Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.
Accredited with A^{++} by NAAC - V Cycle (CGPA 3.53)

Affiliated to
Manonmaniam Sundaranar University, Tirunelveli

Semester I - VI

UG Guidelines & Syllabus

DEPARTMENT OF PHYSICS

2023-2026
(With effect from the academic year 2025-2026)

Issued from
THE DEANS' OFFICE

Vision

Envisions training students for quality Physics education and holistic development empowered to meet challenges and embark on luxuriant careers.

Mission

- To produce competent graduates infused with professionalism, ethical values and social responsibility.
- To prepare students to accentuate learning for life.
- To foster a research environment, to keep up with global development in Science.
- To evolve strategies for the growth of the department towards excellence.

Graduate Attributes

Graduates of our College develop the following attributes during the course of their studies.

- **Creative thinking:**

Equipping students with hands-on-training through skill-based courses and promote startup.

- **Personality development:**

Coping with increasing pace and change of modern life through value education, awareness on human rights, gender issues and giving counselling for the needful.

- **Environmental consciousness and social understanding:**

Reflecting upon green initiatives and understanding the responsibility to contribute to the society; promoting social and cultural diversity through student training and service-learning programmes.

- **Communicative competence:**

Offering effective communication skills in both professional and social contexts through bridge courses and activities of clubs and committees.

- **Aesthetic skills:**

Engaging mind, body and emotions for transformation through fine arts, meditation and exercise; enriching skills through certificate courses offered by Holy Cross Academy.

- **Research and knowledge enrichment:**

Getting in-depth knowledge in the specific area of study through relevant core papers; ability to create new understanding through the process of critical analysis and problem solving.

- **Professional ethics:**

Valuing honesty, fairness, respect, compassion and professional ethics among students. The students of social work adhere to the *National Association of Social Workers Code of Ethics*

- **Student engagement in the learning process:**

Obtaining extensive and varied opportunities to utilize and build upon the theoretical and empirical knowledge gained through workshops, seminars, conferences, industrial visits and summer internship programmes.

- **Employability:**

Enhancing students in their professional life through Entrepreneur development, Placement & Career guidance Cell.

- **Women empowerment and leadership:**

Developing the capacity of self-management, team work, leadership and decision making through gender sensitization programmes.

Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.A/B.Sc. degree programme, the graduates will be able to	Mission addressed
PEO1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	**M1 & M2**

PEO2	inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.	**M2, M3, M4 & M5**
PEO3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	**M3, M4, M5 & M6**

Programme Outcomes (POs)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	**PEO1**
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	**PEO2**
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	**PEO2**
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	**PEO1 & PEO3**
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	**PEO2 & PEO3**
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	**PEO2 & PEO3**
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to improve knowledge and skills.	**PEO1 & PEO3**

Programme Specific Outcome (PSOs)

PSOs	Upon completion of B.Sc. Physics Degree Programme, the graduates of Physics will be able to:	Mapping with POs
PSO1	understand the core theories and principles of physics which include mechanics, thermodynamics, electronics, material science etc.	**PO1**
PSO2	develop extensive comprehension of fundamental and diverse applications of Physics.	**PO2 & PO3**
PSO3	apply knowledge of principles, concepts in Physics and analyze their local, national and global impact. Apply the critical reasoning and computing skills to analyze and solve problems in physics.	**PO4 & PO5**
PSO4	analyze the observed experimental data and relate the results with theoretical expectations. Communicate appropriately and effectively, in a scientific context using present technology.	**PO6**
PSO5	develop entrepreneurial skills, empowered according to the professional requirement and become self-dependent. Understand the professional, ethical, legal, security, social issues and responsibilities.	**PO5 & PO7**

Mapping of POs and PSOs

POs	PSO1	PSO 2	PSO3	PSO4	PSO5
PO1	S	S	S	S	S
PO2	M	S	S	S	S
PO3	M	M	M	S	S
PO4	M	M	S	S	S
PO5	M	M	S	S	S
PO6	M	M	S	S	S
PO7	S	S	S	S	S

Eligibility Norms for Admission

Eligibility: 10 + 2 pattern

Those who seek admission to B.Sc. Physics Course must have passed the Higher Secondary Examinations conducted by the Board of Higher Secondary Examinations, Tamil Nadu with Physics and Mathematics subjects or examination recognized and approved by the Syndicate of Manonmaniam Sundaranar University, Tirunelveli.

Duration of the Programme: 3 years

Medium of Instruction: English

Passing Minimum

A minimum of 40% in the external examination and an aggregate of 40% is required. There is no minimum pass mark for the continuous internal assessment.

Components of the B.Sc. Physics Programme

Part III (Core and Elective)

Core Course	Core-Theory Papers	8x100	800
	Core Research Project	1x100	100
	Core Lab Course	9 x 100	900
	Discipline Specific Elective-Theory Papers	4x 100	400
	Total Marks		**2200**
Elective Course	Theory	4x 100	400
	Lab Course	2x 100	200
	Total Marks		**600**
	Total Marks		**2800**

- Core and Elective Lab Courses carry 100 marks each.
- Practical examination will be conducted at the end of each semester for Core and Elective Courses.

Course Structure

Distribution of Hours and Credits

Curricular Courses:

Course	**S I**	**S II**	**S III**	**S IV**	**S V**	**S VI**	**Total**	
							H	**C**
Part-I Language	6 (3)	6 (3)	6 (3)	6 (3)			24	**12**
Part-II English	6 (3)	6 (3)	6 (3)	6 (3)			24	**12**
Part-III								
Core Course Core Lab Course Core Research Project	5 (5)+ 3 (3)	5 (5)+ 3 (3)	5 (5)+ 3 (3)	5 (5)+ 3 (3)	5 (4)+ 5 (4)+ 5(4) 5(4)	6(5) + 6(5) + 6(4)	70	**62**
Elective /Discipline Specific Elective Courses	4 (3)+ 2 (2)	4 (3)+ 2 (2)	4 (3)+ 2 (2)	4 (3)+ 2 (2)	4 (3)+ 4 (3)	5(3)+ 5 (3)	42	**32**
Part-IV								
Non-major Elective	2 (2)	2 (2)					4	**4**
Skill Enhancement Course		2 (2)	2(2) + 2 (2)	2 (2)			8	**8**
Foundation Course	2 (2)						2	**2**

Environmental Studies				2 (2)			2	**2**
Internship					(2)		-	**2**
Professional Competency Skill					2 (2)	2 (2)	4	**4**
Total	**30 (23)**	**30 (23)**	**30 (23)**	**30 (23)**	**30 (26)**	**30 (22)**	**180**	**140**

Co-curricular Courses

Course	**S I**	**S II**	**SIII**	**S IV**	**S V**	**S VI**	**Total**
LST (Life Skill Training)	-	(1)	-	(1)			2
SDT (Certificate Course)	(1)						1
Field Project		(1)					1
Specific Value-added Course	(1)		(1)				2
Generic Value-added Course				(1)		(1)	2
MOOC	(2)						2
Student Training (ST): Clubs & Committees / NSS				(1)			1
Community Engagement Activity – RUN				(1)			1
Human Rights,Justice and Ethics					(1)		1
Gender Equity and Inclusivity						(1)	1
Total							**14**

Total number of Compulsory Credits = Academic credits + Non-academic credits: 140 + 14

COURSES OFFERED

SEMESTER I

Course	**Course Code**	**Title of the Course**	**Credits**	**Hours /Week**
Part I	TU231TL1 FU231FL1	Language: Tamil French	3	6
Part II	EU241EL1	English: A Stream	3	6
	EU241EL2	English: B Stream		
	EU241EL3	English: C Stream		
Part III	PU231CC1	Core Course I: Properties of Matter and Acoustics	5	5
	PU231CP1	Core Lab Course I: General Physics Lab I	3	3
	PU231EC1	Elective Course I: Allied Physics for Mathematics–I	3	4
	PU231EP1	Elective Lab Course I: Allied Physics Practical for Mathematics–I	2	2
Part IV	PU231NM1	Non-Major Elective NME I: Physics for Everyday Life	2	2
	PU231FC1	Foundation Course FC: Introductory Physics	2	2
		Total	**23**	**30**

SEMESTER II

Course	**Course Code**	**Title of the Course**	**Credits**	**Hours/**

				Week
Part I	TU232TL1 FU232FL1	Language: Tamil French	3	6
Part II	EU242EL1	English: A Stream	3	6
	EU242EL2	English: B Stream		
	EU242EL3	English: C Stream		
Part III	PU232CC1	Core Course II: Heat, Thermodynamics and Statistical Physics	5	5
	PU232CP1	Core Lab Course II: General Physics Lab II	3	3
	PU232EC1	Elective Course II: Allied Physics for Mathematics – II	3	4
	PU232EP1	Elective Lab Course II: Allied Physics Practical for Mathematics–II	2	2
Part IV	PU232NM1	Non-Major Elective NME II: Physics of Music	2	2
	PU232SE1	Skill Enhancement Course SECI: Digital Photography	2	2
		Total	**23**	**30**

SEMESTER III

Course	Course Code	Title of the Course	Credits	Hours/ Week
Part I	TU233TL1 FU233FL1	Language: Tamil French	3	6
Part II	EU243EL1	English: A Stream	3	6
	EU243EL2	English: B Stream		
	EU243EL3	English: C Stream		
Part III	PU233CC1	Core Course III: General Mechanics and Classical Mechanics	5	5
	PU233CP1	Core Lab Course III:General Physics Lab III	3	3
	PU233EC1	Elective Course III: Allied Physics for Chemistry – I	3	4
	PU233EP1	Elective Lab Course III: Allied Physics Practical for Chemistry – I	2	2
Part IV	PU233SE1	Skill Enhancement Course SEC-II: (Indian Knowledge System) Astrophysics	2	2
	UG23CSE2	Skill Enhancement Course SEC-IV: Digital Fluency	2	2
		Total	**23**	**30**

SEMESTER IV

Course	Course Code	Title of the Course	Credits	Hours/ Week
Part I	TU234TL1 FU234FL1	Language: Tamil French	3	6
Part II	EU244EL1	English: A Stream	3	6
	EU244EL2	English: B Stream		
	EU244EL3	English: C Stream		

	PU234CC1	Core Course IV: Optics and Spectroscopy	5	5
	PU234CP1	Core Lab Course IV: General Physics Lab IV	3	3
	PU234EC1	Elective Course IV: Allied Physics for Chemistry–II	3	4
Part III	PU234EP1	Elective Lab Course IV: Allied Physics Practical for Chemistry–II	2	2
	UG23CSE1	Skill Enhancement Course SEC III: Fitness for Wellbeing	2	2
Part IV	UG234EV1	Environmental Studies(EVS)	2	2
		Total	23	30

SEMESTERV

Course	Course Code	Title of the Course	Credits	Hours/ Week
	PU235CC1	Core Course V: Atomic Physics and Lasers	4	5
	PU235CC2	Core Course VI: Relativity and Quantum Mechanics	4	5
	PU235CP1	Core Lab Course V: General Physics Lab V	2	3
	PU235CP2	Core Lab Course VI: General Physics Lab VI	2	2
	PU235RP1	Core Research Project	4	5
	PU235DE1	Discipline Specific Elective I: a) Energy Physics	3	4
	PU235DE2	Discipline Specific Elective I: b) Mathematical Physics		
Part III	PU235DE3	Discipline Specific Elective I:c) Electricity, Magnetism and Electromagnetism		
	PU235DE4	Discipline Specific Elective II: a) Material Science	3	4
	PU235DE5	Discipline Specific Elective II: b) Nano Science		
	PU235DE6	Discipline Specific Elective II: c) Medical Instrumentation		
	UG235PS1	Professional Competency Skill I: Career Skills	2	2
Part IV	PU235IS1	Internship	2	-
		Total	**26**	**30**

SEMESTER VI

Course	Course Code	Title of the Course	Credits	Hours/ Week
	PU236CC1	Core Course VII: Nuclear and Particle Physics	5	6
	PU236CC2	Core Course VIII: Solid State Physics	5	6
	PU236CP1	Core Lab Course VII: General Physics Lab VII	2	2
Part III	PU236CP2	Core Lab Course VIII: General Physics Lab VIII	1	2
	PU236CP3	Core Lab Course IX: General Physics Lab IX	1	2
	PU236DE1	Discipline Specific Elective III: a) Numerical Methods and C++ Programming	3	5
	PU236DE2	Discipline Specific Elective III: b)Digital Electronics and Microprocessor 8085		
	PU236DE3	Discipline Specific Elective III: c) Communication Systems		
	PU236DE4	Discipline Specific Elective IV: a) Electronics	3	5
Part IV	PU236DE5	Discipline Specific Elective IV: b) Geo Physics		

	PU236DE6	Discipline Specific Elective IV: c) Bio Physics		
	PU236PS1	Professional Competency Skill II: Basic Electrical Circuit Troubleshooting	2	2
		Total	**22**	**30**
		TOTAL	**140**	**180**

Co-Curricular Courses

Part	Semester	Code	Title of the Course	Credit
Part V	I & II	UG232LC1	Life Skill Training I: Catechism	1
		UG232LM1	Life Skill Training I: Moral	
	I	UG231C01 –	Skill Development Training (SDT) - Certificate Course	1
	II	PU232FP1	Field Project	1
	I & III	PU231V01 -	Specific Value-added Course	1+1
	VI	UG236OC1 & UG236OC2	MOOC	2
	III & IV	UG234LC1	Life Skill Training II: Catechism	1
		UG234LM1	Life Skill Training II: Moral	
	IV & VI	GVAC2401 -	Generic Value-added Course	1 +1
	I – IV	UG234ST1	Student Training Activity – Clubs & Committees / NSS	1
	IV	UG234CE1	Community Engagement Activity - RUN	1
	V	UG235HR1	Human Rights,Justice and Ethics	1
	VI	UG236GE1	Gender Equity and Inclusivity	1
Total				**14**

Specific Value-added Course

Semester	Course code	Title of the course	Credits	Total hours
I	PU231V01	Photoshop	**1**	**30**
I	PU231V02	Basics of Energy Sources	**1**	**30**
I	PU231V03	Physics of Home Appliances	**1**	**30**
III	PU233V01	Fundamentals of MS- Excel	**1**	**30**
III	PU233V02	Applications of Laser	**1**	**30**
III	PU233V03	Medical Imaging	**1**	**30**

Self-Learning Course

Semester	Title of the Course	Course Code
III / V	Public Service Examination: Physics – I	PU234SL1/PU235SL1
IV/ VI	Public Service Examination : Physics – II	PU234SL1/PU236SL1

Examination Pattern

Each paper carries an internal component. There is a passing minimum for external component. A minimum of 40% in the external examination and an aggregate of 40% is required.

i. Part I – Tamil, Part II – English, Part III - (Core Course/ Elective Course)

Ratio of Internal and External= 25:75

Continuous Internal Assessment (CIA)

Internal Components and Distribution of Marks

Components	**Marks**
Internal test (2) - 40 marks	10
Quiz (2) - 20 marks	5
Assignment: (Model Making, Exhibition, Role Play, Seminar, Group Discussion, Problem Solving, Class Test, Open Book Test etc. (Minimum three items per course should be included in the syllabus & teaching plan) (30 marks)	10
Total	**25**

Question Pattern

Internal Test	**Marks**	**External Exam**	**Marks**
Part A 4 x 1(No choice)	4	Part A 10 x 1 (No choice)	10
Part B 2 x 6 (Internal choice)	12	Part B 5 x 6 (Internal choice)	30
Part C 2 x 12 (Internal choice)	24	Part C 5x 12 (Internal choice)	60
Total	**40**	**Total**	**100**

ii. Lab Course:

Ratio of Internal and External= 25:75

Total: 100 marks

Internal Components and Distribution of Marks

Internal Components	**Marks**
Performance of the Experiments	10
Regularity in attending practical and submission of records	5
Record	5
Model exam	5
Total	**25**

Question pattern

External Exam	**Marks**
Major Practical	
Minor Practical / Spotters /Record	75
Total	**75**

iii. Core Research Project

Ratio of Internal and External = 25:75

Components	**Marks**
Internal	25
External	
Core Research Project Report	40
Viva voce	35
Total	**100**

Part - IV

i. Non-major Elective, Skill Enhancement Course I & II, Foundation Course, Professional Competency Skill

Ratio of Internal and External = 2**5: 75**

Internal Components and Distribution of Marks

Components	**Marks**
Internal test (2) – 25 marks	10

Quiz (2) – 20 marks	5
Assignment: (Model Making, Exhibition, Role Play, Album, Group Activity, etc. (Minimum three items per course)	10
Total	**25**

Question Pattern

Internal Test	**Marks**	**External Exam**	**Marks**
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10
Part B 3 x 4 (Open choice **Three** out of **Five**)	12	Part B 5 x 4 (Open choice any **Five** out of **Eight**)	20
Part C 1 x 9 (Open choice O**ne** out of **Three**)	9	Part C 5 x 9 (Open choice any **Five** out of **Eight**)	45
Total	**25**	**Total**	**75**

ii. Skill Enhancement Course III & IV

Digital Fluency

Components	**Marks**
Internal	
Quiz (15 x 1)	15
Lab Assessment (5 x 2)	10
Total	**25**
External	
Practical (2 x 25)	50
Procedure	25
Total	**75**

Fitness and Wellbeing

Components	**Marks**
Internal	
Quiz (15 x 1)	15
Exercise (2 x 5)	10
Total	**25**
External	
Written Test: Part A: Open choice – 5 out of 8 questions (5 x 5) Part B: Open choice – 5 out of 8 questions (5 x 10)	25 50
Total	**75**

iii. Environmental Studies

Internal Components	**Marks**
Project Report	15
Viva voce	10
Total	**25**

External Exam	**Marks**
Part A 5 x 2 (No Choice)	10
Part B 5 x 4 (Open choice any **Five** out of **Eight**)	20
Part C 5 x 9 (Open choice any **Five** out of **Eight**)	45
Total	**75**

iv. Internship

Components	Marks
Industry Contribution	50
Report & Viva-voce	50
Total	**100**

. v. Professional Competency Skill

Internal Components	Marks
Test – 20 marks	5
Individual Activity	10
Group Activity	10
Total	**25**
External Exam	**Marks**
Part A 5 x 2 (No Choice)	10
Part B 5 x 4 (Open choice any **Five** out of **Eight**)	20
Part C 5 x 9 (Open choice any **Five** out of **Eight**)	45
Total	**75**

Co-Curricular Courses:

i. Life Skill Training: Catechism & Moral
Human Rights,Justice and Ethics
Gender Equity and Inclusivity
Internal Components

Component	Marks
Project - Album on current issues	25
Group Activity	25
Total	**50**

External Components

Component	Marks
Written Test: Open choice – 5 out of 8 questions (5 x 10)	50
Total	**50**

ii. Skill Development Training - Certificate Course:

Components	Marks
Attendance & Participation	50
Skill Test	50
Total	**100**

iii. Field Project:

Components	Marks
Field Work	50
Field Project Report & Viva-voce	50
Total	**100**

iv. Specific Value-Added Courses & Generic Value-Added Courses:

Components	Marks
Internal	25
External	75
Total	**100**

v. Student Training Activity: Clubs and Committees

Compulsory for all I & II year students (1 credit).

Component	Marks
Attendance	25

Participation	75
Total	**100**

vi. Community Engagement Activity: Reaching the Unreached Neighbourhood (RUN)

Components	**Marks**
Attendance & Participation	50
Field Project	50
Total	**100**

vii. Self Learning Course

Ratio of Internal and External = 2**5: 75**

Internal Test	**Marks**	**External Exam**	**Marks**
Part A 7 x 1 (No Choice)	7	Part A 15 x 1(No Choice)	15
Part B 3 x 2 (No Choice)	6	Part B 10 x 2 (No Choice)	20
Part C 3 x 4 (No Choice)	12	Part C 10x 4 (No Choice)	40
Total	**25**	**Total**	**75**

Outcome Based Education (OBE)

(i) Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	**Level**	**Parameter**	**Description**
1	KI	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/ Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

(ii) Weightage of K – Levels in Question Paper

Number of questions for each cognitive level:

Programme	**Assessment**	**Lower Order Thinking**									**Higher order thinking**			**Total number of questions**
		K1			**K2**			**K3**			**K4, K5, K6**			
	Part	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	
I UG	Internal	2	1	-	1	1	1	1	-	1	-	-	-	**8**
	External	5	2	1	3	2	2	2	1	2	-	-	-	**20**
II UG	Internal	1	1	-	1	1	1	1	-	1	1	-	-	**8**
	External	5	1	1	4	1	1	-	3	1	1	-	2	**20**
III UG	Internal	1	-	-	1	-	1	1	1	1	1	1	-	**8**
	External	5	1	1	4	1	1	-	3	1	1	-	2	**20**

The levels of assessment are flexible and it should assess the cognitive levels and outcome attainment.

Evaluation

i. The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points.

ii. Evaluation of each course shall be done by Continuous Internal Assessment (CIA) by the course teacher as well as by an end semester examination and will be consolidated at the end of the semester.

iii. There shall be examinations at the end of each semester, for odd semesters in October/November; for even semesters in April/ May.

iv. A candidate who does not pass the examination in any course(s) shall be permitted to reappear in such failed course(s) in the subsequent examinations to be held in October/ November or April/May. However, candidates who have arrears in practical examination shall be permitted to reappear for their areas only along with regular practical examinations in the respective semester.

v. Viva-voce: Each project group shall be required to appear for Viva -voce examination in defence of the project.

vi. The results of all the examinations will be published in the college website.

Conferment of Bachelor's Degree

A candidate shall be eligible for the conferment of the Degree of Bachelor of Arts / Science / Commerce only if the minimum required credits for the programme there of (140 + 18 credits) is earned.

Grading System

For the Semester Examination:

Calculation of Grade Point Average for End Semester Examination:

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

For the entire programme:

Cumulative Grade Point Average (CGPA) $\Sigma_n\Sigma_i C_{ni}G_{ni} / \Sigma_{ni}\Sigma_i C_{ni}$

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

where

C_i - Credits earned for course i in any semester

G_i - Grade point obtained for course i in any semester

n - semester in which such courses were credited

Final Result

Conversion of Marks to Grade Points and Letter Grade

Range of Marks	Grade Points	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
40-49	4.0-4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

Overall Performance

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	
4.0 and above but below 5.0	C	Third Class
0.0 and above but below 4.0	U	Re-appear

*The candidates who have passed in the first appearance and within the prescribed semester are eligible for the same.

