed during any semester from I – IV

NO CIA, NO ESE</td><td>2</td></tr>
<tr><td>Certificate Course*</td><td>2</td></tr>
<tr><td colspan="3">*Common to all PG programmes</td></tr>
<tr><td colspan="3">(Students of MBA alone can choose between the previous option and the next one)</td></tr>
<tr><td>Student Start-up Venture / Internship / Capstone Project & Viva-voce
(PROVIDED AS ADDITIONAL OPTION ONLY FOR MBA)</td><td>SEMESTER I - IV</td><td>4*

(ALTERNATIVE CREDITS)</td></tr>
</table>

Students are awarded with credits on submission of proofs for completion of the components mentioned therein during semester I – IV and these courses are not evaluated for marks.

4.2.1 Online Course/ Learning Object Repository:(COMMON TO ALL PG)

Semester	Course	Course Completion	Credit
I - IV	Online Course / Learning Object Repository	As guided by faculty mentor	2

Every student is expected to complete an online certificate course (obtaining a certificate is mandatory) or prepare a learning object repository (based on any of her courses in the curriculum) in consultation with her faculty mentor and shall refer to web sites on open yale courses, MIT open classroom, Khan Academy, NPTEL, Swayam, UGC SWAYAM MOOCS, Podcast, CANVAS network, Alison, big data university and similar ones as to their choice. Completing this category during any of the FOUR semesters (I / II / III / IV) will fetch her 2 credits.

4.2.2Certificate Course:

Semester	Course	Course Completion	Credit
I - IV	Certificate Course	As guided by faculty mentor	2

Every student is expected to complete a certificate course (obtaining a certificate is mandatory) in consultation with her faculty mentor. Completing this category during any of the FOUR semesters (I / II / III / IV) will fetch her 2 credits.

4.2.3 Student start-up ventures / Internship / Capstone project & Viva-voce (ONLY MBA)

PART – III – CORE COURSES: 50 MARKS

Course Code : …….. **Reg. No. :** | | | | | | | | | | |

P.K.R ARTS COLLEGE FOR WOMEN (Autonomous), GOBICHETTIPALAYAM
M.ScDEGREE ESE EXAMINATION, 2022– 2023
Branch –PHYSICS
Semester …..
(For the candidates admitted from 2021)
< Title of the Subject >

Time : 3 Hours **Maximum Marks : 50**

Answer ALL the Sections
SECTION – A (10 × 1 = 10 Marks)
(Bloom's Taxonomy K1 / K2 Level)

Answer the following

S. No.	Question	KNOWLEDGE LEVEL
1.	Unit I	**K1**
2.	Unit I	**K2**
3.	Unit II	**K1**
4.	Unit II	**K2**
5.	Unit III	**K1**
6.	Unit III	**K2**
7.	Unit IV	**K1**
8.	Unit IV	**K2**
9.	Unit V	**K1**
10.	Unit V	**K2**

SECTION – B (5 × 3 = 15 Marks)

(Bloom's Taxonomy K3 / K4 Level)
(Bloom's Taxonomy: K3 – 3 questions, K4 – 2 questions)
(Options (a) and (b) should be from same unit and same knowledge level)
Answer ALL Questions

S. No.	Question			KNOWLEDGE LEVEL
11.	(a)	Unit I	**(OR)**	
11.	(b)	Unit I		
12.	(a)	Unit II	**(OR)**	
12.	(b)	Unit II		
13.	(a)	Unit III	**(OR)**	
13.	(b)	Unit III		
14.	(a)	Unit IV	**(OR)**	
14.	(b)	Unit IV		
15.	(a)	Unit V	**(OR)**	
15.	(b)	Unit V		

SECTION – C (5 × 5 = 25 Marks)

(Bloom's Taxonomy K4 / K5 / K6 Level)
(Bloom's Taxonomy: K4 – 1 question, K5 – 3 questions, K6 – 1 question)(Options (a) and (b) are from the same unit and same knowledge level)
Answer ALL Questions

S. No.	Question			UNIT	KNOWLEDGE LEVEL
16	(a)		**(OR)**		
16.	(b)				
17.	(a)		**(OR)**		
17.	(b)				
18.	(a)		**(OR)**		
18.	(b)				
19.	(a)		**(OR)**		
19.	(b)				

20.	(a)		**(OR)**		
20.	(b)				

Q.NO 20 IS A COMPULSORY QUESTION.