SEMESTER I

CORE COURSE I: PROPERTIES OF MATTER AND ACOUSTICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisites:

Basic knowledge on Power, Force, Newton's Laws of Motion

Learning Objectives:

1. To Study the properties of matter leads to information which is of practical value to the physicists.
2. To provide an information about the internal forces which act between the constituent parts of the substance.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	relate elastic behaviour in terms of three modulii of elasticity and working of torsion pendulum.	**K1 & K2**
2	appreciate concept of bending of beams and analyze the expression, quantify and understand nature of materials.	**K2 & K3**
3	explain the surface tension and viscosity of fluid and support the interesting phenomena associated with liquid surface, soap films provide an analogue solution to many engineering problems.	**K2 & K3**
4	analyze simple harmonic motions mathematically and apply them. understand the concept of resonance and use it to evaluate the frequency of vibration. Set up experiment to evaluate frequency of ac mains.	**K1 & K3**
5	understand the concept of acoustics, importance of constructing buildings with good acoustics. Also, to apply their knowledge of ultrasonics in real life, especially in medical field and assimilate different methods of production of ultrasonic waves.	**K2 & K3**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	**ELASTICITY:** Hooke's law – stress-strain diagram – elastic constants – Poisson's ratio – relation between elastic constants and Poisson's ratio – work done in stretching and twisting a wire – twisting couple on a cylinder – rigidity modulus by static torsion– torsional pendulum (with and without masses)	**15**
II	**BENDING OF BEAMS: C**antilever– expression for Bending moment – expression for depression at the loaded end of the cantilever– oscillations of a cantilever – expression for time period – experiment to find Young's modulus – non-uniform bending– experiment to determine Young's modulus by Koenig's method – uniform bending – expression for elevation – experiment to determine Young's modulus using microscope	**15**
III	**FLUID DYNAMICS:** Surface tension: definition – molecular forces– excess pressure over curved surface – application to spherical and cylindrical drops and bubbles – determination of surface tension by Jaegar's method–variation of surface tension with temperature Viscosity: definition – streamline and turbulent flow – rate of flow of liquid in a capillary tube – Poiseuille's formula –corrections – terminal velocity and Stoke's formula– variation of viscosity with temperature	**15**

IV	**WAVES AND OSCILLATIONS:** Simple Harmonic Motion (SHM) – differential equation of SHM – graphical representation of SHM – composition of two SHM in a straight line and at right angles – Lissajous's figures- free, damped, forced vibrations – resonance and Sharpness of resonance. Laws of transverse vibration in strings –sonometer – determination of AC frequency using sonometer –determination of frequency using Melde's string apparatus	**15**
V	**ACOUSTICS OF BUILDINGS AND ULTRASONICS:** Intensity of sound – decibel – loudness of sound –reverberation – Sabine's reverberation formula (derivation) – acoustic intensity – factors affecting the acoustics of buildings. Ultrasonic waves: production of ultrasonic waves – Piezoelectric crystal method – magnetostriction effect –application of ultrasonic waves	**15**
Total		**75**

Self- study	Elastic constants; Oscillations of a cantilever; Molecular forces; Lissajous's figures; Properties of ultrasonic waves

Textbooks

1. Mathur, D, S. 2010. Elements of Properties of Matter, S.Chand& Co.
2. BrijLal, Subrahmanyam, N. 2003. Properties of Matter, S. Chand & Co
3. Khanna, D.R. Bedi, R.S. 1969. Textbook of Sound, Atma Ram & Sons
4. BrijLal and Subrahmanyam, N. 1995. A Text Book of Sound, Second revised edition, Vikas Publishing House.
5. Murugesan, R. 2012. Properties of Matter, S. Chand & Co.

Reference Books

1. Smith, C.J. 1960. General Properties of Matter, Orient Longman Publishers
2. Gulati, H.R. 1977. Fundamental of General Properties of Matter (Fifth edition), R. Chand & Co.
3. French, A.P. 1973. Vibration and Waves, MIT Introductory Physics, Arnold Herrmann India.

Web Resources

1. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-theywork
2. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
3. http://www.sound-physics.com/
4. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-theywork
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3	2	2	3	2	2	1	1
CO2	2	3	3	3	2	2	3	3	3	2	1	1
CO3	3	2	3	2	3	3	2	3	2	2	1	1
CO4	3	3	3	3	3	2	3	3	2	3	2	1
CO5	2	2	3	3	2	3	3	3	2	2	3	2
TOTAL	**13**	**13**	**14**	**15**	**13**	**12**	**13**	**15**	**11**	**11**	**8**	**6**
AVERAGE	**2.6**	**2.6**	**2.8**	**3**	**2.6**	**2.4**	**2.6**	**3**	**2.2**	**2.2**	**1.8**	**1.6**

3 – Strong, 2- Medium, 1- Low

SEMESTER I

CORE LAB COURSE I: GENERAL PHYSICS LAB I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231CP1	-	-	3	-	3	3	45	25	75	100

Pre requisite:

Knowledge on basic Physics and Arithmetics

Learning Objectives:

1. To apply various physics concepts to understand Properties of Matter, set up experimentation to verify theories.
2. To do error analysis and correlate results

Course Outcomes

On the successful completion of the course, students will able to:		
1.	understand the strength of material using Young's modulus.	**K2**
2.	acquire knowledge of thermal behaviour of the materials.	**K1**
3.	analyze the physical principle involved in the various instruments	**K4**
4.	understand the scientific method and an ability to apply the scientific method in practice.	**K2**

K1 - Remember; **K2** - Understand; **K4** - Analyze;

Contents

(Any Eight Experiments)

1. Determination of Young's modulus by uniform bending – load depression graph.
2. Determination of Young's modulus by non-uniform bending – scale & telescope.
3. Determination of rigidity modulus without mass using Torsional pendulum.
4. Determination of rigidity modulus with masses using Torsional pendulum.
5. Determination of surface tension & interfacial surface tension by drop weight method.
6. Determination of co-efficient of viscosity by Stokes' method – terminal velocity.
7. Determination of coefficient of viscosity by Variable Pressure Head - Burette method.
8. Comparison of coefficient of viscosity of two liquids by Burette method.
9. Determination of moment of inertia of an irregular body.
10. Verification of parallel axes theorem on moment of inertia.
11. Verification of perpendicular axes theorem on moment of inertia.
12. Determination of Young's modulus by stretching of wire with known masses.
13. Verification of Hook's law by stretching of wire method.
14. Determination of Young's modulus by cantilever – load depression graph.
15. Determination of Young's modulus by cantilever – oscillation method
16. Determination of rigidity modulus by static torsion.
17. Determination of Y, n and K by Searle's double bar method.
18. Determination of surface tension of liquid by Capillary rise method.
19. Determination of critical pressure for streamline flow.
20. Determination of Poisson's ratio of rubber tube.
21. Determination of radius of capillary tube by mercury pellet method.

Reference Books

1. Manual prepared by the department
2. Ouseph, C, C., Rao, U, J. and Vijayendran, V. 2007. Practical Physics and Electronics. S. Viswanathan, Pvt., Ltd. Chennai.

SEMESTER I

ELECTIVE COURSE I: ALLIED PHYSICS FOR MATHEMATICS – I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231EC1	**4**	**-**	**-**	**-**	**3**	**4**	**60**	**25**	**75**	**100**

Pre-requisite:

Knowledge on basic Physics

Learning Objectives:

1. To impart basic principles of Physics
2. To incorporate concepts of Physics in day-to-day life

Course Outcomes

On the successful completion of the course, student will be able to:		
1	acquire knowledge on elementary ideas of waves, properties of matter, electricity and magnetism, electronics	**K1 & K2**
2	analyze the concepts of ultrasonics, surface tension and study their applications in the medical field.	**K3**
3	interpret the real-life solution using concepts of electricity, magnetism, and electronics in Digital India.	**K2**
4	apply their depth knowledge of Physics in day today life.	**K3**
5	develop their knowledge to carry out the practical by applying these concepts of Physics	**K3**

K1 - Remember; **K2** - Understand; **K3** - Apply

Unit	Contents	No. of Hours
I	**Waves, Oscillations and Ultrasonics** Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics: medical field – lithotripsy, ultrasonography – ultrasonoic maging- ultrasonics in dentistry – physiotheraphy, opthalmology – advantages of noninvasive surgery – ultrasonics in green chemistry.	**12**
II	**Properties of Matter** Elasticity: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum Viscosity: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method, Surface tension: definition – molecular theory – droplets formation– shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension.	**12**
III	**Heat and Thermodynamics** Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde's process of liquefaction of air–liquid Oxygen for medical purpose– importance of cryocoolers – thermodynamic system – thermodynamic equilibrium –	**12**

	laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.	
IV	**Electricity and Magnetism** Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart wifi switches- fuses and circuit breakers in houses	**12**
V	**Digital Electronics and Digital India** logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification – overview of Government initiatives: software technological parks under MeitY, NIELIT- semiconductor laboratories under Dept. of Space – an introduction to Digital India	**12**
TOTAL		**60**

Self-Study	Application of ultrasonics; Streamline and turbulent motion; Reversible and irreversible process; Types of switches; Logic gates-Universal building blocks

Textbooks

1. Ubald Raj, A. and Jose Robin, G. 2012. Allied Physics. Indira Publications. Marthandam.
2. Murugesan, R. 2001. Allied Physics. S. Chand & Co. New Delhi.

Reference Books

1. Brijlal and Subramaniam, N. 1994. Properties of Matter. S. Chand & Co. New Delhi.
2. Murugesan, R. 2017. Electricity and Magnetism. S. Chand & Co. New Delhi.
3. Ubald Raj, A. and Jose Robin, G. 2004. Basic Electronics. Indira Publications. Marthandam.

Web Resources

1. https://youtu.be/M_5KYncYNyc
2. https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
3. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
4. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO3	PSO4	PSO5
CO1	3	3	1	1	1	1	2	3	2	2	3	1
CO2	3	3	3	1	2	2	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	2	2	2	3	3	3	2	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3
TOTAL	**15**	**15**	**14**	**10**	**11**	**11**	**12**	**15**	**14**	**14**	**14**	**13**
AVERAGE	**3**	**3**	**2.8**	**2**	**2.2**	**2.2**	**2.4**	**3**	**2.8**	**2.8**	**2.8**	**2.6**

3 – Strong, 2- Medium, 1- Low

SEMESTER I

ELECTIVE LAB COURSE I: ALLIED PHYSICS PRACTICAL FOR MATHEMATICS – I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231EP1	-	-	2	-	2	2	30	25	75	100

Pre-requisite:

Knowledge in basic Physics

Learning Objectives:

1. To make the students more innovative, in hands on experiments.
2. To elucidate theory through simple experiments in physics.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the basic principles of Physics through experiments.	**K2**
2	measure and determine the various physical parameters.	**K3**
3	develop an idea about the handling of various instruments.	**K2**
4	get an idea about basic Scientific knowledge and implications of its broad working principle	**K2 & K3**
5	analyze, interpreting and evaluate data.	**K3 & K4**

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

Minimum of Eight Experiments from the list:

1. Young's modulus by non-uniform bending using pin and microscope
2. Young's modulus by non-uniform bending using optic lever, scale and telescope
3. Rigidity modulus by torsional oscillations without mass
4. Determination of AC frequency using sonometer
5. Surface tension and interfacial Surface tension – drop weight method
6. Comparison of viscosities of two liquids – burette method
7. Determination of co-efficient of viscosity-Variable pressure head
8. Calibration of low range voltmeter using potentiometer
9. Determination of thermo emf using potentiometer
10. Verification of truth tables of basic logic gates using ICs
11. Verification of De Morgan's theorems using logic gate ICs.
12. Use of NAND as universal building block.
13. Rigidity modulus by static torsion method.
14. Verification of laws of transverse vibrations using sonometer

Note: Use of digital balance is permitted

Reference Books

1. Manual prepared by the department
2. Ubald Raj, A. and Jose Robin, G. 2012. Allied Physics. Indira Publications. Marthandam.

SEMESTER I

NON-MAJOR ELECTIVE NME I: PHYSICS FOR EVERYDAY LIFE

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231NM1	2	-	-	-	2	2	30	25	75	100

Pre-requisite:

Students should know about basic knowledge regarding mechanical objects, laser, optical devices and solar energy.

Learning Objectives:

1. To introduce fundamental physics concepts and their applications in everyday life.
2. To comprehend where all physics principles have been applied in everyday life and to appreciate the concepts with a greater understanding, as well as to learn about Indian scientists who have made significant contributions to Physics.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	understand the knowledge of basic scientific principles and fundamental concepts in motion of bodies.	**K2**
2.	understand the basic laws of physics in domestic appliances	**K2**
3.	recall the physics notions applied in various optical instruments	**K1**
4.	comprehend the utilization of solar energy in everyday life activities	**K2**
5.	know about the various physicists contribution towards science and technology	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	**MECHANICAL OBJECTS** Spring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.	**6**
II	**OPTICAL INSTRUMENTS AND LASER** Vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser.	**6**
III	**PHYSICS OF HOME APPLIANCES** Bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners	**6**
IV	**SOLAR ENERGY** Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.	**6**
V	**INDIAN PHYSICIST AND THEIR CONTRIBUTIONS** C.V.Raman, Homi Jehangir Bhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.	**6**
TOTAL		**30**

Self -Study	Brief description about bulb, fan, Applications of solar energy

Textbooks

1. The Physics in our Daily Lives, Umme Ammara, Gugucool Publishing, Hyderabad, 2019.
2. For the love of physics, Walter Lawin, Free Press, New York, 2011.

Reference Books

1. Gerardin Jayam. (2019). Physics in Everyday Life. Published by the Department of Physics, Holy Cross College (Autonomous), Nagercoil.

Web Resources

1. https://www.scientificworldinfo.com/2021/09/importance-of-physics-in-our-daily-life.html
2. https://www.britannica.com/technology/laser

MAPPING WITH PROGRAMME OUTCOMESAND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1	2	2	3	2	2	2	2
CO2	3	3	2	1	1	2	2	3	3	3	2	2
CO3	3	2	2	1	2	2	2	3	3	3	3	3
CO4	3	3	3	1	1	3	3	3	3	2	2	2
CO5	2	1	1	3	2	2	2	2	2	2	2	2
TOTAL	**14**	**12**	**10**	**7**	**7**	**11**	**11**	**14**	**13**	**12**	**11**	**11**
AVERAGE	**2.8**	**2.4**	**2**	**1.4**	**1.4**	**2.2**	**2.2**	**2.8**	**2.6**	**2.4**	**2.2**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER I

FOUNDATION COURSE: INTRODUCTORY PHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231FC1	2	-	-	-	2	2	30	25	75	100

Pre-requisite:

Students should know the fundamentals of Physics.

Learning Objectives:

1. To help students get an overview of Physics before learning their core courses.
2. To serve as a bridge between the school curriculum and the degree programme.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	apply concept of vectors to understand concepts of Physics and solve problems	**K2 & K3**
2.	interpret different forces present in Nature while learning about phenomena related to these different forces.	**K1 & K2**
3.	describe energy in different process and relate momentum, velocity and energy	**K1 & K2**
4.	differentiate different types of motions they would encounter in various courses and understand their basis	**K1 & K2**
5.	relate various properties of matter with their behavior and connect them with different physical parameters involved.	**K2 & K3**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	**Vector:** Vectors, scalars, Examples for scalars and vectors from physical quantities, addition, subtraction of vectors, resolution and resultant of vectors, units and dimensions, standard physics constants	**6**
II	**Force:** Different types of forces, gravitational, electrostatic, magnetic, electromagnetic, nuclear, mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces	**6**
III	**Energy:** Different forms of energy, Conservation laws of momentum, energy, types of collisions, angular momentum, alternate energy sources, real life examples	**6**
IV	**Motion:** Types of motion, linear, projectile, circular, angular, simple harmonic motions, satellite motion, banking of a curved road, stream line and turbulent motions, wave motion, comparison of light and sound waves, Free, forced and damped oscillations	**6**
V	**Surface tension and Viscosity:** Surface tension, shape of liquid drop – angle of contact – viscosity – lubricants, capillary flow, diffusion, real life examples, properties and types of materials in daily use, conductors, insulators, thermal and electric	**6**
TOTAL		**30**

Self-study	Units and dimensions; Friction; Comparison of light and sound waves; Stream line and turbulent motions; Conductors

Textbooks

1. Mathur D.S. 2010, Elements of Properties of Matter, S.Chand & Co
2. BrijLal& N. Subrahmanyam. 2003, Properties of Matter, S.Chand & Co.

Reference Books

1.Gulati H.R, 1977, Fundamental of General Properties of Matter (Fifth edition), S.Chand& Co.

Web Resources

1. https://www.physicsclassroom.com/class/newtlaws/Lesson-2/Types-of-Forces
2. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://science.nasa.gov/ems/
3. https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/
4. https://testbook.com/physics/types-of-motion
5. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook _Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Physical_Propert ies_of_Matter/States_of_Matter/Properties_of_Liquids/Surface_Tension

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO4**
CO1	3	3	3	3	2	3	3	2.5	2.5	3	3	3
CO2	3	3	3	3	3	2	2	2.5	2.5	2	3	3
CO3	3	3	3	3	3	2	2	2.5	2.5	2	3	3
CO4	3	3	3	3	2	2	2	2.5	2.5	2	3	3
CO5	3	3	3	3	3	2	2	2.5	2.5	2	3	3
TOTAL	**15**	**15**	**15**	**15**	**13**	**11**	**11**	**12.5**	**12.5**	**11**	**15**	**15**
AVERAGE	**3**	**3**	**3**	**3**	**2.6**	**2.2**	**2.2**	**2.5**	**2.5**	**2.2**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER I

SPECIFIC VALUE-ADDED COURSE: PHOTOSHOP

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231V01	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic knowledge on photoshop.

Learning Objectives:

1. Students will be able to create images for web design, logos, graphics, layouts, image touch-ups, and colour enhancement.
2. Students will be able to learn the principles of how different types of media can be processed and presented by computers.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	use photoshop confidently and effectively.	**K3**
2	gain the skills and abilities to use photoshop that make them employable	**K6**
3	create and edit images	**K6**
4	use a range of tools and filters in *photoshop*	**K3**

K3–Apply; **K6-Create**

Units	Contents	No. of Hours
I	**PHOTOSHOP** Introduction - Features of Photoshop - Key Board practice – Creation of new file - saving document - Inserting of Images	**6**
II	**GRAPHICS** Creating Graphics: Combining Photos, Text, & Graphics - Replacing Backgrounds - Colour Correction Using Colour Balance - Colour Correction Using Curves - Preparing Digital Photos for Print - Exporting Files	**6**
III	**SMART FILTERS** Sharpening Photos - Layer Masking - Masking Smart Filters - Converting to Black & White - Adjustment Layers & Mask – Retouching	**6**
IV	**MASKS** Changing Colour with a Blending Mode - Clipping Masks: Filling Shapes with Images - Using Adjustment Layers as Clipping Masks - Camera Raw Fundamentals	**6**
V	**PHOTOSHOP FOR DESIGN** Camera Raw Fundamentals - Photoshop for Design: Adding a Title & Layer Styles - Photoshop for Design: Creating Digital Art in Photoshop - Photoshop for Design: Compositing into a Photo	**6**
TOTAL		**30**

Reference Books

1. Rafael Concepcion, Adobe Photoshop and Lightroom Classic Classroom in a Book 3rd Edition, Kindle Edition, Adobe Press, 2022
2. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2021.
3. Li & Drew, "Fundamentals of Multimedia", Pearson Education, 2019.
4. Robin Nichols, "Mastering Adobe Photoshop Elements 2023", Fifth Edition, Packet Publisher, Dec 2022.

MAPPING WITH PROGRAMME OUTCOMES
AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	3	3	3	3	3	1	2
CO2	3	3	3	2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	1	3	3	3	2	3	3	1
CO4	3	3	3	2	2	3	3	3	3	3	2	2
CO5	3	2	3	3	2	3	3	3	2	3	3	3
TOTAL	**15**	**13**	**15**	**11**	**10**	**15**	**15**	**15**	**13**	**15**	**13**	**11**
AVERAGE	**3**	**2.6**	**3**	**2.2**	**2**	**3**	**3**	**3**	**2.6**	**3**	**2.6**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER I

SPECIFIC VALUE-ADDED COURSE: BASICS OF ENERGY SOURCES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231V02	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic knowledge of non-conventional energy sources.

Learning Objectives:

1. To get the understanding of the conventional and non-conventional energy sources
2. To apply knowledge of conservation and storage systems to design and implement energy-based appliances.

Course Outcomes

Upon completion of this course, students will be able to:		
1	identify various forms of renewable and non-renewable energy sources.	**K1**
2.	understand the fundamentals of wind energy conversion.	**K2**
3.	apply the principle of a wind mill in producing energy.	**K3**
4.	correlate solar-based appliances for enhanced functionality.	**K4**
5.	defend the energy storage capacities of batteries.	**K5**

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

Units	Contents	No. of Hours
I	**BASICS OF ENERGY SOURCES** Conventional and non-conventional energy sources and their availability–Energy from other sources–chemical energy– Energy storage and distribution.	**6**
II	**WIND ENERGY SOURCES** Fundamentals of wind energy conversion–power in the wind– Advantages and disadvantages of wind energy conversion systems (WECS) - Energy storage	**6**
III	**SOLAR ENERGY SOURCES** Solar radiation and its measurements–solar cells- Solar cells for direct conversion of solar energy to electric powers–solar cell parameter–solar cell electrical characteristics	**6**
IV	**SOLAR APPLIANCES** Efficiency–solar radiation geometry - solar water Heater –solar distillation– solar cooking–solar greenhouse - types of greenhouses – Solar pond and its applications	**6**
V	**ENERGY STORAGE** Importance of energy storage- batteries - fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.	**6**
	Total	**30**

Self-study	Batteries, Fuel Cells

Textbooks

1. Rai G D, 1996. *Non – conventional sources* , (4th Edition), Khanna publishers, New Delhi.
2. Agarwal M P,1983*Solar Energy*, S. Chand and Co., New Delhi.
3. Sukhatme S P, 1997. *Solar energy, principles of thermal collection and storage* , (2nd Edition), Tata McGraw-Hill Publishing Co. Lt., New Delhi .
4. Hordeski G M, 1985. *Design of solar appliances.*, Englewood Cliffs, New Jersey: Reston.
5. Horne D F, 1988. *Measuring Systems for energy Applications*, Philadelphia, IOP Publishing ,Pennsylvania.

Reference Books

1. Mehta V K, Rohit Mehta, 2016. *Principles of Electronics*, S.Chand and Company, New Delhi.
2. Vijayendran V, Viswanathan S, 2011. *Introduction to Solar energy*. (1st Edition) (printers and Publishers) Pvt. Ltd.,Chennai.
3. Thomas L. Floyd, 1999. *Energy Fundamentals*.(3rd ed.).,UBS- Publishers Distributers LTD, New Delhi.
4. Millman J. Halkias, C C, 1991. *Integrated Energy sources*. Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Ryder, J D, 2004. *Energy storage: Fundamentals and Applications*. Prentice Hall International, INC., Englewood Cliffs.,United States.

Web Resources

1. https://www.open.edu/openlearn/ocw/mod/oucontent/view.php?id=2411&printable=1
2. https://www.nationalgeographic.org/encyclopedia/tidal-energy/
3. https://www.ge.com/renewableenergy/wind-energy/what-is-wind-energy
4. https://www.reenergyholdings.com/renewable-energy/what-is-biomass/
5. https://www.acciona.com/renewable-energy/solar-energy/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	3	3	3	3	3	1	2
CO2	3	3	3	2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	1	3	3	3	2	3	3	1
CO4	3	3	3	2	2	3	3	3	3	3	2	2
CO5	3	2	3	3	2	3	3	3	2	3	3	3
TOTAL	**15**	**13**	**15**	**11**	**10**	**15**	**15**	**15**	**13**	**15**	**13**	**11**
AVERAGE	**3**	**2.6**	**3**	**2.2**	**2**	**3**	**3**	**3**	**2.6**	**3**	**2.6**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER I

SPECIFIC VALUE-ADDED COURSE: PHYSICS OF HOME APPLIANCES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU231V03	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic knowledge of home appliances.

Learning Objectives:

1.To get the understanding of the physics of home appliances.

2.To apply physics principles in daily life and appreciate the concepts with a better understanding.

Course Outcomes

Upon completion of this course, students will be able to:		
1	illustrate the basic laws of physics in domestic appliances	**K1**
2	interpret the basic functionality of water purifier.	**K2**
2	articulate the fundamental physics concepts and their applications in everyday life.	**K3**
3	relate physics principles used in everyday life home appliances.	**K4**
4	appraise safety and security procedures.	**K5**

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

Units	Contents	No. of Hours
I	**INTRODUCTION TO ELECTRICITY** Electric Charge- Voltage- Electric Current- Ohm's Law- Electric Potential- Cell- Serial and Parallel Circuit- their effect on Voltage and Current Transformer	**6**
II	**MAINTENANCE OF WASHING MACHINE** Testing and identification of the faulty block - rectifying common faults by replacing the damage components - Testing of the damage block after repair	**6**
III	**BASIC FUNCTIONALITY OF WATER PURIFIER** Working principle - functionality of different types of water Purifiers- part identification and their working- steps to install the water purifier- Water Filter Maintenance	**6**
IV	**BASICS OF DOMESTIC APPLIANCES** Electric Bulbs– types of fans and their working – hair drier – television – air conditioners – microwave ovens – vacuum cleaners and their working	**6**
V	**SAFETY AND SECURITY PROCEDURES** Reporting incidents- system failures- power failures -protection Equipment-Fuse- First aid requirement in case of electrical shocks and other injuries	**6**
	Total	**30**

Self-study	Electric bulbs, Fans

Textbooks

1. Murugesan R, 2017. *Electricity and Magnetism,* S. Chand& Co., New Delhi.

2. Murugesan R, 1998. *Modern Physics,* S. Chand& Co. ,New Delhi.
3. Theraja B L , 2003. *Basic Electronics,* S. Chand& Co., New Delhi.
3. Subirkumar Sarkar, 2008. *Home appliances systems*. S. Chand & Company Ltd., New Delhi.
4. Palanisamy P K, 2002. *Semiconductor physics*, SCITECH Publication, Chennai.

Reference Books

1. Murugesan R, Kiruthiga Sivaprasath, 2016. *Modern Physics,* S. Chand & Company Ltd., New Delhi.
2. Ubald Raj A, Jose Robin G, 2006. *Mechanics,* Indira Publications, Marthandam.
3. Murugeshan R ,2016.*Circuits and its working,* S. Chand & Company Ltd., New Delhi.
4. Wilson , Hawker, 2004. *Electronics*, Prentice Hall of India, New Delhi.
5. Battacharya P, 2002. *Semiconductor devices*. PHI, New Delhi.

Web Resources

1. https://www.open.edu/openlearn/ocw/mod/oucontent/view.php?id=2411&printable=1
2. https://www.nationalgeographic.org/encyclopedia/hair drier /
3. https://www.ge.com/renewableenergy/wind-energy/what-is-vacuum cleaner/
4. https://www.reenergyholdings.com/renewable-energy/what-is-airconditioner/
5. https://www.acciona.com/renewable-energy/microwave oven/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	3	3	3	3	3	1	2
CO2	3	3	3	2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	1	3	3	3	2	3	3	1
CO4	3	3	3	2	2	3	3	3	3	3	2	2
CO5	3	2	3	3	2	3	3	3	2	3	3	3
TOTAL	**15**	**13**	**15**	**11**	**10**	**15**	**15**	**15**	**13**	**15**	**13**	**11**
AVERAGE	**3**	**2.6**	**3**	**2.2**	**2**	**3**	**3**	**3**	**2.6**	**3**	**2.6**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

CORE COURSE II: HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite:

Knowledge on Temperature in different Scales and Laws of thermodynamics

Learning Objectives:

1. To understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales.
2. To Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	acquires knowledge on how to distinguish between temperature and heat, and explain practical measurements of high temperature as well as low temperature physics.	**K1 & K2**
2.	derive the efficiency of Carnot's engine and discuss the implications of the laws of Thermodynamics in diesel and petrol engines	**K1 & K3**
3.	analyze performance of thermodynamic systems viz efficiency by problems and gets an insight into thermodynamic properties like enthalpy, entropy	**K2 & K3**
4.	study the process of thermal conductivity and apply it to good and bad conductors.	**K2 & K3**
5.	interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law, Bose-Einstein and Fermi-Dirac .	**K2 & K3**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	**CALORIMETRY:** Specific heat capacity – specific heat capacity of gases C_P& C_V– Meyer's relation – Joly's method for determination of C_V – Regnault's method for determination of C_P **LOW TEMPERATURE PHYSICS:** Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation.	**15**
II	**THERMODYNAMICS-I:** Zeroth law and first law of thermodynamics – P-V diagram – heat engine –efficiency of heat engine – Carnot's engine, construction, working and efficiency of petrol engine and diesel engines – comparison of engines.	**15**
III	**THERMODYNAMICS-II:** Second law of thermodynamics–entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram –thermodynamical scale of temperature – Maxwell's thermodynamical relations – Clasius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death.	**15**
IV	**HEAT TRANSFER:** Modes of heat transfer: conduction, convection and radiation. Conduction: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination of thermal conductivity of a bad conductor by Lee's disc method. Radiation: black body radiation (Ferry's method) – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law –Planck's law of	**15**

	radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law.	
V	**STATISTICAL MECHANICS:** Definition of phase-space – micro and macro states – ensembles –different types of ensembles – classical and quantum Statistics – Maxwell Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics –expression for distribution function – comparison of three statistics.	**15**
TOTAL		**75**

Self-study	Temperature of inversion ; Comparison of engines; Entropy of an ideal gas; Stefan's law; Comparison of three statistics.

Textbooks

1. Brijlal , Subramaniam, N. Henne, P. S. 2008. Heat Thermodynamics and Statistical Physics, Revised Edition, S.Chand & Co., New Delhi.
2. Murugeshan, R. Kiruthiga Sivaprasath. 2013, Thermal Physics, 2nd edn., Sulthan Chand & Sons, New Delhi.
3. Jauaraman, D. Ilangovan. K. 2009, Thermal Physics and Statistical Mechanics, 1st edn., S. Viswanathan Publishers and Printers, Chennai.

Reference Books

1. Ubald Raj A. and Jose Robin G. 2001, Thermal Physics and Statistical Mechanics. 1st edn. Indira publication. Marthandam, Tamil Nadu.
2. Mathur, D.S. 2014. Heat and Thermodynamics, 5th Edition, Sultan Chand & Sons, New Delhi.
3. Gupta, Kumar, Sharma, 2013. Statistical Mechanics (Twenty-Sixth Edition), S. Chand & Co. Ltd., New Delhi.
4. Sears, Zemansky, Hugh D. Young,Roger, Freedman,A. 2021. University Physics with Modern Physics (Fifteenth Edition), Pearson, New Jersey.
5. Ubald Raj A. and Jose Robin G. 2005, Mechanics and Thermal Physics. 1st edn. Indira publication. Marthandam, Tamil Nadu.

Web Resources

1. https://www.youtube.com/watch?v=M_5KYncYNyc
2. https://www.youtube.com/watch?v=pQWwP7YYH6o
3. https://www.youtube.com/watch?v=LUoUb4hGMH8
4. https://ocw.mit.edu/courses/5-60-thermodynamics-kinetics-spring-2008/resources/lecture-2-work-heat-first-law/
5. https://ocw.mit.edu/courses/5-60-thermodynamics-kinetics-spring-2008/resources/lecture-13-gibbs-free-energy/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	2	2	1	1
CO2	2	3	3	3	2	3	3	3	2	2	1	1
CO3	3	3	3	2	3	3	3	3	2	2	2	1
CO4	3	3	3	3	3	3	3	3	2	2	1	2
CO5	3	3	2	3	3	3	2	3	2	2	1	1
TOTAL	**14**	**15**	**14**	**14**	**14**	**15**	**14**	**15**	**10**	**10**	**6**	**6**
AVERAGE	**2.8**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**3**	**2**	**2**	**1.6**	**1.6**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

CORE LAB COURSE II: GENERAL PHYSICS LAB II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232CP1	-	-	3	-	3	3	45	25	75	100

Prerequisites: Types of Modulus, Knowledge on thermal conductivity and specific heat capacity

Learning Objectives:

1. To apply their knowledge gained about the concept of heat and sound waves, resonance.
2. To do error analysis and correlate results

Course Outcomes

On the successful completion of the course, students will able to:		
1.	understand the strength of materials using physical experiments.	**K2**
2.	acquire knowledge of thermal behaviour of the materials.	**K1**
3.	analyze the physical principle involved in the various instruments such as sonometer and Melde's String.	**K4**
4.	understand the scientific method and an ability to apply the scientific method in practice.	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

Contents

(Any Eight Experiments)

1. Verification of Newton's law of cooling
2. Determination of specific heat by cooling – graphical method.
3. Determination of thermal conductivity of bad conductor by Lee's disc method.
4. Frequency of AC by using Sonometer.
5. To verify the laws of transverse vibration using sonometer.
6. Velocity of sound through a wire using Sonometer.
7. To verify the laws of transverse vibration using Melde's apparatus.
8. Determination of g using compound pendulum.
9. Determination of thermal conductivity of good conductor by Searle's method.
10. Determination of thermal conductivity of bad conductor by Charlaton's method.
11. Determination of specific heat capacity of solid.
12. Determination of specific heat of liquid by Joule's electrical heating method (applying radiation correction by Barton's correction/graphical method),
13. Determination of Latent heat of a vaporization of a liquid.
14. Verification of Stefan's-Boltzmans law.
15. Determination of thermal conductivity of rubber tube.
16. Helmholtz resonator.
17. Determination of velocity of sound using Kunds tube.
18. Determination of frequency of an electrically maintained tuning fork
19. To compare the mass per unit length of two strings using Melde's apparatus.
20. Determination of moment of inertia and g using Bifilar pendulum.

Reference Books

1. Manual prepared by the department
2. Ouseph, C, C., Rao, U, J. and Vijayendran, V. 2007. Practical Physics and Electronics. S. Viswanathan, Pvt., Ltd. Chennai.

MAPPING WITH PROGRAMME OUTCOMES
AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	3	3	3	3	3	3	2
CO2	2	3	2	3	2	3	3	3	2	2	3	2
CO3	3	3	2	2	3	3	3	3	2	2	2	2
CO4	3	3	2	3	3	3	3	3	2	2	2	2
TOTAL	**11**	**12**	**8**	**11**	**11**	**12**	**12**	**12**	**9**	**9**	**10**	**8**
AVERAGE	**2.75**	**3**	**2**	**2.75**	**2.75**	**3**	**3**	**3**	**2.25**	**2.25**	**2.5**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

ELECTIVE COURSE II: ALLIED PHYSICS FOR MATHEMATICS – II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232EC1	4	-	-	-	3	4	60	25	75	100

Prerequisites: Knowledge on basic Physics

Learning Objectives:

1. To impart basic principles of Physics
2. To incorporate concepts of Physics in day to day life

Course Outcomes

On the successful completion of the course, student will be able to:		
1	explain the concepts of interference, diffraction and rephrase the concept of polarization	**K1 & K2**
2	outline the basic foundation of different atom models and relate the importance of theoretical models	**K1 & K2**
3	understand the properties of nuclei, nuclear forces, structure of atomic nucleus and nuclear models and interpret nuclear processes like fission and fusion.	**K2& K3**
4	describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation.	**K3 & K4**
5	summarize the working of semiconductor devices like diodes, transistors, USB chargers and EV charging stations.	**K4& K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit	Contents	No. of Hours
I	**OPTICS** Interference – interference in thin films –colours of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries	**12**
II	**ATOMIC PHYSICS** Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect –Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation – applications of photoelectric effect: solar cells, solar panels, optoelectric devices	**12**
III	**NUCLEAR PHYSICS** Nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses –controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods –introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.	**12**

IV	**INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES** Frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence – introduction on gravitational waves, LIGO, ICTS opportunities at International Centre for Theoretical Sciences	**12**
V	**SEMICONDUCTOR PHYSICS** p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations	**12**
TOTAL		**60**

Self-study	Application in sugar industries; Zeeman effect; nuclear fusion; ICTS opportunities at International Centre for Theoretical Sciences; USB cell phone charger

Textbooks

1. Murugesan R. (2001), Allied Physics,S. Chand &Co, New Delhi.
2. Ubald Raj, A. and Jose Robin, G. 2012. Allied Physics. Indira Publications. Marthandam.

Reference Books

1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11th Edn., John Willey and Sons, Asia Pvt .Ltd., Singapore.
2. Thangaraj K.and Jayaraman D. (2004), Allied Physics, Popular Book Depot, Chennai.
3. Beiser A. (2003), Concepts of Modern Physics, Tata McGraw Hill Publication, New Delhi.
4. Murugesan R. (2005), Modern Physics, S.Chand&Co, New Delhi.
5. Subramaniyam A. (2001), Applied Electronics, 2nd Edn., National Publishing Co., Chennai.

Web Resources

1. https://www.berkshire.com/learning-center/delta-p-facemask/
2. https:/ /www.youtube.com/watch?v=QrhxU47gtj4
3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/
4. https://www.atoptics.co.uk/atoptics/blsky.htm -
5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects
6. https://www.berkshire.com/learning-center/delta-pfacemask/https://www.youtube.com/watch?v=QrhxU47gtj4
7. https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_log

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	2	2	2	2	2
CO2	2	3	3	2	3	2	3	2	3	2
CO3	2	2	2	2	2	3	3	3	2	2
CO4	3	3	2	2	3	2	2	2	2	2
CO5	2	3	2	3	2	2	3	2	2	2
TOTAL	**12**	**14**	**11**	**11**	**13**	**11**	**13**	**11**	**11**	**10**
AVERAGE	**2.4**	**2.8**	**2.2**	**2.2**	**2.6**	**2.2**	**2.6**	**2.2**	**2.2**	**2.0**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

ELECTIVE LAB COURSE II: ALLIED PHYSICS PRACTICAL FOR MATHEMATICS II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232EP1	-	-	2	-	2	2	30	25	75	100

Prerequisites:

Basic Knowledge in physics experiments

Learning Objectives:

1. To apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyze,
2. To able to do error analysis and correlate results

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the nature of monochromatic light and its diffraction and interference phenomenon	**K2**
2	design simple logic circuits	**K3**
3	analyze the physical principle involved in the various instruments	**K4**
4	understand the scientific method and an ability to apply the scientific method in practice.	**K2**

K2 – Understand; **K3** - Apply; **K4** - Analyze

Contents

(Any Eight Experiments)

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Thermal conductivity of poor conductor using Lee's disc
7. Determination of Earth's magnetic field using field along the axis of a coil
8. Determination of AC frequency using sonometer
9. Characterization of Zener diode
10. Construction of Zerner/IC regulated power supply
11. Construction of AND, OR, NOT gates using diodes and transistor
12. NOR gate as a universal building block

Reference Books

1. Ubald Raj, A. and Jose Robin, G. 2012. Allied Physics. Indira Publications. Marthandam.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	3	2	2	2	2	2	3
CO2	2	3	3	2	3	2	3	2	3	2	3
CO3	2	2	2	2	2	3	2	3	2	2	3
CO4	3	3	2	2	3	2	3	2	2	3	3
TOTAL	**9**	**11**	**9**	**8**	**11**	**9**	**10**	**9**	**9**	**9**	**12**
AVERAGE	**2.25**	**2.75**	**2.25**	**2.0**	**2.75**	**2.25**	**2.5**	**2.25**	**2.25**	**2.25**	**3.0**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

NON-MAJOR ELECTIVE NME II: PHYSICS OF MUSIC

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232NM1	2	-	-	-	2	2	30	25	75	100

Pre-requisite:

Students should know about the basic knowledge regarding sound, vibrating systems and musical instruments.

Learning Objectives:

1. To educate and instruct students on the significance of physics in music.
2. To gain understanding of musical notes and instruments.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	understand the principles and basic scientific concepts in sound waves	**K2**
2.	understand the various phenomena of simple vibrating systems.	**K1**
3.	comprehend the various musical notes and its production	**K2**
4.	apply the knowledge of recording music in day to day life activities.	**K3**
5.	know the scientific concepts of music	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	**SCIENTIFIC STUDY OF MUSIC:** vibrations of atoms of matter– vibrations coupling to air – propagation of sound waves in air, other media, fluids & solids – velocity, frequency, wavelength, time period, intensity: definition and unit fs – classification of sound on frequency and velocity– human & animal sound perception– mechanism of ear and hearing – psychoacoustics	**6**
II	**SIMPLE VIBRATING SYSTEMS:** Simple harmonic motion – tuning fork– amplitude, phase, energy, energy loss/damping/ dissipation – power – travelling waves and standing waves– laws of vibration in stretched strings– one-dimensional medium – open and closed organ pipes – over tones, harmonics – quality of sound: pitch, timber, loudness – octaves, musical notes	**6**
III	**MUSICAL TONE:** pure/simple tones – sine/cosine waves– well-defined frequencies, wavelengths, amplitudes & phases– partial tones – assembly of pure tones– mix of different frequencies & amplitudes– complex tone – superposition of simple tones – complex waveform– periodic complex waveform – formants – resonances– sound envelope	**6**
IV	**PRODUCTION OF MUSICAL SOUNDS:** human voice,mechanism of vocal sound production – larynx (sound box) – stringed Instruments:plucked &bowed, guitar, mandolin, violin, piano, etc. – wind instruments: whistles, flute, saxophone, pipe organ, bag pipes,etc – percussion instruments:plates, membranes,drums, cymbals, xylophone etc. – electronic instruments: keyboards, electric guitars, rhythm pads, etc. – analog and digital sound synthesizers,–MIDI instrument– computer generated music	**6**
V	**RECORDING OF MUSIC & SOUND** Edison phonograph – cylinder & disk records – magnetic wire and tape recorders – digital recording (e.g. to CD, DVD, etc.)– analog transducers, condenser, dynamic microphones, loudspeaker – complex sound fields – near	**6**

	& far fields of acoustic– spectral analysis techniques – continuous & discrete Fourier transforms, digital signal processing – digital filtering – specifications of recording studios	
TOTAL		**30**

Self -Study	Simple tones, frequencies, wavelength, Musical Instruments

Textbooks

1. Harvey White, 2014, Physics and Music: The Science of Musical Sound. Dover Publications Inc, New York.
2. Barry Parker, 2009, Good Vibrations – The Physics of Music. John Hopkins University Press, Baltimore
3. Curt Sachs, 2006, The History of Musical Instruments. Dover Publications Inc, New York
4. Kinko Tsuji and Stefan C. Müller, 2021, Physics and Music: Essential Connections and Illuminating Excursions, Springer Nature, Switzerland.
5. Panos Photinos, 2017, Musical Sounds, Instruments and Equipment, Morgan Claypool Publishers, USA

Reference Books

1. Gerardin Jayam. 2019. Physics in Everyday Life. Published by the Department of Physics, Holy Cross College (Autonomous), Nagercoil.
2. Ian Johnston, 2009, Measured Tones, 3rd edition, CRC Press, Taylor and Francis Group, New York.
3. Michael J Morovcsik, 2002, Musical Sound, A Solomon Press Book, Kluwer Academic/Plenum Publishers, Moscow.
4. Curt Sachs, 2022, The Rise of Music in the Ancient World: East And West, Gyan Publishing House, New Delhi
5. Panos Photinos, 2021, The Physics of Sound Waves: Music, Instruments, and Sound Equipment, 2 nd Edition, IOP Publishing Ltd, UK

Web Resources

1. https://www.britannica.com/science/musical-sound
2. https://blog.landr.com/sound-recording/
3. https://www.britannica.com/topic/music-recording/The-development-of-musicalrecording
4. https://ccrma.stanford.edu/CCRMA/Courses/152/vibrating_systems.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	1	2	2	3	2	2	2	2
CO2	3	2	1	1	1	2	2	3	2	2	2	2
CO3	3	2	1	1	1	1	2	2	2	2	2	2
CO4	3	3	2	1	1	2	3	3	2	2	2	2
CO5	2	2	2	1	1	2	2	2	2	2	2	2
TOTAL	**14**	**11**	**7**	**5**	**5**	**9**	**11**	**13**	**10**	**10**	**10**	**10**
AVERAGE	**2.8**	**2.2**	**1.4**	**1**	**1**	**1.8**	**2.2**	**2.6**	**2**	**2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER II

SKILL ENHANCEMENT COURSE SEC-I: DIGITAL PHOTOGRAPHY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232SE1	2	-	-	-	2	2	30	25	75	100

Prerequisites:

Basic Knowledge in optics and imaging.

Learning Objectives:

1. To understand the principles of photography and image formation and the science and arts behind it.
2. To understand the essential components of conventional and digital cameras and also the different image processing techniques.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	describe the principle of image formation in Photography	**K2**
2	apply the parameters for controlling the images	**K3**
3	identify different types of camera	**K4**
4	explain the image formation in Digital Photography	**K2**
5	illustrate the digital image – postproduction procedures	**K3**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

Units	Contents	No. of Hours
I	**PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION:** Principle –chemical route and digital route –light, wavelengths, colours – shadows – light intensity and distance – making light form images –pin-hole images – practical limitations to pin-hole images – lens instead of pin-hole – focal length and image size – imaging of closer subjects.	**6**
II	**LENSES – CONTROLLING THE IMAGES:** Photographic lens – focal length and angle of view (problems) – focusing movement – aperture and f-numbers (problems) – depth of field– depth of focus – image stabilization – lenses for digital cameras – lens and camera care	**6**
III	**CAMERA USING FILMS AND ITS TYPES:** Camera and its essential components– shutter – aperture – light measurement – film housing – camera types: view camera– view finder camera – Reflex camera– single lens reflex (SLR) camera	**6**
IV	**DIGITAL CAMERAS PRINCIPLE AND TYPES** Principle of digital image capturing –comparison of digital and analog picture information – megapixel – grain, noise and pixel density – optical and digital zooming – image stabilizer – bit depth – white balance – colour modes – file formats (TIFF, RAW & JPEG) – storage cards and types – digital cameras: camera phones – compact camera – hybrid camera – digital SLR.	**6**
V	**THE DIGITAL IMAGE – POSTPRODUCTION** Hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness & contrast – colour balance – hue/saturation – dodge/burn – cloning & amp; retouching – removing an element in an image –	**6**

	advanced editing: histogram/levels – curves – selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/ light jet printers.	
TOTAL		**30**

Self-study	Imaging of closer subjects; Lens and camera care; Camera and its essential components; Digital cameras: camera phones;Laser printer

Textbooks

1. Michel J.Langford, Anna Fox & Richard Sawdon Smith, 2010, Basic Photography, 9th Edition, Focal press, London
2. Henry Carroll. 2014, Read this if you want to take great photographs of people, Laurence King Publishing House.