****

K –LEVEL	Q.NO.	No. of Questions
K1	1,3,5,7,9	5
K2	2,4,6,8,10,	5
K3	3 QUESTIONS IN SECTION B	3
K4	2 QUESTIONS IN SECTION B 1 QUESTION IN SECTION C	3
K5	3 QUESTIONS IN SECTION C	3
K6	1 QUESTION IN SECTION C	1
	TOTAL	**20 QUESTIONS**

PG:

PART – IV – COURSES: 100 MARKS

Course Code : …….. **Reg. No:**

P.K.R ARTS COLLEGE FOR WOMEN (Autonomous), GOBICHETTIPALAYAM
M.ScDEGREE ESE EXAMINATION, 2022-2023
Branch - PHYSICS
Semester …..
(For the candidates admitted from 2021)
< Title of the Subject >

Time : 3 Hours **Maximum Marks : 100**

Answer ALL the Questions
SECTION – A (5× 20 = 100 Marks)
(Bloom's Taxonomy K1/K2 / K3 / K4 /K5/K6 Levels)

(Options (a) and (b) should be from same unit and same knowledge level)
Answer ALL Questions

S. No.	Question			KNOWLEDGE LEVEL
1.	(a)	Unit I	**(OR)**	
1.	(b)	Unit I		
2.	(a)	Unit II	**(OR)**	
2.	(b)	Unit II		
3.	(a)	Unit III	**(OR)**	
3.	(b)	Unit III		
4.	(a)	Unit IV	**(OR)**	
4.	(b)	Unit IV		
5.	(a)	Unit V	**(OR)**	
5.	(b)	Unit V		

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CO-SCHOLASTIC COURSES OFFERED FOR THE STUDENTS ADMITTED IN THE PG PROGRAMMES IN 2021-22 AND ONWARDS

CO - SCHOLASTIC COURSES FOR PG PROGRAMMES:

The co-scholastic courses are offered with an intention to provide learner centric, skill oriented technical training that help an individual to showcase their competency, learn commitment for the profession, add value and build expertise in their area of study and helps with job advancement / career building opportune for students of all PG programmes. Evaluation in this category is done by INTERNAL EXAMINERS / COMPETENT CERTIFYING PROFESSIONAL BODIES / PROFESSIONAL INSTITUTIONS as is required, at the end of the semester/ an academic year.Score obtained in this category WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

Value Added Course is taught 40 Hours in a year and assessment is made at the end of the academic year (even semester ESE ONLY). Students who score the passing minimum will be given certificates with grades, based on the marks scored during the final Examination.

Following are the co-scholastic courses offered for the students admitted in PG programmes during the academic year 2021-22 and onwards:

Categories available for students admitted in PG Programmes:

1. VALUE ADDED COURSES
2. EXTRA CREDIT COURSES

are the TWO categories of CO-SCHOLASTIC COURSES offered to nurture - choice based skill / ability / proficiency / competency enhancement of an individual in addition to the courses specified under the scheme of examinations for scholastic courses of the PG programmes.

Scheme of examination for Co-Scholastic Courses:

1. VALUE ADDED COURSES:

Pattern	Department	Course Code	Course Title	Contact Hours / week	Exam Duration Hours	Max. Marks @ annual Exam		
						Theory	Practical	Total
Course to be taught after regular hours **I YEAR**								
Value Added Course I								
Annual	Physics	21PHVAP1	MATERIAL SCIENCE	2	3	100	-	100
Value Added Course II **II YEAR**								
Annual	Physics	21PHPAP2	PROBLEM SOLVING ING FOR NET/SLET	2	3	100	-	100

2. EXTRA CREDIT COURSES (Self-study courses)

Distribution of Marks for ECC is based on the programme structure and the scheme of examinations of the course opted by the candidate.