Reference Books

1. Mark Galer (2006), Digital Photography in Available Light essential skills, Focal press, London
2. Paul Harcourt Davies (2005), The Photographer's practical handbook, UK Press

Web Resources

1. https://www.accessengineeringlibrary.com/binary/mheaeworks/27573c8a4e04bc1a/1ae690cdd3d5711fdbe6463f02945caf923faf161b30f99e05e9d8f1d5932641/principles-of-photography-and-imaging.pdf?implicit-login=true&sigma-token=AibpD1dgOcmXs4X3fz1ok4_1xmSXEZEQOFzoGKqklE
2. https://www.masterclass.com/articles/basic-photography-101-understandingcamera-lenses
3. https://blog.magnasonic.com/different-film-types-formats-sizes/
4. https://av.jpn.support.panasonic.com/support/global/cs/dsc/knowhow/knowhow01.ht ml
5. https://en.wikibooks.org/wiki/Digital_Photography/Post_Processing

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3	2	3	3	3
TOTAL	**14**	**14**	**15**	**14**	**15**	**15**	**15**	**14**	**14**	**15**	**15**	**15**
AVERAGE	**2.8**	**2.8**	**3**	**2.8**	**3**	**3**	**3**	**2.8**	**2.8**	**3**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

SEMESTER I & II

LIFE SKILL TRAINING I: CATECHISM

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG232LC1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To develop human values through value education
2. To understand the significance of humane and values to lead a moral life
3. To make the students realize how values lead to success

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the aim and significance of value education	K1,K2
2	develop individual skills and act confidently in the society	K3
3	learn how to live lovingly through family values	K3
4	enhance spiritual values through strong faith in God	K6
5	learn good behaviours through social values	K6

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Value Education:** Human Values – Types of Values – Growth – Components – Need and Importance - Bible Reference: Matthew: 5:3-16	3
II	**Individual Values: Esther** Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life - Bible Reference: Esther 8:3-6	3
III	**Family Values: Ruth the Moabite** Respecting Parents – Loving Everyone – Confession – True Love Bible Reference: Ruth 2:10-13 **Spiritual Values: Hannah** Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds -Bible Reference: 1 Samuel 1:24-28	3
IV	**Social Values: Deborah** Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts –The Role of Youth in Social Welfare - Bible Reference: Judges 4:4-9	3
V	**Cultural Values**: **Mary of Bethany** Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth - Bible Reference: Luke 10:38-42	3
	Total	15

Textbook

Humane and Values. Holy Cross College (Autonomous), Nagercoil

The Holy Bible

SEMESTER I & II

LIFE SKILL TRAINING I: MORAL

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG232LM1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To develop human values through value education
2. To understand the significance of humane and values to lead a moral life
3. To make the students realize how values lead to success

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the aim and significance of value education	**K1,K2**
2	develop individual skills and act confidently in the society	**K3**
3	learn how to live lovingly through family values	**K3**
4	enhance spiritual values through strong faith in God	**K6**
5	learn good behaviours through social values	**K6**

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Value Education:** Introduction – Limitations – Human Values – Types of Values – Aim of Value Education – Growth – Components – Need and Importance	**3**
II	**Individual Values:** Individual Assessment – Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life.	**3**
III	**Family Values:** Life Assessment – Respecting Parents – Loving Everyone – Confession – True Love.	**3**
IV	**Spiritual Values:** Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds.	**3**
V	**Social Values:** Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts – Drug Free Path – The Role of Youth in Social Welfare. **Cultural Values**: Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth.	**3**
	Total	**15**

Text Book

Humane and Values. Holy Cross College (Autonomous), Nagercoil

SEMESTER III

CORE COURSE III: GENERAL MECHANICS AND CLASSICAL MECHANICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233CC1	5	–	–	–	5	5	75	25	75	100

Pre–requisite:

Basic knowledge of physics principles, Laws of conservation and Rigid Body.

Learning Objectives:

1. To have a basic understanding of the laws and principles of mechanics and to apply the concepts of forces existing in the system.
2. To understand the forces of physics in everyday life and to apply Lagrangian equation for solving complex problems.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recognize Newton's Law of motion, general theory of relativity, Kepler's laws and the basic principles behind planetary motion.	**K1**
2.	infer the knowledge on the conservation laws.	**K2**
3.	relate conservation law and calculate energy of various systems, understand and differentiate conservative and non–conservative forces.	**K3**
4.	devise concepts of rigid body dynamics and solve problems.	**K4**
5.	defend Lagrangian system of mechanics and D' Alembert's principle.	**K5**

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyse; **K5** – Evaluate

Units	Contents	No. of Hours
I	**LAWS OF MOTION** Newton's Laws– forces – equations of motion – motion of a particle in a uniform gravitational field –Gravitation: Classical theory of gravitation– Kepler's laws, Newton's law of gravitation – Determination of G by Boy's method – Earth–moon system– Earth satellites –Earth density – mass of the Sun – gravitational potential – velocity of escape –Einstein's theory of gravitation – introduction – Principle of equivalence– gravitational red shift – bending of light.	15
II	**CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM** Conservation of linear and angular momentum – Internal forces and momentum conservation – Centre of mass – Examples – General elastic collision of particles of different masses – System with variable mass – Examples – Conservation of angular momentum – Torque due to internal forces – Torque due to gravity – Angular momentum about centre of mass – Proton scattering by heavy nucleus.	15
III	**CONSERVATION LAWS OF ENERGY** Introduction – Significance of conservation laws – Law of conservation of energy – Work – Power – Work – Kinetic energy theorem– Work done in lifting and lowering an object – Conservative forces – Work done by spring force – Work done by the gravitational force – Gravitational potential energy and elastic potential energy – Examples – Non–conservative forces	15

IV	**RIGID BODY DYNAMICS** Translational and rotational motion – Angular momentum – Moment of inertia – General theorems of moment of inertia – Examples – Rotation about fixed axis – Kinetic energy of rotation – Examples – Body rolling along a plane surface – Body rolling down an inclined plane – Gyroscopic precision – Gyrostatic applications.	**15**
V	**LAGRANGIAN MECHANICS** Generalized coordinates –Degrees of freedom – Constraints – Holonomic and non–holonomic –Scleronomic and rheonomic constraints – Principle of virtual work and D' Alembert's Principle –Lagrange's equation from D' Alembert's principle – Application – Simple pendulum – Atwood's machine.	**15**
	Total	**75**

Self–study	Kepler's laws, Newton's law of gravitation

Textbooks

1. Upadhyaya J C, 2019. *Classical Mechanics*, Himalaya Publishing house, Mumbai.
2. Halliday, David Robert Resnick, Walker Jearl, 2008. *Fundamentals of Physics*, John Wiley, New Delhi
3. Durai Pandian P, Laxmi Durai Pandian, Muthamizh Jayapragasam, 2005. *Mechanics*, (6th Edition), S. Chand & Co, Chennai.

Reference Books

1. Goldstein Herbert, 2011. *Classical Mechanics*, (3rd Edition), Dorling Kindersley Pearson Education, India.
2. Mathur D S, Hemne P S, 2012. *Mechanics*, (Revised Edition), Chand and Co, New Delhi.
3. Roy N R, 2016. *Introduction to Classical Mechanics*, (1st Edition), Vikas Publishing House, New Delhi.
4. Rao K, 2003. *Classical Mechanics*, Universities Press, India.
5. Narayanamurthi, Nagarathnam N, 1998. *Dynamics*, National Publishing, Chennai.

Web Resources

1. https://youtu.be/X4_K–XLUIB4
2. https://nptel.ac.in/courses/115103115
3. https://www.youtube.com/watch?v=p075LPq3Eas
4. https://www.youtube.com/watch?v=mH_pS6fruyg
5. https://onlinecourses.nptel.ac.in/noc22_me96/preview

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	2	3	3	3	3
CO2	3	3	3	3	3	2	3	3	2	3	3	3
CO3	3	3	3	3	2	3	3	2	3	3	3	3
CO4	3	3	3	3	2	3	3	2	3	3	3	3
CO5	3	3	3	3	3	2	3	3	2	3	3	3
TOTAL	**15**	**15**	**15**	**15**	**12**	**13**	**15**	**12**	**13**	**15**	**15**	**15**
AVERAGE	**3**	**3**	**3**	**3**	**2.4**	**2.6**	**3**	**2.4**	**2.6**	**3**	**3**	**3**

3 – Strong, 2– Medium, 1– Low

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SEMESTER III

CORE LAB COURSE III: GENERAL PHYSICS LAB III

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233CP1	-	-	3	-	3	3	45	25	75	100

Pre-requisite:

Knowledge on basic Physics, Electricity, Magnetism and Arithmetic.

Learning Objectives:

1. To understand electricity, current, resistance, and circuit parameters by constructing different circuits.
2. To apply the concepts of electricity, current, resistance, and circuit parameters for setting up experiments, and then observe, analyse and assimilate the concepts.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember and understand the scientific method to construct simple circuits.	**K1&K2**
2.	apply basic skills and attitudes enabling application in the physics field.	**K3**
3.	analyse the physical principle involved in the various instruments such as potentiometer, galvanometer, electrical bridge etc.	**K4**
4.	evaluate a record of experiments in a clear and structured written format augmented with relevant figures and graphs wherever needed.	**K5**
5.	develop prototypes by utilizing physics concepts in practical situations.	**K6**

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

Contents (Any Eight experiments)

1. Calibration of low range voltmeter using potentiometer
2. Calibration of ammeter using potentiometer.
3. Compare the capacitances of two capacitors by forming De Sauty's bridge.
4. Determine self-inductance of the coil using Owen's bridge.
5. Determine the resonant frequency, inductance of the coil, band width, voltage magnification factor and quality factor (Q) of the LCR - Series resonance circuit.
6. Determination of figure of merit of BG.
7. Construct a Zener diode voltage regulator and measure its DC output.
8. Construct Zener Diode circuit in Forward and Reverse bias and analyze V-I Characteristics of Zener diode.
9. Determine absolute value of the magnetic dipole moment (M) of the given dipole and earth's horizontal magnetic induction (B_H) using deflection and vibration magnetometer.
10. Determine the dipole moment of the bar magnet using the field along the axis of a circular coil caring current.
11. Determination of absolute capacitance using BG.
12. Determination of earth's magnetic field using field along axis of current carrying coil.

Textbooks

1. Ouseph C, Rao U J, Vijayendran V, 2007. *Practical Physics and Electronics*, S. Viswanathan, Pvt., Ltd. Chennai.
2. Arora C L, 2001. B.Sc. *Practical Physics*, S. Chand Publishing, New Delhi.
3. Srinivasan M N, Balasubramanian S, Ranganathan R, 2013. *A Textbook of Practical Physics*, S. Chand Publishing, New Delhi.
4. Wood L, Sladjana, 2017. *General Physics Lab Manual*, Volume Two (Third Edition) American Press, United States.
5. Harnam Singh, 2000. *B.Sc. Practical Physics*, S. Chand Publishing, New Delhi.

Reference Books

1. Shukla R K, 2007. *Practical Physics*. New Age International (P) Limited, Publishers. India.
2. Ware M J, Peatross J, 2015. *Physics of Light and Optics*, Black & White Brigham Young University, Department of Physics, United States.
3. James J F, 2014. *An Introduction to Practical Laboratory Optics*. Cambridge University Press, United Kingdom
4. Henderson J, 2006. *Practical Electricity and Magnetism*. Longmans Green and Company, India.
5. Purcell E M, 2013. *Electricity and Magnetism*. Cambridge University Press, United Kingdom.

Web Resources

1. https://youtu.be/3eC3qtGOENA?si=9HSj8ENuBZMmkgJd
2. https://youtu.be/AWkmfIH_MNA?si=cvTPWfVHTjKhed8Q
3. https://youtu.be/Lga4b7j-MQM?si=_-bsXaaOUoq_bUpQ
4. https://youtu.be/PfBQEhLKDRc?si=P5ze_milbPw2egNf
5. https://youtu.be/ugO1G7_1a-o?si=yG2vmtZMS7jUFGLl

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2	3	3	3	3	3	3	3
CO2	3	3	3	2	2	3	3	3	3	3	3	3
CO3	3	3	3	2	2	3	3	3	3	3	3	3
CO4	3	2	2	2	2	3	2	2	2	3	3	2
CO5	3	2	2	3	3	2	2	2	2	3	3	2
TOTAL	**15**	**13**	**13**	**11**	**11**	**14**	**13**	**13**	**13**	**15**	**15**	**13**
AVERAGE	**3**	**2.6**	**2.6**	**2.2**	**2.2**	**2.8**	**2.6**	**2.6**	**2.6**	**3**	**3**	**2.6**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

ELECTIVE COURSE III: ALLIED PHYSICS FOR CHEMISTRY – I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basic knowledge of physics principles, Properties of Matter, Waves

Learning Objectives:

1. To gain a comprehensive understanding of the fundamental principles in Physics.
2. To develop skills for interpreting physical phenomena beneficial for students who have taken programmes other than Physics.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	identify the basic concepts in waves, characteristics of matter, electricity and magnetism, as well as electronics.	**K1**
2.	interpret the principles of ultrasonics and surface tension, and explore their practical applications within the medical domain.	**K2**
3.	articulate real-world solutions leveraging the principles of electricity, magnetism, and electronics within the framework of Digital India.	**K3**
4.	categorise physics principles in everyday situations.	**K4**
5.	prioritize Boolean algebraic concepts in practical scenarios.	**K5**

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyse; **K5** – Evaluate

Units	Contents	No. of Hours
I	**PROPERTIES OF MATTER** Elasticity: Elastic constants – Bending of beam – Theory of non- uniform bending – Determination of Young's modulus by non-uniform bending – determination of rigidity modulus by torsional pendulum Viscosity: streamline and turbulent motion – Critical velocity – Coefficient of viscosity Surface tension: definition – Interfacial surface tension - Drop weight method	**12**
II	**HEAT AND THERMODYNAMICS** Joule-Kelvin effect – Joule-Thomson porous plug experiment – Temperature of inversion –Liquefaction of Oxygen – Linde's process of liquefaction of air – Liquid Oxygen for medical purpose- Laws of thermodynamics – Entropy – Heat engine – Carnot's cycle – Efficiency	**12**
III	**ELECTRICITY AND MAGNETISM** Potentiometer– Principle – measurement of thermo emf using potentiometer – Magnetic field due to a current carrying conductor – Biot Savart's law – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – Types of switches in household and factories	**12**
IV	**WAVES, OSCILLATIONS AND ULTRASONICS** Simple Harmonic Motion – composition of two SHMs at right angles (periods in the ratio 1:1) – Laws of transverse vibrations of strings – Determination of AC frequency using sonometer – Ultrasound – production –Piezoelectric method – Application of ultrasonics.	**12**

V	**DIGITAL ELECTRONICS AND DIGITAL INDIA** Logic gates, OR, AND, NOT logic gates – Boolean algebra – De Morgan's theorem – verification – Overview of Government initiatives: software technological parks under MeitY (Ministry of Electronics and Information Technology), NIELIT (National Institute of Electronics & Information Technology) - Semiconductor laboratories under Dept. of Space – An introduction to Digital India.	**12**
	Total	**60**

Self-study	NIELIT- Semiconductor laboratories under Dept. of Space –Introduction to Digital India.

Textbooks

1. Ubald Raj A, Jose Robin G, 2012. *Allied Physics*, Indira Publications. Marthandam.
2. Murugesan R, 2001. *Allied Physics*, S. Chand & Co., New Delhi.
3. Murugesan R, 2017. *Electricity and Magnetism*, S. Chand & Co., New Delhi.
4. Hugh D Young, Rogger A, Freedman, 2015. *University Physics with Modern Physics*, Pearson Publishers, Chennai.

Reference Books

1. Murugesan R, 2012. *Properties of Matter*, S. Chand & Co., New Delhi.
2. Mathur D S, 2010. *Elements of Properties of Matter*, S. Chand& Co., New Delhi.
3. Brijlal, Subramaniam N, Henne P S, 2008. *Heat Thermodynamics and Statistical Physics*, Revised Edition, S Chand & Co., New Delhi.
4. Ubald Raj A, Jose Robin G. 2004. *Basic Electronics*, Indira Publications. Marthandam.
5. David Halliday, Robert Resnick, Jearl Walker, 2013. *Fundamentals of Physics*, Wiley Publishers, India.

Web Resources

1. https://youtu.be/M_5KYncYNyc
2. https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
3. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
4. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	1	1	2	3	2	2	3	1
CO2	3	3	3	1	2	2	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	2	2	2	3	3	3	2	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3
TOTAL	**15**	**15**	**14**	**10**	**11**	**11**	**12**	**15**	**14**	**14**	**14**	**13**
AVERAGE	**3**	**3**	**2.8**	**2**	**2.2**	**2.2**	**2.4**	**3**	**2.8**	**2.8**	**2.8**	**2.6**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

ELECTIVE LAB COURSE I: ALLIED PHYSICS PRACTICAL FOR CHEMISTRY – I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233EP1	-	-	**2**	-	**2**	**2**	**30**	**25**	**75**	**100**

Pre-requisite:

Knowledge in basic Physics.

Learning Objectives:

1. To make the students more innovative, in hands on experiments.
2. To elucidate theory through simple experiments in physics.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	remember the basic principles of Physics through experiments.	**K1**
2.	interpret the handling of various instruments.	**K2**
3.	relate the various physical parameters for measuring properties of the given material.	**K3**
4.	devise the implications of working principle of logic gates.	**K4**
5.	estimate the Q-factors and design simple electronic circuits.	**K5&K6**

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

Minimum of Eight Experiments from the list:

1. Young's modulus by non-uniform bending using pin and microscope
2. Young's modulus by non-uniform bending using optic lever, scale and telescope
3. Surface tension and interfacial Surface tension – drop weight method
4. Comparison of viscosities of two liquids – burette method
5. Determination of co-efficient of viscosity-Variable pressure head
6. Calibration of low range voltmeter using potentiometer
7. Calibration of ammeter using potentiometer.
8. Verification of truth tables of basic logic gates using ICs
9. Determination of rigidity modulus without mass using Torsional pendulum.
10. Verification of truth tables of AND, OR and NOT using NAND (IC 7400)
11. Resonance Frequency of the LCR circuit

Note: Use of digital balance is permitted

Textbooks

1. Ubald Raj A, Jose Robin G, 2012. *Allied Physics*, Indira Publications, Marthandam.
2. Jerry D. Wilson, Cecilia A. Hernández-Hall, 2017. *Physics laboratory experiments*, Cengage Learning publishers, Delhi.
3. Hugh D Young, Rogger A. Freedman, 2015. *University Physics with Modern Physics*, Pearson Publishers, Chennai.
4. David Halliday, Robert Resnick, Jearl Walker, 2013. *Fundamentals of Physics*, Wiley Publishers, India.

Reference Books

1. Jerry D, Wilson, Cecilia A. Hernández-Hall, 2003. *Experimental Physics: Modern Methods*, Cengage Learning publishers, Delhi.
2. Donald E, Simanek, Derek K, Senft, 2005. *Laboratory Manual for Introductory Physics*, John Wiley & Sons, United States.
3. Squires G L, *Practical Physics*, 2001. Cambridge University Press. India

4. Savant C J, 2014. *Experiments in Physics for Students of Science and Engineering*, Cengage Learning publishers, Delhi.
5. David H, Loyd, 2012. *Physics Laboratory Manual*, Cengage Learning publishers, Delhi.

Web Resources

1. https://www.youtube.com/watch?v=TZWk5-8R5tc
2. https://www.electricaldeck.com/2021/04/calibration-of-voltmeter-ammeter-wattmeter-using-potentiometer.html
3. https://www.youtube.com/watch?v=TeWPWBbS9tI
4. https://www.youtube.com/watch?v=0J1jFa8Uhpw
5. https://de-iitr.vlabs.ac.in/exp/truth-table-gates/theory.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	1	1	2	3	2	2	3	1
CO2	3	3	3	1	2	2	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	2	2	2	3	3	3	2	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3
TOTAL	**15**	**15**	**14**	**10**	**11**	**11**	**12**	**15**	**14**	**14**	**14**	**13**
AVERAGE	**3**	**3**	**2.8**	**2**	**2.2**	**2.2**	**2.4**	**3**	**2.8**	**2.8**	**2.8**	**2.6**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

SKILL ENHANCEMENT COURSE SEC -II: ASTROPHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233SE1	2	-	-	-	2	2	30	25	75	100

Pre-requisite: Basics of Solar Systems, Galaxies and Planets.

Learning Objectives:

1. To introduce principles of astrophysics describing the science of formation and evolution of stars and interpretation of various heavenly phenomena.
2. To provide an understanding of the physical nature of celestial bodies.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall the total and annular solar and lunar eclipses.	**K1**
2.	summarize the different layers of the Sun and its phenomenon.	**K2**
3.	articulate the basic concepts of Solar systems on planetary motion.	**K3**
4.	relate the distinct properties of planets revolving around the sun.	**K4**
5.	grade the principle of planetary motion towards science and technology.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** – Evaluate

Units	Contents	No. of Hours
I	**THE SUN** The Sun – A typical star – Photosphere – Limb darkening - Chromosphere – Spicules – Plages and filaments - Solar corona – The inner corona – The outer corona – The emission corona - prominences – sunspots - solar flares	**6**
II	**SOLAR SYSTEM** Comets – Nucleus – Coma – Hydrogen cloud – Dust tail – Ion tail - Asteroids – Debris – Meteors – Shooting stars – Falling stars – Meteoroids – Crater - Kuiper belt – Oort cloud - Bode's law of planetary distances	**6**
III	**ECLIPSES** Types of eclipses – Solar eclipse – Solar eclipse geometry - Total and annular solar eclipse – Lunar eclipse – Umbra – Penumbra - Total and partial lunar eclipse	**6**
IV	**INNER PLANETS** Mercury: Planet closest to the sun – Venus: Earth's twin - Earth: The water planet – Mars: The red planet	**6**
V	**OUTER PLANETS** Jupiter: The largest planet – Saturn: The ringed planet – Uranus: Neptune's twin – Neptune: The blue planet – Pluto – Dwarf planet.	**6**
	Total	**30**

Self-study	Solar Corona, shooting stars, total and partial lunar eclipse, greenhouse effect

Textbooks

1. Baidyanath Basu, 2010. *An introduction to Astrophysics*, (2nd Edition), Prentice Hall of India (P) Ltd, New Delhi.

2. Krishnaswamy K S, 2002. *Astrophysics: a modern perspective*, New Age International (P) Ltd, New Delhi.
3. Shylaja B S, Madhusudan H. R, 1999. *Eclipse: A Celestial Shadow Play*, Universities Press Private limited, India.
4. Bradley W Carroll, 2017. *An introduction to modern astrophysics*, (3rd Edition), University Press, Cambridge.
5. Charles Keeton, 2014. *Principles of Astrophysics*, Springer.

Reference Books

1. Abhyankar K D, 2009. *Astrophysics of the solar system*, (2nd Edition), Universities press Private limited, India.
2. Stan Owocki, 2021. *Fundamentals of Astrophysics*, Cambridge University Press.
3. Gerardin Jeyam, 2008. *Physics Everyday*, Holy Cross College (Autonomous), Nagercoil.
4. Gourav Banerjee, 2021. *Becoming an Astronomer: A Friendly Guide to Pursue Astronomy as a Career*, Palmview Publishing, Kolkata.
5. Madhur Sorout, 2019. *Astrophysics Simplified: A Simple Guide to the Universe*, Notion Press, Chennai.

Web Resources

1. https://optcorp.com/blogs/telescopes-101/refractor-vs-reflector-telescopes
2. https://pages.uoregon.edu/jschombe/glossary/bode_titus_relation.html
3. https://www.timeanddate.com/eclipse/eclipse-information.html
4. https://pressbooks.online.ucf.edu/astronomybc/chapter/23-1-the-death-of-low-mass-stars/
5. https://science.nasa.gov/universe/galaxies/types/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	3	3	3	3	3	1	2
CO2	3	3	3	2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	1	3	3	3	2	3	3	1
CO4	3	3	3	2	2	3	3	3	3	3	2	2
CO5	3	2	3	3	2	3	3	3	2	3	3	3
TOTAL	**15**	**13**	**15**	**11**	**10**	**15**	**15**	**15**	**13**	**15**	**13**	**11**
AVERAGE	**3**	**2.6**	**3**	**2.2**	**2**	**3**	**3**	**3**	**2.6**	**3**	**2.6**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER III / IV

SKILL ENHANCEMENT COURSE SEC – IV: DIGITAL FLUENCY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG23CSE2	2	-	-	-	2	2	30	50	50	100

Pre-requisite: Basic computer knowledge

Learning Objectives:

1. To provide a comprehensive suite of productivity tools that enhance efficiency
2. To build essential soft skills that are needed for professional success.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	work with text, themes and styles	**K1**
2.	produce a mail merge	**K2**
3.	secure information in an Excel workbook	**K2**
4.	perform documentation and presentation skills	**K2, K3**
5.	add special effects to slide transitions	**K3**

K1 - Remember; **K2** - Understand; **K3** – Apply

Units	Contents	No. of Hours
I	**Microsoft Word 2010:** Starting Word 2010 - Understanding the Word Program Screen - Giving Commands in Word - Using Command Shortcuts – Document: Creating - Opening - Previewing - Printing and Saving. Getting Started with Documents: Entering and Deleting Text - Navigating through a Document - Viewing a Document. Working with and Editing Text: Spell Check and Grammar Check- Finding and Replacing Text - Inserting Symbols and Special Characters – Copying, Moving, and Pasting Text.	**6**
II	**Formatting Characters and Paragraphs**: Changing Font Type, Font Size, Font Color, Font Styles and Effects, Text Case, Creating Lists, Paragraph Alignment, Paragraph Borders and Shadings, Spacing between Paragraphs and Lines. Formatting the Page: Adjusting Margins, Page Orientation and Size, Columns and Ordering, Headers and Footers, Page Numbering. Working with Shapes, Pictures and SmartArt: Inserting Clip Art, Pictures and Graphics File, Resize Graphics, Removing Picture's Background, Text Boxes, Smart Art, Applying Special Effects. Working with Tables: Create Table, Add and delete Row or Column, Apply Table Style - Working with Mailings.	**6**
III	**Microsoft Excel 2010:** Creating Workbooks and Entering Data: Creating and Saving a New Workbook - Navigating the Excel Interface, Worksheets, and Workbooks - Entering Data in Worksheets - Inserting, Deleting, and Rearranging Worksheets. Formatting Worksheets: Inserting and Deleting Rows, Columns and Cells - Formatting Cells and Ranges - Printing your Excel Worksheets and Workbooks. Crunching Numbers with Formulas and Functions: Difference between Formulae and Functions - Applying Functions. Creating Powerful and Persuasive Charts: Creating, Laying Out, and Formatting a Chart.	**6**
IV	**Microsoft PowerPoint 2010:** Creating a Presentation - Changing the Slide Size and Orientation - Navigating the PowerPoint Window - Add content to a Slide - Adding, Deleting, and Rearranging Slides - Using views to work on Presentation. Creating Clear and Compelling Slides: Planning the Slides in Presentation - Choosing Slide Layouts to Suit the Contents - Adding Tables, SmartArt, Charts, Pictures, Movies,	**6**

	Sounds, Transitions and Animations - Slideshow.	
V	**Digital Platforms:** Graphic Design Platform: Canva - Logo Making, Invitation Designing. E-learning Platform: Virtual Meet – Technical Requirements, Scheduling Meetings, Sharing Presentations, Recording the Meetings. Online Forms: Creating Questionnaire, Publishing Questionnaire, Analyzing the Responses, Downloading the Response to Spreadsheet.	**6**
	Total	**30**

Self-study	Parts of a computer and their functions

Textbook:

Anto Hepzie Bai J. & Divya Merry Malar J.,2024, Digital Fluency, Nanjil Publications, Nagercoil.

Reference Books:

1. Steve Schwartz, 2017, *Microsoft Office 2010 for Windows*, Peachpit Press.
2. Ramesh Bangia, 2015, Learning Microsoft Office 2010, Khanna Book Publishing Company.
3. Bittu Kumar, 2018, *Mastering MS Office*, V & S Publishers.
4. James Bernstein, 2020, *Google Meet Made Easy*, e-book, Amazon.
5. Zeldman, Jeffrey, 2005, *Web Standards Design Guide*, Charles River Media.

Web Resources:

1. https://www.youtube.com/watch?v=oocieLn6umo
2. https://www.youtube.com/watch?v=pPSwbK4_GdY
3. https://www.youtube.com/watch?v=DKAiSDhU4To
4. https://www.youtube.com/watch?v=sbeyPahs-ng
5. https://www.youtube.com/watch?v=fACEzzmXelY

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: FUNDAMENTALS OF MS- EXCEL

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233V01	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic knowledge of MS- Excel.

Learning Objectives:

1. To understand the fundamental principles of Microsoft Excel and its features.
2. To apply knowledge of Excel in data analysis.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	illustrate Microsoft Excel and its features.	**K1**
2.	understand the formula functions – sum - average, if, count, max, min, proper, upper, lower, using autosum.	**K2**
3.	apply Excel features for designing and integrating calculations.	**K3**
4.	analyse spreadsheet enhanced functionality.	**K4**
5.	evaluate table data analysis.	**K5**

K1- Remember- **K2**- Understand- **K3 –** Apply- **K4**- Analyze- **K5**- Evaluate

Units	Contents	No. of Hours
I	**FUNDAMENTALS OF MS EXCEL** MS Excel software - Spreadsheet window pane - Title Bar - Menu Bar - Standard Toolbar - Formatting Toolbar - the Ribbon -File Tab and Backstage View - Formula Bar - Workbook Window - Status Bar.	**6**
II	**RANGES AND FUNCTIONS** Using Ranges - Selecting Ranges - Entering Information Into a Range - Using AutoFill Creating Formulas- Formula Functions – Sum - Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum.	**6**
III	**PIVOT TABLES** Sorting, Filter - Text to Column - Data Validation PivotTables - Creating PivotTables - Manipulating a PivotTable - Using the PivotTable Toolbar - Changing Data Field –Properties.	**6**
IV	**WORKSHEETS** Moving between Spreadsheets, Selecting Multiple Spreadsheets - Inserting and Deleting Spreadsheets -Copying and Pasting Data between Spreadsheets - Hiding - Protecting worksheets.	**6**
V	**SPECIAL TECHNIQUES** Concatenate, Vlookup, Hlookup, Match, Countif, Text, Trim Spreadsheet Charts- Different types of chart, Formatting Chart Objects - Showing and Hiding the Data.	**6**
	Total	**30**

Self-study	Spreadsheets, Data analysis

Textbooks

1. Ken Bluttman, 2020. *Microsoft Excel Formulas & Functions for Dummies,* Wiley, USA.
2. M.L. Humphrey, 2019. *Intermediate Excel: 2 (Excel Essentials),* Humphrey Publishers, UK.

Reference Books

1. M.L. Humphrey, 2019. *Excel for Beginners,* Humphrey Publishers, UK.
2. Lokesh Lalwani, 2019. *Excel 2019 All-In-One: Master the new features of Excel 2019 / Office 365,* BPB Publications, India.
3. Ritu Arora, 2023. Mastering Advanced Excel, BPB Publications, India.
4. Jordan Goldmeier, 2014. *Advanced Excel Essentials,* Apress, UK.
5. Alan Murray, 2022. *Advanced Excel Formulas: Unleashing Brilliance with Excel Formulas,* Apress, UK.

Web Resources

1. https://excel-practice-online.com/
2. https://intellipaat.com/ course
3. https://www.simplilearn.com/tutorials/excel-tutorial/excel-basics
4. https://support.microsoft.com/en-us/office/basic-tasks-in-excel-dc775dd1-fa52-430f-9c3c-d998d1735fca
5. https://corporatefinanceinstitute.com/resources/excel/basic-excel-formulas-beginners/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	3	3	3	3	3	1	2
CO2	3	3	3	2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	1	3	3	3	2	3	3	1
CO4	3	3	3	2	2	3	3	3	3	3	2	2
CO5	3	2	3	3	2	3	3	3	2	3	3	3
TOTAL	**15**	**13**	**15**	**11**	**10**	**15**	**15**	**15**	**13**	**15**	**13**	**11**
AVERAGE	**3**	**2.6**	**3**	**2.2**	**2**	**3**	**3**	**3**	**2.6**	**3**	**2.6**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: APPLICATIONS OF LASER

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233V02	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic knowledge of Lasers.

Learning Objectives:

1.To understand the fundamental principles of Lasers, including their operation, types, and characteristics.

2.To apply knowledge of the basics of lasers and their diversified applications

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	identify Laser types, principles, and applications in modern technology	**K1**
2.	understand the working mechanism of lasers.	**K2**
3.	use the principle of lasers in designing and integrating Lasers into appliance systems.	**K3**
4.	contrast different types of lasers, laser instrumentation and their applications.	**K4**
5.	evaluate laser systems, their characteristics and diversified applications including industry, medicine and astronomy.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** – Evaluate

Units	Contents	No. of Hours
I	**FUNDAMENTALS OF LASER** Basic principles-Spontaneous and stimulated emission – Einstein'scoefficient – pumping mechanism- optical, electrical and laser pumping – population inversion	**6**
II	**TYPES OF LASER** Solidstatelaser- rubylaser- Nd:YAG laser- Nd:Glass laser– semiconductor laser- intrinsic semiconductor laser - doped semiconductorlaser	**6**
III	**APPLICATIONS OF LASER IN INDUSTRY** Application of laser in metrology – optical communication – material processing - laser instrumentation of material processing- powder feeder- Laser instruments	**6**
IV	**APPLICATIONS OF LASER IN MEDICINE** Medical application in eye related surgeries– Laser instrumentation for surgeries– Monochromaticity- Spatial and temporal coherence- rightness- Focus ability- ultra-short pulse generation- Peak Power	**6**
V	**APPLICATIONS OF LASER IN ASTRONOMY** Laser resonators- General conditions of stability- Plane and spherical mirror cavities- Modes and optical resonators- Gaussian beam propagation- laser telescopes in optical and radio space instruments	**6**
	Total	**30**

Self-study	Semiconductor laser, Conditions of stability

Textbooks

1. Laud Metha B B, 2013. *Laser and Non-linear Optics,* New Age International Publications, (3rd Edition), NewDelhi.
2. Avadhunulu A, 2020, *An Introduction to laser, theory and applications* M.N.S.,Chand&Co, NewDelhi
3. Anokh Singh, Chopra A K, 2013. *Principles of communication Engineering,* S. Chand & CoLtd, New Delhi.
4. Chitode J S, 2020.*Digital Communications*, Unicorn publications, Chennai.
5. Senior John, 2010. *Laser Communications*, Pearson Education, India.

Reference Books

1. Dennis Roody, Coolen, 1995. *Electronic communications*. Prentice Hall of India, (4th Edition), New Jersey: Prentice Hall.
2. Ohba R, 2006. *Advanced electronics communication systems*. New York: John Wiley & Sons.
3. Pallas Areny R, Webster J G, 1999. *Electronics communications*, New York: John Wiley & Sons.
4. Wayne Tomasi, 1998. *Advanced Electronics communication System*, (4th edition), Prentice Hall of India, India.
5. Salivahanan,S , 2015. *Laser Devices and Circuits*, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Web Resources

1. https://www.geeksforgeeks.org/digital-electronics-laser-tutorials/
2. https://www.polytechnichub.com/laser instruments/
3. http://nptel.iitm.ac.in/laser applications./
4. http://web.ewu.edu/
5. http://nptel.iitm.ac.in/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	3	3	3	3	3	1	2
CO2	3	3	3	2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	1	3	3	3	2	3	3	1
CO4	3	3	3	2	2	3	3	3	3	3	2	2
CO5	3	2	3	3	2	3	3	3	2	3	3	3
TOTAL	**15**	**13**	**15**	**11**	**10**	**15**	**15**	**15**	**13**	**15**	**13**	**11**
AVERAGE	**3**	**2.6**	**3**	**2.2**	**2**	**3**	**3**	**3**	**2.6**	**3**	**2.6**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: MEDICAL IMAGING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233V03	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic knowledge of medical physics.

Learning Objectives

1. To understand the fundamental principles of instruments like ECG,EEG including their operation, types, and characteristics.
2. To apply knowledge of the basics of medical imaging, diagnostic specialties, operation theatre and their expanded applications.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	identify medical imaging types, principles, and applications in modern technology.	**K1**
2.	understand bio-potential based instrumentation.	**K2**
3.	apply principles of ECG,EEG into medical systems.	**K3**
4.	analyse medical imaging instrumentation and their applications.	**K4**
5.	evaluate medical systems, their characteristics and diversified applications	**K5**

K1- Remember- **K2-** Understand- **K3 –** Apply- **K4-** Analyze- **K5-** Evaluate

Units	Contents	No. of Hours
I	**DESIGN OF MEDICAL INSTRUMENTS** Components of bio-medical instrumentation – electrodes – electrode potential – metal microelectrode – depth and needle electrodes – types of surface electrode – the pH electrode.	**6**
II	**BIO-POTENTIAL BASED INSTRUMENTATION** Electrocardiography (ECG) – origin of cardiac action potential - ECG lead configuration –block diagram of ECG recording set up– Electroencephalography (EEG)	**6**
III	**APPLICATIONS OF MEDICAL SCANNERS** Medical imaging in nuclear imaging technique –computer tomography (CT) – principle – mathematical basis of image construction –block diagram of CT scanner	**6**
IV	**APPLICATIONS OF MAGNETIC RESONANCE IMAGING** MRI principle and instrumentation- ultrasonic imaging systems – construction of transducer – display modes – image intensifiers – angiography – applications	**6**
V	**OPERATION THEATRE AND SAFETY** Diathermy –electrosurgical diathermy– shortwave, microwave, ultrasonic diathermy – ventilators – servo-controlled systems– pocket type radiation alarm – thermo-luminescence dosimeter.	**6**
	Total	**30**

Self-study	MRI, ECG

Textbooks

1. Leslie Cromwell B.B., 2015. *Biomedical Instrumentation and measurement*, New Age International Publications, NewDelhi.
2. John R. Cameron,James G. Skofronick., 1985, *Medical Physics* M.N.S.,Chand &Co, New Delhi.
3. Ohba R, 2006. *Magnetic resonance imaging*, John Wiley & Sons, New York
4. Pallas Areny R, Webster J G, 1999. *Operation theatre and safety*, John Wiley & Sons, New York.
5. Wayne Tomasi, 1998. *Advanced Electronics communication System, (*4th Edition), Prentice Hall of India, India.

Reference Books

1. Dennis Roody, Coolen. 1995. *Electrosurgical diathermy*. Prentice Hall of India, IV edition, New Jersey: Prentice Hall.
2. Salivahanan S , 2015, *Medical Devices and Circuits*, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Anokh Singh, Chopra A K, 2013. *Principles of medical imaging*, S. Chand & Co Ltd, New Delhi.
4. Chitode J S, 2020. *Digital imaging*, Unicorn publications, Chennai.
5. Senior John, 2010. *ECG*, Pearson Education, India.

Web Resources

2. https://www.geeksforgeeks.org/Medical Devices and Circuits -tutorials/
3. https://www.polytechnichub.com/medical instruments/
4. http://nptel.iitm.ac.in/Digital imaging /
5. http://web.ewu.edu/
6. http://nptel.iitm.ac.in/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	3	3	3	3	3	1	2
CO2	3	3	3	2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	1	3	3	3	2	3	3	1
CO4	3	3	3	2	2	3	3	3	3	3	2	2
CO5	3	2	3	3	2	3	3	3	2	3	3	3
TOTAL	**15**	**13**	**15**	**11**	**10**	**15**	**15**	**15**	**13**	**15**	**13**	**11**
AVERAGE	**3**	**2.6**	**3**	**2.2**	**2**	**3**	**3**	**3**	**2.6**	**3**	**2.6**	**2.2**

3 – Strong, 2- Medium, 1- Low

SEMESTER III / V

SELF LEARNING COURSE SLC: PUBLIC SERVICE EXAMINATION: PHYSICS-I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233SL1/ PU235SL1	-	-	-	-	1	-	-	25	75	100

Pre- requisite:

Knowledge based on mechanics, wave propagation, optics, electrostatics and magnetostatics.

Learning Objectives:

1. To gain knowledge in the behaviour of light waves and understand how these phenomena contribute to the formation of images and optical instruments.
2. To learn the contemporary topics in optics and understand these technologies and their practical applications.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember and understand the fundamental principles and core concepts in mechanics, electrostatics, optics and magnetostatics.	**K1& K2**
2.	apply the mathematical and analytical techniques to solve problems related to mechanics principles- optics- electro and magnetostatics.	**K3**
3.	apply principles of geometrical optics to analyze the behavior of light rays in various optical systems- such as lenses- mirrors- and optical fibers.	**K3**
4.	relate abstract concepts in physics and apply them to real- world phenomena- including understanding the principles behind various physical phenomena and their applications	**K4**
5.	evaluate circuit problems involving series and parallel connections	**K5**

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

Units	Contents
I	**MECHANICS OF PARTICLES AND CONTINUOUS MEDIA** Laws of motion-conservation of energy and momentum-applications to rotating frames-centripetal and Coriolis accelerations- Motion under a central force-Conservation of angular momentum-Kepler's laws-Fields and potentials-Gravitational field and potential due to spherical bodies-Gauss and Poisson equations-gravitational self- energy-Two- body problem-Reduced mass-Rutherford scattering- Centre of mass a laboratory reference frames. Elasticity-Hooke's law and elastic constants of isotropic solids and their inter- relation-Streamline (Laminar) flow-viscosity-Poiseuille's equation-Bernoulli's equation-Stokes' lawand applications. Michelson-Morley experiment and its implications-Lorentz transformations-length contraction-time dilation- the addition of relativistic velocities- aberration- and Doppler effect- mass- energy relation
II	**WAVES AND OPTICS** Simple harmonic motio damped oscillation- forced oscillation and resonance-Beats- Stationary waves in a string- Pulses and wave packets- Phase and group velocities- Reflection and Refraction from Huygens' principle. Laws of reflection and refraction from Fermat's principle- Matrix method in paraxial optics- thin lens formula- nodal planes- system of two thin lenses- chromatic and spherical aberrations. Interference of Light- Young's experiment- Newton's rings- interference by thin films- Michelson interferometer- Multiple beam interference- and Fabry- Perot interferometer. Fraunhofer diffraction- single slit- double slit- diffraction

	grating- resolving power- Diffraction by a circular aperture and the Airy pattern- Fresnel diffraction: half- period zones and zone plates- circular aperture
III	**MODERN OPTICS** Production and detection of linearly and circularly polarised light- Double refraction- quarter wave plate- Optical activity- Principles of fibre optics- attenuation- Pulse dispersion in step index and parabolic index fibres- Material dispersion- single mode fibres- Lasers- Einstein A and B coefficients- Ruby and He- Ne lasers- Characteristics of laser light- spatial and temporal coherence- Focusing of laser beams- Three- level scheme for laser operation- Holography and simple applications.
IV	**ELECTROSTATICS AND MAGNETOSTATICS** Laplace and Poisson equations in electrostatics and their applications- Energy of a system of charges- multiple expansion of scalar potential- Method of images and its applications- Potential and field due to a dipole- force and torque on a dipole in an external field- Dielectrics- polarization- Solutions to boundary-value problems- conducting and dielectric spheres in a uniform electric field- Magnetic shell- uniformly magnetized sphere- Ferro magnetic materials- hysteresis- energy loss.
V	**CURRENT ELECTRICITY** Kirchhoff's laws and their applications- Biot- Savart law- Ampere's law- Faraday's law- Lenz's law- Self- and mutual- inductances- Mean and r m s values in AC circuits- DC and AC circuits with R- L- and C components- Series and parallel resonances- Quality factor- Principle of transformer.

Textbooks

1. Palanisamy P K, 2012. *Engineering Physics*, (1st Edition), India: Scitech Publications (India) Pvt. Ltd.
2. Gupta A B, 2015. *Modern Physics*, (2nd Edition), Books and Allied (p) Ltd, Kolkatta.
3. Subrahmanyam Brijilal N, 2004. *A text book of optics*, (22nd Edition), S.Chand and Company Pvt. Ltd, New Delhi.

Reference Books

1. Arthur Beiser, 2006. *Concepts of Modern Physics*. (6th Edition), Tata McGraw Hill,s India.
2. Subrahmanyam Brijilal N, Avadhanulu M N, 2015. *A text book of Optics*. (25th Edition), S.Chand and Company Pvt. Ltd, Newdelhi.
3. David J Griffiths, 2004. *Introduction to Electrodynamics*. (3rd Edition), Prentice Hall of India Private Ltd.
4. Reitz, 1987. *Foundations of Electromagnetic Theory*, (3rd Edition), Narosa Publishing House, New Delhi.
5. Nayyar N K, 2009. *Unique Quintessence of Physics* (For M.Sc. Entrance Examinations (All Universities) & other Competitive Examinations), Unique Publishers, New Delhi.

Web Resources

1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo
2. https://www.youtube.com/watch?v=JrRrp5F-Qu4
3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/
4. https://www.atoptics.co.uk/atoptics/blsky.htm
5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

MAPPING WITH PROGRAMME OUTCOMES
AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	2	3	3	3	3	3	2
CO2	3	3	2	3	3	3	3	3	3	3	3	2
CO3	3	3	2	3	3	2	3	3	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	2
CO5	3	3	2	3	3	3	3	3	3	3	3	2
TOTAL	**15**	**15**	**10**	**15**	**15**	**13**	**15**	**15**	**15**	**15**	**15**	**10**
AVERAGE	**3**	**3**	**2**	**3**	**3**	**2.6**	**3**	**3**	**3**	**3**	**3**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

CORE COURSE IV: OPTICS AND SPECTROSCOPY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite:

Basic knowledge on wave and ray optics, spectroscopy.

Learning Objectives:

1. To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics and explain the behaviour of light in different mediums.
2. To comprehend the variations in the major phenomena interference, diffraction, and polarization and to use the understanding in day-to-day activities.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces.	**K1**
2	understand the wave nature of light through working of interferometer.	**K2**
3	apply the knowledge of nature of light through diffraction techniques and apply mathematical principles to analyse the optical instruments.	**K3**
4	categorise basic formulation of polarization and appraise its usage in industries.	**K4**
5	evaluate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries	**K5**

K1 - Remember; **K2 -** Understand; **K3** – Apply; **K4 -** Analyse; **K5 -** Evaluate

Units	Contents	No. of Hours
I	**LENS AND PRISMS** Lens maker's formula – Equivalent focal length of two thin lenses separated by a distance. Aberrations: Spherical aberration in a lens – Methods of minimizing Spherical aberration-condition for minimum spherical aberration – Chromatic aberration. Prism: Dispersion, deviation, Achromatic combination of Prisms – Dispersion without deviation –Deviation without dispersion – applications – Direct vision spectroscope.	15
II	**INTERFERENCE** Division of wave front – Fresnel's biprism – fringes with white light – division of amplitude: interference in thin films due to (i) reflected light (ii) transmitted light – air wedge – Newton's rings. Michelson's interferometer – applications, (i) determination of the wavelength of a monochromatic source of light, (ii) determination of the wavelength and separation D_1 and D_2 lines of sodium light.	15
III	**DIFFRACTION** Fresnel's assumptions – zone plate – action of zone plate for an incident spherical wave front – differences between a zone plate and a convex lens – Fresnel type of diffraction – diffraction pattern due to a straight edge– Fraunhofer type of diffraction – Fraunhofer diffraction at a single slit – plane diffraction grating– experiment to determine wavelengths.	15
IV	**POLARISATION** Polarizer and analyser – double refraction – optic axis, principal plane – Huygens's explanation of double refraction in uniaxial crystals – Polaroids and applications – Circularly and elliptically polarized light – quarter wave	15

	plate – half wave plate – Production and detection of circularly and elliptically polarized lights – Fresnel's explanation.	
V	**SPECTROSCOPY** Infra-red spectroscopy-Near infra-red and far infra-red –Properties –IR source- IR Detectors- IR spectrophotometer – applications -Scattering of light – Raman effect - Experimental study of Raman effect –applications – Ultraviolet and visible spectroscopy –properties – UV source – UV Detectors- Spectrographs for UV regions- Applications.	**15**
	Total	**75**

Self-study	Rayleigh's criterion for resolution; Half wave plate; Plane diffraction grating

Textbooks

1. Subramaniam N, Brijlal. 2014. *Optics*, (25th Edition), S.Chand&Co, New Delhi.
2. Gupta S L, Kumar V, Sharma R.C.2017. *Elements of Spectroscopy*, (13th Edition), Pragati Prakashan, Meerut.
3. Aruldhas G, 2000. *Molecular Structure and Spectroscopy*, (2nd Edition), PHI Pvt Ltd, New Delhi.
4. Sasikumar P R, 2012. *Photonics*, PHI Pvt Ltd, New Delhi.
5. Rajagopal K, 2008. *Engineering Physics*, PHI Pvt Ltd, New Delhi.