There are five categories, namely,

2.1 Courses offered (Not Chosen electives by the candidate) by parent department for ALL STUDENTS OF THE PROGRAMME

2.2 List of courses offered for ADVANCED LEARNERS ONLY

2.3 Courses offered in a department under PART-III for STUDENTS OF OTHER PROGRAMMES – Inter-disciplinary courses

2.4 Credit transferability for Disciplinary / Inter-disciplinary / Trans-disciplinary / General courses offered in UGC SWAYAM MOOCS

2.5. Comprehension Courses

2.1 Courses offered (Not Chosen elective by the candidate) by parent department for ALL STUDENTS OF THE PROGRAMME: Refer to the scheme of examinations of the programme for the list of courses.

2.2 List of courses offered for ADVANCED LEARNERS ONLY:

Department	Course Code	Courses offered for ADVANCED LEARNERS ONLY
Department of Physics	21PHALP1	Advanced Quantum Mechanics
	21PHALP2	Statistical Mechanics
	21PHALP3	Advanced Instrumentation
	21PHALP4	Plasma physics

*QP pattern for advanced learner courses is the same as regular core paper pattern.

2.3 Courses offered in a department under PART-III for STUDENTS OF OTHER PROGRAMMES – Inter-disciplinary courses- Refer to the scheme of examinations of the PG programme for the list of courses.

2.4 Credit transferability for Disciplinary / Inter-disciplinary /Trans-disciplinary / General courses offered in UGC SWAYAM MOOCS: Refer to the UGC SWAYAM eligibility, guidelines for courses available in the official website.

2.5. Comprehension Courses :

Department of Physics	21PHP1	Comprehension in Physics - I
	21PHP2	Comprehension in Physics - II
	21PHP3	Comprehension in Physics - III
	21PHP4	Comprehension in Physics - IV

In the comprehension component, students are tested on their grasping ability of the courses of study. Comprehension in …….- I, II, III, IV are SELF-STUDY courses courses that have only MCQ from Part III Courses. ONLINE EXAMINATION (END-SEMESTER) consisting of 50 Multiple Choice Questions (on Core and Core Elective courses studied in the

respective semesters) will be conducted at the end of each semester I, II, III, AND IVrespectively, for a maximum of 100 marks.

Self Study : Online Exams will be conducted at the end of each semester with one credit each.

Distribution of Marks for Value Added Course:

Category	Theory	Practical	Total Marks	PASSING MINIMUM @ ANNUAL EXAM	Grade
BOTH Theory and Practical	50	50	100	**50**	Marks 90 - 100 - A++ Outstanding Marks 80 – 89 - A+ Excellent Marks 70 – 79 - A Very Good Marks 60 - 69 - B+ Good Marks 50 – 59 - B Average Marks 40 – 49 - C Satisfactory Marks 0 - 39 - U Re-appear
ONLY Theory	100	--	100	50	
ONLY Practical	--	100	100	50	

Question Paper pattern for Value added Courses:

SPLIT – UP	COMPONENTS		TOTAL MARKS
ONLY Theory 100 marks	**ANNUAL EXAM** **Section A** **5 X 20 = 100** 3 Hours One question from each unit *(*Either / or type*)* *Both options from the same unit / same level* *K1, K2,K3,K4,K5, K6 - ANY LEVEL*		100
Both Theory and	**PRACTICALS**	5	100
	Seminar		

Practical **100 marks**	A student will be evaluated during the semester on her participation in class, case studies presentation, group discussion, surprise / informed quizzes that may be conducted online / offline with simple multiple choice questions, etc. Average marks in these activities will fetch her maximum of 25 marks.	20	
	Completion of activities / experiments / exercises	15	
	Viva-Voce	10	
	<u>THEORY - ANNUAL EXAM</u> **Section A 5 X 10 = 50** 1.5 Hours *One question from each unit* *(*Either / or type*)* *Both options from the same level* *K1, K2,K3,K4,K5, K6 - ANY LEVEL*	50	
ONLY Practical **100 marks**	Record / Observation	10	100
	Completion of activities / experiments / exercises	20	
	2 experiments on the day of assessment	60	
	Viva-Voce	**10**	

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