Reference Books

1. Agarwal B.S. 2011. *Optics*, Kedernath Ramnath Publishers, Meerut.
2. Sathyaprakash. 1990. *Optics*, (7th Edition), Ratan Prakashan Mandhir, New Delhi.
3. Banwell C.N.2006.*Introduction to Molecular Spectroscopy*, (4th Edition), TMH Publishing Co, New Delhi.
4. AjoyGhatak. 2009. *Optics*, (4th Edition), PHI Pvt Ltd, New Delhi.
5. Singh, Agarwal, 2002. *Optics and Atomic Physics*, (9th Edition), PragatiPrakashan Meerut.
6. Halliday D, Resnick R, Walker J.2001. *Fundamentals of Physics*, (6th Edition), Willey, New York.
7. Jenkins A, Francis, White. 2011. *Fundamentals of Optics*, (4th Edition), McGraw Hill Inc., New Delhi.

Web Resources

1. https://science.nasa.gov/ems/
2. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
3. https://science.nasa.gov/ems/
4. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-
5. https://imagine.gsfc.nasa.gov/educators/gammarabursts/imagine/index.html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMMESPECIFICOUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	1	3	3	3	3	3	2
CO2	3	3	2	3	3	1	3	3	3	3	3	2
CO3	3	3	2	3	3	1	3	3	3	3	3	2
CO4	3	3	2	3	3	1	3	3	3	3	3	2
CO5	3	3	2	3	3	1	3	3	3	3	3	2
TOTAL	**15**	**15**	**10**	**15**	**15**	**5**	**15**	**15**	**15**	**15**	**15**	**10**
AVERAGE	**3**	**3**	**2**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

CORE LAB COURSE IV: GENERAL PHYSICS LAB IV

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234CP1	-	-	3	-	**3**	**3**	**45**	**25**	**75**	**100**

Pre-requisite:

Knowledge on basic Physics, Optics and Mathematics.

Learning Objectives:

1. To understand the basic concepts of electromagnetic radiation and their behavior in encounters different mediums, including the principles behind mirrors and lenses
2. To comprehend the principles of interference, diffraction, and polarization.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	identify the dual nature of light, understanding it as both a wave and a particle.	**K1**
2.	understand and explore nonlinear optics, laser spectroscopy, interferometry, and laser-based measurements.	**K2**
3.	use the optical principles involved in the different medium including the principles behind mirrors and lenses.	**K3**
4.	devise light paths through lenses, grating and mirrors.	**K4**
5.	prioritize the applications problems related to laser physics and develop a prototype.	**K5 & K6**

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

Contents (Any Eight experiments)

1. Determination of refractive index of prism using spectrometer.
2. Determination of refractive index of liquid using hollow prism and spectrometer
3. Determination of dispersive power of a prism.
4. Determination of radius of curvature of lens by forming Newton's rings.
5. Determination of thickness of a wire using air wedge.
6. Determination of resolving power of grating
7. Determination of refractive index using Laser.
8. Determination of wavelengths, particle size using Laser/Monochromatic source.
9. Determination of resolving power of telescope
10. Verification of Newton's formula for a lens separated by a distance.
11. Determination of refractive index of a given liquid by forming liquid lens
12. Determination of resolving power of Diffraction grating using Laser
13. Determination of thickness of wire using Laser.

Textbooks

1. Ouseph C, Rao U J, Vijayendran V, 2007. *Practical Physics and Electronics*, S. Viswanathan, Pvt., Ltd. Chennai.
2. Arora C L, 2001. B.Sc. *Practical Physics*, S. Chand Publishing, New Delhi.
3. Srinivasan M N, Balasubramanian S, Ranganathan R, 2013. *A Textbook of Practical Physics*, S. Chand Publishing, New Delhi.
4. Wood L, Sladjana, 2017. *General Physics Lab Manual*, Volume Two (3rd Edition) American Press, United States.
5. Harnam Singh, 2000.B.Sc. *Practical Physics*, S. Chand Publishing, New Delhi.

Reference Books

1. Shukla R K, 2007. *Practical Physics*. New Age International (P) Limited, Publishers. India.

2. Ware M J, Peatross J, 2015. *Physics of Light and Optics* (Black & White Brigham Young University, Department of Physics, United States.
3. James J F, 2014. *An Introduction to Practical Laboratory Optics*, Cambridge University Press, United Kingdom.
4. Meschede D, 2017. *Optics, Light and Lasers: The Practical Approach to Modern Aspects of Photonics and Laser Physics*, Wiley, Purcell Germany.
5. James J F, 2014. *An Introduction to Practical Laboratory Optics*, Cambridge University Press, United Kingdom.

Web Resources

1. https://youtu.be/oRch7irmLvo?si=GGBBqt6w9harEEVW
2. https://youtu.be/_whtX5uXzb4?si=SIUyPIJtoBjqGJq0
3. https://youtu.be/Su8TvWW-j0g?si=XUNsSeh9JiyZdEmX
4. https://youtu.be/0FxfmBLN31s?si=JHRiqmgOR16sGPof
5. https://youtu.be/br6LLJrqYtI?si=Yg1O9ZjxcYe5Knwd

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	2	3	3	3	3	3	2
CO2	3	3	2	3	3	3	3	3	3	3	3	2
CO3	3	3	2	3	3	2	3	3	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	2
CO5	3	3	2	3	3	3	3	3	3	3	3	2
TOTAL	**15**	**15**	**10**	**15**	**15**	**13**	**15**	**15**	**15**	**15**	**15**	**10**
AVERAGE	**3**	**3**	**2**	**3**	**3**	**2.6**	**3**	**3**	**3**	**3**	**3**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE COURSE IV: ALLIED PHYSICS FOR CHEMISTRY – II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Basic knowledge of physics principles, atoms, semiconductors.

Learning Objectives:

1. To obtain an all-encompassing comprehension of the basic ideas of Physics.
2. To analyse the fundamental ideas behind optics, electronics, relativity, and quantum physics.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	explain the notions of interference, diffraction and polarization using principles of superposition of waves.	**K1**
2.	understand the basic foundation of different atom models and periodic classification of elements	**K2**
3.	apply the basic concepts of relativity like inertial frames and get an overview of research projects of National and International importance.	**K3**
4.	relate the properties of nuclei, nuclear forces, structure of atomic nucleus and nuclear models.	**K4**
5.	defend the working of semiconductor devices like junction diode, Zener diode and practical devices.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

Unit	Contents	No. of Hours
I	**OPTICS** Interference – interference in thin films –colours of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double refraction – Brewster's law – optical activity –Application in sugar industry	**12**
II	**ATOMIC PHYSICS** Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Stark effect – Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation	**12**
III	**NUCLEAR PHYSICS** Nuclear models – liquid drop model - shell model – magic numbers – nuclear energy – mass defect – binding energy curve – Natural radioactivity – half life – mean life – nuclear fission and Fusion – comparison –energy released in fission– thermonuclear reactions	**12**
IV	**NUCLEAR REACTORS** Chain reaction – Controlled chain reaction – uncontrolled chain reaction – Atom bomb – nuclear reactor – Construction and Working – breeder reactor – types – Introduction to Department of atomic energy (DAE) – International atomic energy agency (IAEA)	**12**

V	**SEMICONDUCTOR PHYSICS** P-N junction diode – Forward and reverse biasing – characteristic of diode – Zener diode – Characteristic of Zener diode – voltage regulator – USB cell phone charger – Introduction to e-vehicles and EV charging stations	**12**
	Total	**60**

Self-study	Optical activity –Application in sugar industry

Textbooks

1. Murugesan R, 2005. *Allied Physics*, S. Chand & Co, New Delhi.
2. Thangaraj K, Jayaraman D, 2004. *Allied Physics*, Popular Book Depot, Chennai.
3. Gupta A B, 2015. *Modern Physics*, (2nd Edition), Kolkatta Books and Allied (p) Ltd.
4. Hugh D Young, Rogger A, Freedman, 2015. *University Physics with Modern Physics*, Pearson Publishers, Chennai.
5. David Halliday, Robert Resnick, Jearl Walker, 2013. *Fundamentals of Physics*, Wiley Publishers, India.

Reference Books

1. Brijlal N, Subramanyam, 2002. *Textbook of Optics*, S. Chand &Co, New Delhi.
2. Murugesan R, 2005. *Modern Physics*, S. Chand &Co, New Delhi.
3. Ubald Raj A, Jose Robin G, 2004. *Basic Electronics*, Indira Publications. Marthandam.
4. Thomas L Floyd, 2017. *Digital Fundamentals*, (11th Edition), Universal Book Stall. New Delhi.
5. Metha V K, 2004. *Principles of electronics*, (6th Edition), S.Chand and Company. New Delhi.

Web Resources

1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo
2. https://www.youtube.com/watch?v=JrRrp5F-Qu4
3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/
4. https://www.atoptics.co.uk/atoptics/blsky.htm
5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	1	1	2	3	2	2	3	1
CO2	3	3	3	1	2	2	2	3	3	3	3	3
CO3	3	3	2	3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	2	3	2	3	3	3	2	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3
TOTAL	**15**	**15**	**14**	**10**	**11**	**11**	**12**	**15**	**14**	**14**	**14**	**13**
AVERAGE	**3**	**3**	**2.6**	**2**	**2.2**	**2.4**	**2.4**	**3**	**2.8**	**2.8**	**2.6**	**2.6**

3– Strong, 2- Medium, 1- Low

SEMESTER IV

ELECTIVE LAB COURSE II: ALLIED PHYSICS PRACTICAL FOR CHEMISTRY II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234EP1	-	-	2	-	**2**	**2**	**30**	**25**	**75**	**100**

Prerequisite:

Basic Knowledge in physics experiments.

Learning Objectives:

1. To apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves.
2. To set up experimentation for verifying theories, to do error analysis and correlate results.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	identify the nature of monochromatic light and its diffraction and interference phenomenon.	**K1**
2.	understand the concept of frequency measurements.	**K2**
3.	use the physical principle involved in the various instruments to perform experiments.	**K3**
4.	devise scientific method and examine it in practice.	**K4**
5.	defend logic theorems and design simple logic circuits.	**K5 & K6**

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

Contents

(Any Eight Experiments)

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Verification of Newton's law of cooling
4. Specific heat capacity of liquid by cooling method
5. Determination of AC frequency using sonometer
6. Thermal conductivity of poor conductor using Lee's disc
7. Construction of AND, OR, NOT gates using diodes and transistor
8. Characteristics of Zener diode
9. Determination of g using compound pendulum.
10. Determination of refractive index of prism using spectrometer.
11. Construction of Zener/IC regulated power supply

Textbooks

1. Ubald Raj A, Jose Robin G, 2012. *Allied Physics*. Indira Publications, Marthandam.
2. Donald E Simanek, Derek K Senft, 2005. *Laboratory Manual for Introductory Physics*, John Wiley & Sons, United States.
3. David H Loyd, 2012. *Physics Laboratory Manual*, Cengage Learning publishers, Delhi.
4. David Halliday, Robert Resnick, Jearl Walker, 2013. *Fundamentals of Physics*, Wiley Publishers, India.
5. Hugh D Young, Rogger A. Freedman, 2015. *University Physics with Modern Physics*, Pearson Publishers, Chennai.

Reference Books

1. Jerry D Wilson, Cecilia A. Hernández-Hall, 2017. *Physics laboratory experiments*, Cengage Learning publishers, Delhi.

2. Squires G L, 2001. *Practical Physics*, Cambridge University Press. India
3. Savant C. J, 2014. *Experiments in Physics for Students of Science and Engineering*, Cengage Learning publishers, Delhi.
4. Douglas C Giancoli, 2018. *Physics for Scientists and Engineers with Modern Physics*, Pearson Publishers, Chennai.
5. Jerry D Wilson, Cecilia A Hernández-Hall, 2003. *Experimental Physics: Modern Methods*, Cengage Learning publishers, Delhi.

Web Resources

1. https://study.com/academy/lesson/newton-s-law-of-cooling
2. https://byjus.com/physics/zener-diode/
3. https://www.youtube.com/watch?v=zFRWbDpDvtE
4. https://www.youtube.com/watch?v=XuXUtGN928U
5. https://v1.nitj.ac.in/physics/Downloads/lee%20method7831.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	2	3	3	3	3	3	2
CO2	3	3	2	3	3	3	3	3	3	3	3	2
CO3	3	3	2	3	3	2	3	3	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	2
CO5	3	3	2	3	3	3	3	3	3	3	3	2
TOTAL	**15**	**15**	**10**	**15**	**15**	**13**	**15**	**15**	**15**	**15**	**15**	**10**
AVERAGE	**3**	**3**	**2**	**3**	**3**	**2.6**	**3**	**3**	**3**	**3**	**3**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER III / IV

SKILL ENHANCEMENT COURSE SEC-III: FITNESS FOR WELLBEING

Course Code	L	T	P	S	Credits	Total Hours	Marks		
							CIA	External	Total
UG23CSE1	1	-	1	-	2	30	25	75	100

Pre-requisites: Basic understanding of health and wellness concepts

Learning Objectives

1. To understand the interconnectedness of physical, mental, and social aspects of well-being, and recognize the importance of physical fitness in achieving holistic health.
2. To develop proficiency in mindfulness techniques, yoga practices, nutritional awareness, and personal hygiene practices to promote overall wellness and healthy lifestyle.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	know physical, mental, and social aspects of health	K1
2	understand holistic health and the role of physical fitness.	K2
3	apply mindfulness and yoga for stress management and mental clarity.	K3
4	implement proper personal hygiene practices for cleanliness and disease prevention.	K3
5	evaluate and implement right nutritional choices.	K5

K1-Remember; **K2**-Understand; **K3**-Apply; **K5**-Evaluate

Unit	Contents	No. of Hours
I	**Understanding Health and Physical Fitness** Health – definition- holistic concept of well-being encompassing physical, mental, and social aspects. Physical fitness and its components- muscular strength- flexibility, and body composition. Benefits of Physical Activity- its impact on health and well-being.	6
II	**Techniques of Mindfulness** Mind – Mental frequency, analysis of thought, eradication of worries Breathing Exercises – types and its importance Mindfulness –pain management - techniques for practicing mindfulness - mindfulness and daily physical activities.	6
III	**Foundations of Fitness** Stretching techniques to improve flexibility. Yoga-Definition, yoga poses (asanas) for beginners, Sun Salutations (Surya Namaskar), Yoga Nidra – benefits of yoga nidra.	6
IV	**Nutrition and Wellness** Role of nutrition in fitness - macronutrients, micronutrients - mindful eating practices, balanced diet - consequences of overeating. Components of healthy food. Food ethics.	6
V	**Personal Hygiene Practices** Handwashing- techniques, timing, and importance, oral hygiene- brushing, flossing, and dental care, bathing and showering- proper techniques and frequency, hair care- washing, grooming, and maintaining cleanliness, maintaining personal hygiene, dangers of excessive cosmetic use.	6
	Total	30

Self-study	Balance diet and basic excercises

Textbook

Bojaxa A. Rosy and Virgin Nithya Veena. V. 2024. *Fitness for Wellbeing*.

Reference Books

1. Arul Raja Selvan S. R, 2022. *Yogasanam and Health Science*. Self publisher.
2. Vision for Wisdom. 2016. *Value Education*. The World Community Service Centre Vethathiri Publications.
3. WCSC – Vision for Wisdom. 2016. *Paper 1: Yoga and Empowerment*. Vazhga Valamudan Offset Printers Pvt Ltd 29, Nachiappa St, Erode.
4. Lachlan Sleigh. 2023. *Stronger Together the Family's Guide to Fitness and Wellbeing*. Self Publisher.
5. William P. Morgan, Stephen E. Goldston. 2013. *Exercise And Mental Health*. Taylor & Francis.

Web Resources

1. https://www.google.co.in/books/edition/Psychology_of_Health_and_Fitness/1lYOAwAABAJ?hl=en&gbpv=1&dq=fitness+for+wellbeing&printsec=frontcover
2. https://www.google.co.in/books/edition/The_Little_Book_of_Active_Wellbeing/aA6SzgEACAAJ?hl=en
3. https://www.google.co.in/books/edition/Physical_Activity_and_Mental_Health/yu96DwAAQBAJ?hl=en&gbpv=1&dq=fitness+for+wellbeing&printsec=frontcover
4. https://www.google.co.in/books/edition/The_Complete_Manual_of_Fitness_and_Well/pLPAXPLIMv0C?hl=en&gbpv=1&bsq=fitness+for+wellbeing&dq=fitness+for+wellbeing&printsec=frontcover
5. https://www.google.co.in/books/edition/The_Wellness_Code/4QGZtwAACAAJ?hl=en

SEMESTER IV

ENVIRONMENTAL STUDIES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234EV1	2	-	-	-	2	2	30	25	75	100

Pre-requisite: Interest to learn about nature and surrounding.

Learning Objectives

1.To know the different types of pollutions, causes and effects

2.To understand the importance of ecosystem, resources and waste management

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	know the different kinds of resources, pollution and ecosystems	**K1**
2.	understand the biodiversity and its constituents	**K2**
3.	use the methods to control pollution and, to conserve the resources and ecosystem	**K3**
4.	analyse the factors behind pollution, global warming and health effects for sustainable development	**K4**
5.	evaluate various water, disaster and waste management systems	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

Units	Contents	No. of Hours
I	**Nature of Environmental Studies** Multidisciplinary nature of environmental studies- scope of environmental studies - environmental ethics-importance- types- natural resources - renewable and non-renewable resources – forest, land, water and energy resources.	**6**
II	**Biodiversity and its Conservation** Definition: genetic, species of biodiversity - biodiversity hot-spots in India - endangered and endemic species of India – Red Data Book - In-situ and Ex-situ conservation of biodiversity. Ecosystem- types - structure and function - food chain - food web- ecological pyramids- forest and pond ecosystems.	**6**
III	**Environmental Pollution** Pollution - causes, types and control measures of air, water, soil and noise pollution. Role of an individual in prevention of pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Disaster management– cyclone, flood, drought and earthquake.	**6**
IV	**Environmental Management and Sustainable Development** From unsustainable to sustainable development -Environmental Law and Policy – Objectives; The Water and Air Acts-The Environment Protection Act -Environmental Auditing-Environmental Impact Assessment-Life Cycle Assessment- Human Health Risk Assessment, Water conservation, rain water harvesting, watershed management.	**6**
V	**Social Issues and the Environment** Population explosion-impact of population growth on environment and social environment. Women and Child Welfare, Role of information technology in environment and human health. Consumerism and waste products. Climate change - global warming, acid rain and ozone layer depletion. **Field work:** Address environmental concerns in the campus (or) Document environmental assets- river / forest / grassland / hill / mountain in	**6**

	the locality (or) Study a local polluted site-urban / rural / industrial / agricultural area.	
	Total	**30**

Self-study	Pollutants, Ecosystems and Resources

Textbook

Punitha A and Gladis Latha R, 2024. Fundamentals of Environmental Science.

Reference Books

1. Agarwal, K.C., 2001. *Environmental Biology*, Nidi Publishers. Ltd. Bikaner.
2. Brunner R.C., 1989, *Hazardous Waste Incineration*, McGraw Hill Ltd.
3. Gorhani, E & Hepworth, M.T. 2001. *Environmental Encyclopedia*, Jaico Publ. House, Mumbai.
4. De A.K.,2018. *Environmental Chemistry*, Wiley Eastern Ltd.
5. Gleick, H.P. 1993. *Water in crisis*, Pacific Institute for Studies Oxford Univ. Press.

Web Resources

1.https://www.sciencenews.org/topic/environment
2.https://news.mongabay.com/2024/05/
3. https://www.sciencedaily.com/news/earth_climate/environmental_issues/
4.https://wildlife.org/rising-oryx-numbers-may-distress-new-mexico-ecosystem/
5. https://phys.org/news/2024-02-global-wild-megafauna-ecosystem-properties.html

SEMESTER III & IV

LIFE SKILL TRAINING II: CATECHISM

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234LC1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To develop human values through value education
2. To understand the importance of personal development to lead a moral life

Course Outcomes

On the successful completion of the course, student will be able to:		
1	know and understand the aim and importance of value education	K1,K2
2	get rid of inferiority complex and act confidently in the society	K3
3	live lovingly by facing loneliness and make decisions on their own	K3
4	develop human dignity and able to stand bravely in adversity	K6
5	learn unity in diversity and grow in a life of grace	K6

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Face Loneliness:** Loneliness – Causes for Loneliness – Loneliness in Jesus Christ Life – Ways to Overcome Loneliness – Need and Importance Bible Reference: Matthew: 6:5-6	3
II	**Inferiority Complex:** Inferiority Complex - Types – Ways to Get Rid of Inferiority Complex – Words of Eric Menthol – Balanced Emotion – Jesus and his Disciples. Bible Reference: Luke 8:43-48	3
III	**Decision Making:** Importance of Decision Making – Different Steps – Search – Think – Pray – Decide- Jesus and his Decisions Bible Reference: Mathew 7:7-8 **Independent:** Freedom from Control – Different Types of Freedom - Jesus the Liberator Bible Reference: Mark 10:46-52	3
IV	**Human Dignity:** Basic Needs – Factors that Degrade Human Dignity – How to Develop Human Dignity. Bible Reference: Luke 6:20-26 **Stand Bravely in Adversity:** Views of Abraham Maslow – Jesus and his Adversity. Bible Reference: Luke 22:43	3
V	**Unity in Diversity:** Need for Unity – The Second Vatican Council on the Mission of Christian Unity. Bible Reference: I Corinthians 1:10 **To Grow in a Life of Grace:** Graceful Life – View of Holy Bible – Moses – Amos – Paul – Graceful Life of Jesus Bible Reference: Amos 5:4	3
TOTAL		**15**

Textbooks

Valvukku Valikattuvom, Christian Life Committee, Kottar Diocese

The Holy Bible

SEMESTER III & IV

LIFE SKILL TRAINING II: MORAL

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234LM1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To cultivate human values through value education
2. To comprehend the importance of humane and morals to lead ethical and moral life.

Course Outcome

On the successful completion of the course, student will be able to:		
1	know the significance of life	K1
2	understand the importance of self-care	K2
3	realise the duty of youngsters in the society and live up to it	K3
4	analyse how to achieve success in profession	K4
5	develop mystical values by inculcating good thoughts	K5

K1 - Remember; K2 - Understand; K3 – Apply; K4 - Analyse; K5 – Evaluate

Unit	Contents	No. of Hours
I	**Edu Care:** Introduction- -Personal Care-Temple of Mind-Emotional stability- Inner views- Internal and external Beauty- Life is a Celebration	**3**
II	**Self-care:** Self- discipline- Selfishness in doing good things- Adolescence stage- What am I? - Self-esteem- Self-Confidence- Respect for womanhood	**3**
III	**Profession based Values:** Time Management-Continuous effort- What next? –Present moment is yours, Hard work and Smart Work-Broad view- destruct your failures	**3**
IV	**Mystical Values:** Thoughts- Positive and negative thoughts- Origin of negative thoughts-Moralisation of needs- Elimination of obstacles	**3**
V	**Society and you:** Knowing Humanity-Thankfulness- love and happiness-Honesty- Heroism -Youth is gift of God-Youngsters in politics and social media utilization.	**3**
TOTAL		**15**

Text Book

"Munaetrathin Mugavari", G. Chandran, Vaigarai Publisher.

SEMESTER IV/ VI

SELF LEARNING COURSE: PUBLIC SERVICE EXAMINATION: PHYSICS- II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234SL1/ PU236SL1	-	-	-	-	1	-	-	**25**	**75**	**100**

Pre-requisite:

Knowledge based on Quantum Mechanics, thermodynamics, atomic, molecular and nuclear physics.

Learning Objectives:

1. To provide a structured approach to understand both electromagnetic waves and quantum mechanics, covering fundamental concepts, mathematical frameworks, experimental evidence, and real-world applications.
2. To equip students with the knowledge, skills and abilities necessary to understand, analyze and design electronic systems based on solid-state devices, fostering their intellectual development.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember the principles of electromagnetic theory, including Maxwell's equations and their applications.	**K1**
2.	understand the key principles of quantum mechanics, including quantization, superposition, and wave-particle duality.	**K2**
3.	apply thermodynamic principles for solving problems related to energy, heat transfer, and the behavior of thermodynamic systems.	**K3**
4.	analyse atomic structure, quantum mechanical models, and atomic spectra.	**K4**
5.	evaluate the characteristics and operation of semiconductor devices, including voltage-current relationships, small-signal behavior, and determine the frequency response	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

Units	Contents
I	**ELECTROMAGNETIC WAVES AND BLACKBODY RADIATION** Displacement current and Maxwell's equations- Wave equations in vacuum, Pointing theorem -Electromagnetic field tensor, covariance of Maxwell's equations- Wave equations in isotropic dielectrics, reflection and refraction at the boundary of two dielectrics- Fresnel's relations- Total internal reflection; Normal and anomalous dispersion-Rayleigh scattering; Black body radiation and Planck's radiation law, Stefan - Boltzmann law, Wien's displacement law and Rayleigh-Jeans' law.
II	**QUANTUM MECHANICS** Wave-particle duality- Schrodinger equation and expectation values; Uncertainty principle- Solutions of the one-dimensional Schrodinger equation for a free particle (Gaussian wave-packet), particle in a box, particle in a finite well, linear harmonic oscillator- Reflection and transmission by a step potential and by a rectangular barrier- Particle in a three-dimensional box, density of states, free electron theory of metals- Angular momentum- Hydrogen atom -Spin half particles, properties of Pauli spin matrices.
III	**THERMODYNAMICS** Laws of thermodynamics, reversible and irreversible processes, entropy-

	Isothermal, adiabatic, isobaric, isochoric processes and entropy changes- Otto and Diesel engines- Gibbs' phase rule and chemical potential- Vander Waals equation of state of a real gas, critical constants- Maxwell-Boltzmann distribution of molecular velocities, transport phenomena, equipartition, and virial theorems- Dulong-Petit, Einstein, and Debye's theories of specific heat of solids- Maxwell relations and applications; Clausius- Clapeyron equation.
IV	**ATOMIC AND MOLECULAR PHYSICS** Stern-Gerlach experiment, electron spin, fine structure of hydrogen atom; L-S coupling, J-J coupling- Spectroscopic notation of atomic states- Zeeman effect; Frank Condon principle and applications- Elementary theory of rotational, vibrational and electronic spectra of diatomic molecules- Raman effect and molecular structure- Laser Raman spectroscopy; Importance of neutral hydrogen atom, molecular hydrogen and molecular hydrogen ion in astronomy- Fluorescence and Phosphorescence- Elementary theory and applications of NMR.
V	**SOLID STATE PHYSICS, DEVICES AND ELECTRONICS** Crystalline and amorphous structure of matter- Different crystal systems, space groups- Methods of determination of crystal structure- X-ray diffraction, scanning, and transmission electron microcopies; Band theory of solids - conductors, insulators and semiconductors- Thermal properties of solids, specific heat, Debye theory- Magnetism: para and ferromagnetism; Elements of superconductivity, Meissner effect, Josephson junctions, and applications- Elementary ideas about high-temperature superconductivity. Intrinsic and extrinsic semiconductors; p-n-p and n-p-n transistors; Amplifiers and oscillators- Op-amps- Digital electronics-Boolean identities, DeMorgan's laws, logic gates, and truth tables; Simple logic circuits- Thermostats, solar cells- Fundamentals of microprocessors and digital computers.

Textbooks

1. Murugesan S., 2014. *Modern Physics*, S. Chand Publishing, New Delhi, India.
2. Nayyar N K, 2009. *Unique Quintessence of Physics* (For M.Sc. Entrance Examinations (All Universities) & other Competitive Examinations) Unique Publishers, New Delhi.
3. Arthur Beiser, 2006. *Concepts of Modern Physics*. Tata Mc Graw Hill ,India.

Reference Books

1. Aruldhas, G. 2005. *Quantum Mechanics*. Prentice-Hall of India, New Delhi.
2. Donald. P. Leach, Albert Paul Malvino, 2002. *Digital Principles and Applications*. (5th Edition), Tata, Mc Graw Hill publishing company Ltd., New Delhi.
3. Aruldhas, G., Rajagopal, R. 2005. *Modern Physics*. Prentice Hall of India Pvt Limited, India.
4. Halliday D, Resnick R, Walker J, 2001. *Fundamentals of Physics*, (6th Edition), Willey, New York.
5. Jenkins A, Francis, White. 2011. *Fundamentals of Optics*, (4th Edition), McGraw Hill Inc., New Delhi.

Web Resources

1. https://science.nasa.gov/ems/
2. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
3. https://science.nasa.gov/ems/

4. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
5. https://imagine.gsfc.nasa.gov/educators/gammaraybursts/imagine/index.html

MAPPING WITH PROGRAMME OUTCOMES
AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	2	3	3	3	3	3	2
CO2	3	3	2	3	3	3	3	3	3	3	3	2
CO3	3	3	2	3	3	2	3	3	3	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	2
CO5	3	3	2	3	3	3	3	3	3	3	3	2
TOTAL	**15**	**15**	**10**	**15**	**15**	**13**	**15**	**15**	**15**	**15**	**15**	**10**
AVERAGE	**3**	**3**	**2**	**3**	**3**	**2.6**	**3**	**3**	**3**	**3**	**3**	**2**

3 – Strong, 2- Medium, 1- Low

SEMESTER V

CORECOURSE V: ATOMIC PHYSICS AND LASERS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235CC1	5	-	-		4	5	75	25	75	100

Pre-requisite:

Students should understand the atomic models, quantum mechanics, electromagnetic waves, experimental techniques related to charge and mass measurements.

Learning Objectives:

1. To understand the relativistic model, vector atom model and practical applications of photoelectric cells
2. To get knowledge on the working principles of lasers and to analyze spectral line splitting

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	understand the different types of crystal imperfections and their effects on material properties	**K1**
2.	interpret the concepts of elastic and inelastic behavior of materials at an atomic level.	**K2**
3.	utilize non-linear optical (NLO) materials in designing optical communication and laser systems.	**K3**
4.	analyze the working principles of NLO materials, LEDs and LCDs for display applications	**K3&K4**
5.	assessthesuitabilityofvarioustestingtechniquesforevaluatingmaterial properties	**K5**

K1-Remember;**K2**-Understand;**K3** -Apply;**K4** -Analyze;**K5** -Evaluate

Units	Contents	No. of Hours
I	**THE ELECTRON AND POSITIVE RAYS:** Introduction**,** e/m of electron by Dunnington's method –charge of electron by Millikan's oil drop method – properties of positive rays –e/m of positive rays by Thomson's parabola method (problems calculation of e/m ratio of positive rays)– mass spectrographs and uses–Bainbridge and Dempster's mass spectrographs	**15**
II	**ATOMIC STRUCTURE:** Sommerfield's relativistic atom model – vector atom model –various quantum numbers – L-S and J-J coupling – Pauli's exclusion principle–magnetic dipole moment of an electron due to orbital and spin motion – Bohr magneton - Stern and Gerlach experiment – Lande 'g' factor.	**15**
III	**SPLITTING OF SPECTRAL LINES:** Excitation, ionization and critical potentials – Davis and Goucher's method – optical spectra – spectral notation and selection rules – fine structure of sodium D-line – Zeeman effect – experimental arrangement - Larmor's theorem – anomalous Zeeman effect–Paschen Back effect - Stark effect (Qualitative only).	**15**

IV	**LASERS: g**eneral principles of lasers – properties of lasers action – spontaneous and stimulated emission – population inversion – optical pumping – He-Ne laser (principle and working) – semiconductor laser – **s**olid state laser: ruby laser, Nd: YAG laser –laser applications– holography	**15**
V	**Applications of LASER:** application of laser in metrology – optical communication – material processing: laser instrumentation of material processing, powder feeder, laser heating, laser welding, laser melting – medical application – Laser instrumentation for surgeries–laser in astronomy	**15**
	Total	75
Self Study	Semiconductor laser	

Textbooks

1. R. Murugeshan & Kiruthiga Sivaprasath .2016. *Modern Physics*,(18th Edition). S. Chand & Company, New Delhi. Vol.1
2. M. N. Avadhanulu & P. S. Hemne .2012. *An Introduction to Lasers – Theory and Applications* (First Edition), S. Chand & Company, New Delhi.

Reference Books

1. Brij Lal & N. Subrahmanyam .2007. *Atomic and Nuclear Physics*. S. Chand & Company.
2. D. L. Sehgal, K. L. Chopra, & N. K. Sehgal .2013. *Modern Physics* (9th Edition). Sultan Chand & Sons.
3. B. B. Laud. 2021. *Lasers and Non-linear Optics* (Latest Edition). New Age International Publishers, New Delhi.
4. Beiser, A. 2003. *Concepts of Modern Physics*, Vol. 1, (6th Edition), McGraw Hill, New York.
5. Girish, K.M .2023. *Lasers and its Applications*, Vol. 1, (1st Edition), Notion Press, Chennai.

Web Resources

1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
2. https://makingphysicsfun.files.wordpress.com/2015/01/photoelectric-effect.pptx
3. https://www.khanacademy.org/science/physics/quantum-physics/in-in-nuclei/v/types-of-decay
4. https://www.khanacademy.org/science/in-in-class-12th-physics-india/nuclei
5. https://ocw.mit.edu/courses/8-421-atomic-and-optical-physics-i-spring-2014/

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	2	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	3	3	3	3	1	3	3	2	3	3	3
TOTAL	**15**	**15**	**15**	**15**	**13**	**12**	**12**	**14**	**14**	**15**	**15**	**15**
AVERAGE	**3**	**3**	**3**	**3**	**2.6**	**2.4**	**2.4**	**2.8**	**2.8**	**3**	**3**	**3**

3– Strong,2-Medium,1-Low

SEMESTER V

CORE COURSE VI: RELATIVITY AND QUANTUM MECHANICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235CC2	5	–	–	–	4	5	75	25	75	100

Pre–requisite:

Basic knowledge of physics principles, relativity and wave functions.

Learning Objectives:

1. To learn the importance of transformation equations and also to differentiate between special and general theory of relativity.
2. To interpret the wave theory of matter with various theoretical and experimental evidences.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	gain knowledge in the concepts of relativity and quantum mechanics	**K1**
2.	understand the various theory of relativity, transformation relation, matter waves, operators and schrodinger equations.	**K2**
3.	realize the wave nature of matter, use of operators the relativity theories and Schrödinger equation to simple problems.	**K3**
4.	appreciate the importance of transformation equations, theory of relativity, wave nature and operators in quantum mechanics**.**	**K4**
5.	derive schrodinger equation and transformation relations for the system.	**K5**

K1-Remember**; K2**-Understand**; K3**–Apply**; K4**-Analyse**; K5–** Evaluate

Units	Contents	No. of Hours
I	**SPECIAL THEORY OF RELATIVITY:** Michelson-Morley experiment**–**frames of reference – Galilean Relativity – postulates of special theory of relativity – Lorentz transformation – consequences – time dilation–concept of simultaneity– Doppler effect – length contraction–variationofmasswithvelocity–Einstein'smass-energyrelation– Relativistic momentum–energy relation	**15**
II	**TRANSFORMATIONRELATIONS:** Transformation of velocity, mass, energy and momentum–four vector– Invariance under transformation–Lorentz transformation and velocity addition equations in terms of hyperbolic functions. **GENERAL THEORY OF RELATIVITY:** Inertial and Gravitational mass– Principle of equivalence–Experimental evidences for General theory of Relativity	**15**
III	**PHOTONSANDMATTER WAVES:** Difficulties of classical physics and origin of quantum theory –black body radiation – Planck's law – Einstein's photoelectric equation –Compton effect – pair production–De Broglie waves–phase velocity and group velocity–Davisson and Germer's experiment –uncertainty principle – consequences – illustration of Gamma ray microscope.	**15**

IV	**OPERATORSANDSCHRÖDINGEREQUATION:** Postulates of quantum mechanics – Wave function and its interpretation – Schrödinger's equation – linear operators – Eigen value – Hermitian operator – properties of Hermitian operator– observable – operators for position, linear Momentum, angular momentum components–commutator algebra–commutator between these operators –expectation values of position and momentum – Ehrenfest theorem.	**15**
V	**SOLVINGSCHRÖDINGEREQUATIONFORSIMPLEPROBLEMS:** One-dimensional problems :(i)particle in a box(ii)barrier penetration problem – quantum mechanical tunneling, (iii) linear harmonic oscillator. higher dimensional problems: (i) Rigid rotator (qualitative)(ii) Hydrogen atom (qualitative).	**15**
	Total	**75**
Self-study	De Broglie waves, uncertainty principle.	

Textbooks

1. PuriS.P.2013.*Special Theory of Relativity*, Pearson Education, New Delhi.
2. BeiserA.2003.*Concepts of Modern Physics*,(6thEdition), McGraw-Hill,Inc., New Delhi.

Reference Books

1. Murugeshan R., Kiruthiga Sivaprasath. 2014. *Modern Physics*, (17th Revised Edition,) S. Chand & Co, New Delhi.
2. Singh S.P, Bagde M.K.2000.*Quantum Mechanics*, S.Chand & Co.New Delhi.
3. Satyaprakash, SwatiSaluja. *Quantum mechanics*. Kedar Nath Ram Nath &Co.
4. PeterJ. Nolan.2014.*FundamentalsofModernPhysics*, (1stEdition),by Physics.
5. Mathews &Venkatesan, 2008. *A Text Book of Quantum Mechanics*, Tata McGraw Hill, New Delhi.

Web Resources

1. http://hyperphysics.phy-astr.gsu.edu/hbase/qapp.html
2. https://swayam.gov.in/nd2_arp19_ap83/preview
3. https://swayam.gov.in/nd1_noc20_ph05/preview
4. https://www.khanacademy.org/science/physics/special-relativity/minkowski spacetime/v/introduction-to-special-relativity-and-minkowski-spacetime-diagrams
5. https://phys.libretexts.org/Bookshelves/Nuclear_and_Particle_Physics/Introduction_to_Applied_Nuclear_Physics_(Cappellaro)/02%3A_Introduction_to_Quantum_Mechanics/2.05%3A_Operators_Commutators_and_Uncertainty_Principle

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	2	3	1	1	3	3	3	3	2
CO2	3	2	1	2	3	1	1	3	3	3	3	2
CO3	3	2	1	2	3	1	1	3	3	3	3	2
CO4	3	2	1	2	3	1	1	3	3	3	3	2
CO5	3	2	1	2	3	1	1	3	3	3	3	2
TOTAL	**15**	**10**	**5**	**10**	**15**	**5**	**5**	**15**	**15**	**15**	**15**	**10**
AVERAGE	**3**	**2**	**1**	**2**	**3**	**1**	**1**	**3**	**3**	**3**	**3**	**2**

SEMESTER V

CORE LAB COURSE V: GENERAL PHYSICS LAB V

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235CP1	-	-	3	-	2	3	45	25	75	100

Pre-requisite:

Knowledge on wave properties of light, applications of a Ballistic Galvanometer (B.G), thermal conductivity and heat flow in solids and propagation of sound waves.

Learning Objectives:

1. To understand and analyze the principles of optics, electromagnetism, and thermal physics through experimental techniques, including spectrometry, diffraction grating, and ballistic galvanometer measurements.
2. To develop hands-on skills in precision measurements and data analysis for determining optical properties, inductance, sound velocity, and thermal conductivity of materials, enhancing experimental and analytical capabilities in physics.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall fundamental principles of optics, diffraction, interference and thermal conductivity.	**K1&K2**
2.	apply experimental methods to determine optical parameters, measure inductance.	**K3**
3.	analyze experimental data to determine dispersive power, mutual inductance, and material properties.	**K4**
4.	assess and interpret experimental results to verify theoretical concepts and improve measurement accuracy in optical, electrical, and thermal systems.	**K5**
5.	develop prototypes using physics concepts.	**K6**

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

Contents (Any Six Experiments)
1. Spectrometer: Diffraction grating-Normal incidence. Wavelength of Mercury spectral lines.
2. Spectrometer: Diffraction grating-Minimum deviation.
3. Spectrometer: Hartmann's Interpolation.
4. Spectrometer: Oblique incidence
5. Spectrometer: Dispersive power of plane diffraction grating.
6. Brewster's law- polarization
7. Figure of Merit using B.G -Charge Sensitivity
8. Comparison of Mutual Inductance using B.G
9. Absolute Determination of Mutual Inductance using B.G
10. Thickness of a thin film using Bi-prism
11. Kundt's tube–Velocity of sound, Adiabatic Young's modulus of the material of the rod.
12. Forbe's method– Thermal conductivity of a metal rod.

Text Books:

1. Chauhan S. P., C. L. Arora, 2021. B.Sc. Practical Physics. S. Chand Publishing, New Delhi, India.
2. Singh R. K., 2019. Practical Physics: A Laboratory Manual. Pearson Education, New Delhi, India.

Reference Books:

1. Shukla R.P., Anchal Srivastava, 2016. Experimental Physics: Principles and Methods, New Age International, New Delhi, India.
2. Arthur Beiser, 2003.Concepts of Modern Physics, McGraw-Hill, NewYork, United States.
3. Eugene Hecht, 2017. Optics, Pearson, Harlow, United Kingdom.
4. David Halliday, Robert Resnick, Jearl Walker, 2013. Fundamentals of Physics, Wiley, Hoboken, United States.
5. Francis A., Harvey E.White, 2001. Fundamentals of Optics, McGraw-Hill, New York, United States.

Web Resources:

1. https://ocw.mit.edu/courses/physics/
2. https://nptel.ac.in/courses/115/101/115101005/
3. http://hyperphysics.phy-astr.gsu.edu/
4. https://phet.colorado.edu/en/simulations/category/physics
5. https://www.khanacademy.org/science/physics/light-waves

MAPPING WITH PROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	2	2	2	2	2	2	3	3	2
TOTAL	**15**	**15**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**15**	**15**	**14**
AVERAGE	**3**	**3**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**3**	**3**	**2.8**

3– Strong,2-Medium,1-Low

SEMESTER V

CORE LAB COURSE VI: GENERAL PHYSICS LAB VI

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235CP2	-	-	2	-	2	2	30	25	75	100

Prerequisite:

Knowledge on basic concepts of ICs, Transistors, Multivibrators and Op-amps

Learning Objectives:

1. To understand the role of different components in generating pulses and stable signals.
2. To observe the frequency generation and stability of the oscillator circuits.

Course Outcomes

On the successful completion of the course, students will able to:		
1.	recall the basic concepts of transistors, multivibrators and Operational amplifiers.	**K1& K2**
2.	design and analyze transistor-based oscillators, including Colpitt's and Hartley oscillators, and evaluate their frequency stability.	**K3**
3.	construct and test astable, monostable, and bistable multivibratorsusingIC555timers	**K3**
4.	verify De Morgan's theorem and implement NOR gate as a universal gate using digital ICs.	**K3**
5.	design and implement half adders, full adders, half subtractors, and full subtractors using basic logic gates.	**K4**

K1–Remember; **K2**–Understand; **K3**-Apply; **K4**-Analyze

Contents (Any Six Experiments)
1. Colpitt's oscillator using transistor
2. Hartley oscillator using transistor
3. Astable multivibrator using IC555
4. Verification of De Morgan's theorem using ICs–NOT,OR,AND
5. NOR as universal building block
6. Half adder / Full adder using basic logic gate ICs
7. Monostable Multivibrator using IC555
8. Encoder using IC or Equivalent circuit
9. Half subtractor /Full subtractor using basic logic gate ICs
10. Bistable multivibrator using transistor
11. FET-characteristics.
12. FET–amplifier(common drain)

Text Books

1. Gayakwad, RamakantA.2000.*Op-Amps and Linear Integrated Circuits.* Pearson Education, New Delhi, India.
2. Boylestad, Robert L.,and Louis Nashelsky.2017. *Electronic Devices and Circuit Theory.* Pearson Education, New Delhi, India.

Reference Books

1. Bell, DavidA. 2015. *Electronic Devices and Circuits.* Oxford University Press, New Delhi, India.
2. Mano, M. Morris, and Michael D. Ciletti.2018.*Digital Design.* Pearson Education, New Delhi, India.

3. Jain,R.P.2010. *Modern Digital Electronics.*Mc Graw Hill Education, NewDelhi, India.
4. Millman, Jacob, and Christos C.Halkias.2010. *Electronic Devices and Circuits.* McGraw Hill Education, New Delhi, India.
5. Louis Nashelsky.2015. *Electronic Devices.* Pearson Education, New Delhi, India.

Web Resources:

1. https://www.allaboutcircuits.com/
2. https://www.electronics-tutorials.ws/
3. https://www.khanacademy.org/science/electrical-engineering
4. https://www.allaboutcircuits.com/
5. https://circuitdigest.com/

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	P O1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	2	2	3	2	2	2	3	3	2
TOTAL	**14**	**15**	**14**	**14**	**14**	**15**	**14**	**14**	**14**	**15**	**15**	**14**
AVERAGE	**2.8**	**3**	**2.8**	**2.8**	**2.8**	**3**	**2.8**	**2.8**	**2.8**	**3**	**3**	**2.8**

3– Strong,2-Medium,1-Low

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE I: a) ENERGY PHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235DE1	-	4	-	-	3	4	60	25	75	100

Pre-requisite:

Students should know the different energy sources and their principles

Learning Objectives:

1. To get the understanding of the conventional and non-conventional energy sources, their conservation and storage systems.
2. To realize the significance of energy consumption as a measure of prosperity.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	explain the importance of energy consumption and assess the availability, advantages, and limitations of conventional and non-conventional energy sources.	**K1**
2.	describe the fundamentals of different energy sources, and applications such as solar cookers, water heaters, and solar cells.	**K2**
3.	examine the principles of energy conversion, identify components of Energy Conversion Systems(ECS),and explore the potential of different energies.	**K3**
4.	describe the significance of different energy sources and energy storage systems.	**K4**
5.	classify different energy sources, explain energy conversion technologies, and understand the processes involved.	**K5**

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

Units	Contents	No. of Hours
I	**INTRODUCTION TO ENERGY SOURCES:** Energy consumption as a measure of prosperity – world energy future – energy sources and their availability – conventional energy sources – non-conventional and renewable energy sources – comparison – merits and demerits.	12
II	**SOLAR ENERGY:** Solar energy Introduction – solar constant – solar radiation at the Earth's surface – solar radiation geometry – Solar radiation measurements – solar radiation data –solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse –types of greenhouses – solar cells –Schematic diagram for small, medium and major solar plants(1 kW,2kW, 10kW).	12
III	**WIND ENERGY:** Introduction –nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation – basic components of Wind Energy Conversion Systems(WECS)–advantages and disadvantages of WECS– applications–tidal energy	12
IV	**BIOMASS ENERGY:** Introduction – classification – biomass conversion technologies –photosynthesis – fermentation - biogas generation –classification of biogas plants–anaerobic digestion for biogas– wood gasification–advantages & disadvantages.	12

V	**ENERGY STORAGE:** Importance of energy storage- batteries - lead acid battery -nickel-cadmium battery – fuel cells – types of fuel cells–advantages and disadvantages of fuel cells– Applications of fuel cells- hydrogen storage.	**12**

Self study	Advantages and disadvantages of fuel cells- Applications of Fuel Cells

Textbooks:

1. Rai, G.D. 2009. Non-Conventional Sources of Energy (Fourth Edition) Published by Khanna Publishers, New Delhi.
2. Sukhstme, S.P.Nayak, J.K.2008. Solar Energy, Principles of Thermal Collection and Storage, (Third Edition)) Published by McGraw Hill (India).

Reference Books

1. JohnTwidell.TonyWeir.2005.Renewable Energy Resources (Second Edition) Published by Taylor & Francis.
2. Abbasi S.A. Nasema Abbasi.2008.Renewable Energy sources and their environmental impact, Published by PHI Learning Pvt. Ltd,
3. Agarwal, M. P.1982.SolarEnergy, Published by S. Chand & Co. Ltd., New Delhi.
4. Jain,H.C.1986.Non-Conventional Sources of Energy, , Published by Sterling Publishers (India) Private Limited.
5. Sri Niwas Singh, Prabhakar Tiwari, 2021. Fundamentals and Innovations in Solar Energy, , Published by Springer publications, New York

Web Resources

1. https://www.energysage.com/about-clean-energy/solar/
2. https://forumias.com/blog/status-of-wind-energy-in-india-explained-pointwise/
3. https://naturalenergyhub.com/renewable-energy/biomass-types-methods-converting-energy-advantages-disadvantages/
4. https://youtu.be/40ztd8uoU9Q
5. https://youtu.be/bPwvS5V5RW4

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	2	2	3	2	2
CO2	2	2	3	3	3	2	2	2	3	2	2
CO3	3	3	3	3	3	2	2	3	3	2	2
CO4	3	2	3	3	2	2	2	2	3	2	2
CO5	3	2	2	3	3	2	2	2	3	2	2
TOTAL	**14**	**11**	**14**	**15**	**13**	**11**	**10**	**10**	**15**	**10**	**10**
AVERAGE	**2.8**	**2.2**	**2.8**	**3**	**2.6**	**2.2**	**2**	**2**	**3**	**2**	**2**

3– Strong,2-Medium,1-Low

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE I: b) MATHEMATICAL PHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235DE2	-	4	-	-	3	4	60	25	75	100

Pre-requisite:

To understand higher mathematical concepts which are applied to solve problems in Physics and similar situations.

Learning Objectives:

1. This course covers essential mathematical concepts such as matrices, vector calculus, fourier series and partial differential equations.
2. It helps students to develop problem-solving skills and apply mathematical techniques to engineering and scientific problems.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember the definitions and properties of matrices, eigenvalues, and eigenvectors.	**K1 & K2**
2.	understand mathematical concepts and develop a strong foundation in matrices, vector calculus, fourier series and partial differential equations.	**K2 & K4**
3.	compute and interpret vector differentiation, integration, and fundamental theorems in real-world applications by applying vector calculus	**K3 & K5**
4.	apply mathematical principles to analyse and solve physics-related problems.	**K4 & K6**
5.	evaluate the accuracy of fourier series approximations for different types of functions and design innovative approaches to solving partial differential equations based on specific constraints.	**K5 & K6**

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

Units	Contents	No. of Hours
I	**MATRICES:** Types of matrices – symmetric, Hermitian, unitary and orthogonal matrices– characteristic equation of a matrix –Determinants of 2x2 and 3x3 Matrices-Eigen values and Eigen vectors of a matrix – Cayley-Hamilton theorem – inverse of matrix by Cayley-Hamilton theorem –diagonalization of 2x2 real symmetric matrices.	**12**
II	**VECTOR CALCULUS:** vector differentiation – directional derivatives – definitions & Physical significance of gradient, divergence, curl – Laplace operators–Divergence and Curl in Cartesian Coordinates – line, surface and volume integrals – statement, proof and simple problems for Gauss's divergence theorem, Stoke's theorem, Green's theorem.	**12**
III	**ORTHOGONAL CURVILINEAR COORDINATES**: Polar Coordinates in 2D-Applications of Cylindrical Coordinates-tangent basis vectors – unit vectors in cylindrical and spherical coordinate systems –gradient of a scalar –divergence and curl of a vector	**12**

IV	**FOURIER SERIES:** Basic Properties of Fourier Series-Fourier Transform of Exponential Functions-periodic functions – Dirichlet's conditions – general Fourier series – even and odd functions and their Fourier expansions – Fourier cosine and sine – half range series – change of length of interval. Fourier analysis of half wave/full wave rectifier wave forms.	**12**
V	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (PDE):** PDE for transverse vibrations in elastic strings (one dimensional wave equation) –one dimensional heat flow equation – solutions to these PDE's by method of separation of variables – problems based on boundary conditions and initial conditions.	**12**
	Total	**60**

Self-study	Matrices-Types of Matrices Orthogonal Curvilinear Coordinates- Gradient of a Scalar Function

Textbooks:

1. Chattopadhyay P K, 2013. *Mathematical Physics*, (2nd edition), New Age International Publishers, New Delhi, India.
2. Dass HK & Rama Verma, 2014.*Mathematical Physics*, (7thEdition), S. Chand & Company Pvt Ltd, New Delhi.

Reference Books:

1. Jain J.C, 2009.*Vector space & Matrices*, Narosa Publishing House Pvt Ltd, New Delhi.
2. Rajput B.S, 2008. *Mathematical Physics*, (20th Edition), Pragati Prakashan, Chennai.
3. Arfken, G.B, Weber H.J, Harris F.E, 2013. *Mathematical Methods for Physicists*, (7th Edition), Elsevier,USA.
4. Balakrishnan V, 2020. *Mathematical Physics Applications and Problems*, Springer, Ane Books Pvt Ltd.India.
5. Satya Prakash, 2005. *Mathematical Physics*, (4th Edition), S. Chand & Sons Company Pvt Ltd,New Delhi.

Web Resources

1. https://math.libretexts.org/Bookshelves/Linear_Algebra/A_First_Course_in_Linear_Algebra_(Kuttler)/07%3A_Spectral_Theory/7.01%3A_Eigenvalues_and_Eigenvectors_of_a_Matrix
2. https://www.geeksforgeeks.org/vector-calculus/
3. https://sites.engineering.ucsb.edu/~baronp/ChE230A/ortho-curvilinear-coords.pdf
4. http://ndl.ethernet.edu.et/bitstream/123456789/55096/1/Tsuneo%20Arakawa.pdf
5. https://cayley.academic.csusb.edu/content/notes/transform_notes.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	2	2	3	2	2
CO2	3	2	3	3	3	2	2	2	3	2	2
CO3	3	2	3	3	3	2	2	2	3	2	2
CO4	3	2	3	3	2	2	2	2	3	2	2
CO5	3	2	3	3	3	2	2	2	3	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**10**	**15**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**2**	**3**	**2**	**2**

3 – Strong, 2- Medium, 1-Low

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE I:c) ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235DE3	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Students should know the fundamentals of electricity and magnetism and to know about the communication by electromagnetic waves.

Learning Objectives:

1. To classify materials based on their electrical and magnetic properties and to analyse the working principles of electrical gadgets.
2. To understand the behaviour of DC, AC and transient currents.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	recall and define key concepts in Electromagnetic Theory	**K1**
2.	understand the fundamentals of electrostatics and capacitors	**K2**
3.	apply current electricity concepts in practical scenarios	**K3**
4.	analyze magnetism and magnetic material properties	**K4**
5.	evaluate different physical quantities used to explain magnetic properties of materials	**K5**

K1-Remember ; **K2**-Understand; **K3** -Apply; **K4** -Analyze; **K5** - Evaluate

Units	Contents	No. of Hours
I	**CAPACITORS AND THERMO ELECTRICITY:** Capacitor-principle - capacitance of a parallel plate capacitor (with and without dielectric slab) - effect of dielectric - Carey Foster bridge - temperature coefficient of resistance - Seebeck effect - Laws of thermo emf - Peltier effect-Thomson effect-Thermoelectric diagrams and their uses-thermodynamics of thermocouple.	12
II	**MAGNETIC EFFECT OF CURRENT:** Biot and Savart's law-Magnetic induction due to circular coil-force on a current element by magnetic field-force between two infinitely long conductors-torque on- A current loop in a field-moving coil galvanometer-damping correction-Ampere's circuital law-differential form–divergence of magnetic field-Magnetic induction due to toroid	12

III	**MAGNETISM AND ELECTROMAGNETIC INDUCTION:** Magnetic induction B – Magnetization M –relation between B, H and M – magnetic susceptibility- magnetic permeability- experiment to draw B-H curve - energy loss due to hysteresis - importance of hysteresis curve – Faraday and Lenz laws - self inductance-coefficient of self inductance of solenoid-Anderson's method-mutual inductance- coefficient of mutual Inductance between two coaxial solenoids-coefficient of coupling.	**12**
IV	**TRANSIENT AND ALTERNATING CURRENTS:** Growth and Decay of current in a circuit containing resistance and inductance -growth and decay of charge in a circuit containing resistance and capacitor - growth and decay of charge in an LCR circuit (expression for charge only)-peak, average and rms values of ac- LCR series-parallel circuits -resonance condition-Q factor-power factor.	**12**
V	**MAXWELL'SEQUATIONSANDELECTROMAGNETIC WAVES:** Maxwell's equations in vacuum, material media - physical significance of Maxwell's equations - displacement current - plane electromagnetic waves in free space-velocity of light-Poynting vector-Electromagnetic waves in a linear homogeneous media-refractive index.	**12**
	Total	60

Self Study	Self-inductance, Mutual Inductance

Text Books

1. Murugeshan, R, 2006,Electricity and Magnetism(eighth edition), S.Chand and Co, New Delhi.
2. Sehgal D.L., Chopra K.L, Sehgal N.K., 2020, Electricity and Magnetism (seventh edition), Sultan Chand and Sons, New Delhi.

Reference Books

1. Brijlal, Subramanyan. N and Jivan Seshan, 2005, Mechanics and Electrodynamics (fifth edition), Eurasia Publishing House (Pvt.) Ltd., New Delhi.
2. David J. Griffiths, 1997, Introduction to Electrodynamics (second Edition), Prentice Hall of India Pvt. Ltd., New Delhi.
3. Halliday. D, Resnik. RandWalker. J, 200, -Fundamentals of Physics (sixth Edition), Wiley, New York.
4. Narayanamurthy. M and Nagarathnam.N, 2010, Electricity and Magnetism (fourth Edition), National Publishing Co., Meerut.
5. Tewari. K. K, 2007, Electricity and Magnetism (Third edition), S.Chand and Co, New Delhi.

Web Resources

1. https://web.njit.edu/~vitaly/121/notes121.pdf
2. https://www.lehman.edu/faculty/dgaranin/Introductory_Physics/PHY167-5-Electromagnetism.pdf
3. https://rajeshvcet.home.blog/wp-content/uploads/2021/11/purcell-e.m.-morin-d.j.-electricity-and-magnetism-2013-cambridge-university-press-libgen.lc_.pdf
4. https://ocw.mit.edu/courses/8-022-physics-ii-electricity-and-magnetism-fall-2004/pages/lecture-notes/
5. https://ocw.mit.edu/courses/8-022-physics-ii-electricity-and-magnetism-fall-2004/pages/assignments/

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	2	2	3	2	2
CO2	3	2	3	3	3	2	2	2	3	2	2
CO3	3	2	3	3	3	2	2	2	3	2	2
CO4	3	2	3	3	2	2	2	2	3	2	2
CO5	3	2	3	3	3	2	2	2	3	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**10**	**15**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**2**	**3**	**2**	**2**

3– Strong,2-Medium,1-Low

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE II: a) MATERIAL SCIENCE

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235DE4	4	-	-		3	4	60	25	75	100

Pre-requisite:

Students should know basic Physics (mechanics, thermodynamics, electricity, and optics), Chemistry (atomic structure, bonding, and crystals), and Mathematics (algebra and calculus).

Learning Objectives:

1. To learn imperfections in crystals, deformation of materials and testing of materials.
2. To get knowledge on behavior of a material, under the action of light and their applications.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	understand the different types of crystal imperfections and their effects on material properties	**K1&K2**
2.	interpret the concepts of elastic and inelastic behavior of materials at an atomic level.	**K2**
3.	utilize non-linear optical (NLO) materials in designing optical communication and laser systems.	**K3**
4.	analyze the working principles of NLO materials, LEDs, and LCDs for display applications	**K3&K4**
5.	assess the suitability of various testing techniques for evaluating material properties.	**K5**

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

Units	Contents	No. of Hours
I	**Crystal Imperfections:** introduction – point defects: vacancies, interstitials, impurities, electronic defects – equilibrium concentration of point imperfections –application of point defects – line defects: edge dislocation, screw dislocation – surface defects: extrinsic defects – intrinsic defects: grain boundaries, tilt &twist boundaries, twin boundaries, stacking faults– volume defects– effect of imperfections.	12
II	**Material Deformation:** introduction–elastic behavior of materials –atomic model of elastic behavior–modulus as a parameter in design–rubber like elasticity–inelastic behavior of materials– relaxation process– viscoelastic behavior of materials– spring-Dashpot models of viscoelastic behavior of materials	12
III	**Permanent Deformation and Strengthening Methods of Materials:** introduction –plastic deformation: tensile stress-strain curve – plastic deformation by slip – creep: mechanism of creep – creep resistant materials–strengthening methods: strain hardening, grain refinement–solid solution strengthening– precipitation strengthening.	12

IV	**Optical Materials:** introduction – optical absorption in metals, semiconductors and insulators – NLO materials and their applications – display devices and display materials: fluorescence and phosphorescence–light emitting diodes– liquid crystal displays.	**12**
V	**Mechanical Testing:** destructive testing: tensile test, compression test, hardness test – nondestructive testing (NDT): radiographic methods, ultrasonic methods – thermal methods of NDT: thermography– equipment used for NDT: metallurgical Microscope	**12**
	Total	**60**

Self study	NLO materials and their applications

Textbooks

1. Rajendran,V, 2017. Materials science, Second Edition, McGraw Hill publications, Uttar Pradesh.
2. Palanisamy P.K., 2015. Materials Science, Second Edition, SciTech Publications (India) Pvt. Ltd, Chennai.

Reference Books

1. William D. Callister Jr., 2007. Material Science &Engineering – An Introduction, Eighth Edition, John Wiley & Sons, Inc., New Jersey.
2. Bolton W., 2001. Engineering materials technology, Third Edition, Butterworth & Heinemann,. Oxford.
3. Donald R. Askel, Pradeep P. Phule, 2002. The Science and Engineering of Materials, Fifth Edition, Nelson Engineering.
4. William F. Smith, 1993. Second edition, Structure and Properties of Engineering Alloys, Mc-Graw-Hill Inc., U.S.A.
5. Narula G.K., Narula K.S., Gupta,V.K.,1988. Materials Science, Tata McGraw- Hill, U.S.A.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc20_mm02/preview
2. https://nptel.ac.in/courses/112104229
3. https://archive.nptel.ac.in/courses/113/105/113105081
4. https://nptel.ac.in/courses/113/105/113105025/
5. https://eng.libretexts.org/Bookshelves/Materials_Science/Supplemental_Modules_(Materials_Science)/Electronic_Properties/Lattice_Vibrations

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	3	3	3	3	1	3	3	2	3	3	3
TOTAL	**15**	**15**	**15**	**15**	**13**	**12**	**12**	**14**	**14**	**15**	**15**	**15**
AVERAGE	**3**	**3**	**3**	**3**	**2.6**	**2.4**	**2.4**	**2.8**	**2.8**	**3**	**3**	**3**

3– Strong, 2-Medium, 1-Low

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE II: b) NANOSCIENCE

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235DE5	4	–	–	–	3	4	75	25	75	100

Pre-requisite:

Basic physics, chemistry, material science, quantum mechanics, mathematics, spectroscopy, electron microscopy, and fundamentals of nanotechnology.

Learning Objectives:

1. To provide the basic knowledge about nanoscience and nanotechnology and to learn the structures and properties of nanomaterials.
2. To acquire the knowledge about synthesis methods and characterization techniques and its applications.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall fundamental concepts of nanoscience, including nanostructures, size effects and quantum confinement.	**K1**
2.	explore the mechanical, optical, electrical, magnetic, and electrochemical properties of nanomaterials.	**K2**
3.	apply various synthesis methods such as sol-gel, CVD, sputtering, and electrochemical deposition.	**K3**
4.	analyze the structural, morphological, and optical properties of nanomaterials using characterization techniques	**K4**
5.	evaluate the applications of nanomaterials in real-world technological advancements.	**K5**

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyse; **K5**-Evaluate

Units	Contents	No. of Hours
I	**INTRODUCTIONTO NANOSCIENCE:** History of Nanotechnology-Nanoscale-nature and nanostructures - Nanostructures:0D,1D, 2D-surface to volume ratio-size effect - excitons - quantum confinement-Semiconductor Nanoparticles - nanocomposites (non-polymer based) - carbon nanostructures - fullerene - SWCNT and MWCNT and its properties.	**12**
II	**PROPERTIESOFNANOMATERIALS:** Introduction - mechanical behavior - elastic properties - hardness and strength - ductility and toughness - superplastic behavior - optical properties - surface plasmon resonance - electricalproperties- dielectric materials and properties- magnetic properties- superparamagnetism- electrochemical properties.	**12**
III	**PREPARATIONOF NANOMATERIALS:** Top-down and bottom-up approaches-electrochemical method- chemical vapour deposition-sputtering-ballmilling-sol-gel Process-Electro deposition-Spray Pyrolysis-Solvo thermal Synthesis - Sonochemical Synthesis.	**12**

IV	**CHARACTERIZATIONTECHNIQUES:** Powder XRD method: determination of structure and grain size analysis - scanning electron microscopy - transmission electron microscopy - atomic force microscopy - UV-visible and photoluminescence spectroscopy - X-ray photoelectron Spectroscopy (XPS) - EDS analysis.	**12**
V	**APPLICATIONSOFNANOMATERIALS:** Medicine: Targeted drug delivery- energy: fuel cells -rechargeable batteries - supercapacitors - photovoltaics. Sensors: nano sensors based on optical and physical properties- electrochemical sensors– Nano biosensors - GMR-nanorobots.	**12**
	Total	**60**

Self Study	Rechargeable batteries , Supercapacitors Photovoltaics.

Textbooks:

1. Kulkarni, Sulabha K. 2015. *Nanotechnology: Principles and Practices*.3rded. Springer.
2. Sr.Gerardin Jayam, Sonia.S, 2019. Nanophysics, Holy Cross College (Autonomous), Nagercoil.

Reference Books:

1. K.K. Chattopadhyayand A.N. Banerjee, (2012), Introduction to Nanoscience and Nanotechnology, PHI Learning Pvt. Ltd.,
2. M.A. Shah, Tokeer Ahmad (2010), Principles of Nanoscience and Nanotechnology, Narosa Publishing House Pvt Ltd.
3. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc.US
4. J.H. Fendler (2007) Nanoparticles and nanostructured films; Preparation, Characterization and Applications, John Wiley & Son.
5. B.S. Murty, et al (2012) Textbook of Nanoscience and Nanotechnology, Universities Press.

Web Resources:

1. www.its.caltec.edu/feyman/plenty.html
2. http://www.library.ualberta.ca/subject/nanoscience/guide/index.cfm
3. http://www.understandingnano.com
4. http://www.nano.gov
5. http://www.nanotechnology.com

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2.6	2.4	2.6	3	3	3	3	3
CO2	3	3	3	3	2.6	2.4	2.6	2	3	3	3	3
CO3	3	3	3	3	2.6	2.4	2.6	3	3	3	3	3
CO4	3	3	3	3	2.6	2.4	2.6	3	3	3	3	3
CO5	3	3	3	3	2.6	2.4	2.6	3	2	3	3	3
TOTAL	**15**	**15**	**15**	**15**	**13**	**12**	**13**	**14**	**14**	**15**	**15**	**15**
AVERAGE	**3**	**3**	**3**	**3**	**2.6**	**2.4**	**2.6**	**2.8**	**2.8**	**3**	**3**	**3**

3–Strong, 2-Medium, 1-Low

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE II: c) MEDICAL INSTRUMENTATION

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235DE6	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Students should have enough knowledge in Basic Physics, electricity and magnetism

Learning Objectives:

1. To provide background of the physics principles
2. To apply physics principles in medical instrumentation technologies through theoretical& practical learning.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	define the basic concepts of medical instrumentation and components of the man-instrument system.	**K1**
2	understand the challenges involved in measuring physiological parameters in living systems.	**K2**
3	interpret various bioelectric potentials (ECG, EEG, and EMG) and their physiological sources.	**K3**
4	compare different imaging techniques and diagnostics radiology	**K4**
5	assess image quality factors affecting diagnostic accuracy, ethical and legalconsiderations in the development and use of medical instrumentation.	**K5&K6**

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

Units	Contents	No. of Hours
I	**Biometrics:** Introduction to man-instrument system and its components –problems encountered in measuring living systems – transducers– force, motion, pressure transducers. **Audiometry:** mechanism of hearing – air and bone conduction – threshold of hearing –audiometer – masking in audiometry – pure tone and speech audiometer– evoked response audiometry– Hearing aids	12
II	**Bioelectric Potentials and Electrodes:** biomedical signals– sources of bioelectric potentials– resting, action and propagation of Bioelectric potentials–bio-potential electrodes–skin surface, needle	12

	electrodes. **Biomedical Recorders:** electro-conduction system of heart –electro cardiogram (ECG) – Einthoven's triangle — electro encephalogram(EEG)–brainwaves–EEG instrumentation–recording Of evoked potentials –electro-myogram (EMG)–pulseoximeter.	
III	**Diagnostic Radiology:** radiography– primary radiological image – contrast agents, filters– beam restrictor, grid –image quality- Radioisotopes–gamma camera–positron emission tomography– Disposal of radioactive waste.	**12**
IV	**Ultra sound Imaging:** ultrasound transducer–ultrasound imaging– Doppler ultrasound – ultrasound image quality & bio-effects.	**12**
V	**Magnetic Resonance Imaging:** Proton and external magnetic field–precession–radio frequency and resonance–MRI signal–relaxation time – MRI instrumentation – imaging sequences – bio-safety	**12**

Self- study	MRI instrumentation–imaging sequences –bio-safety

Textbook

1. Leslie Cromwell, Fred Weibell, Erich Pfieffer , 2002, Biomedical Instrumentation& Measurements Prentice Hall of India, New Delhi.
2. R.S.Khandpur, 2003, Hand book of BiomedicalInstrumentation2nd Edn.TataMcGrawHill, New Delhi.

Reference Books

1. JohnWebster,2004, Bioinstrumentation John Wiley and Sons, Singapore.
2. John Enderle, Susan Blanchard, Joseph Bronzino, 2005,Introduction to Biomedical Engineering, 2nd ed. Elsevier, San Deigo
3. William Hendee, Geoffrey Ibbott, Eric Hendee, 2005, Radiation therapy Physics 3rd edition. Wiley- Liss, New Jersey

Web Resources

1. https://www.youtube.com/watch?v=GJ5Bn-tEkdw
2. https://www.youtube.com/watch?v=TBGrY_IfK8w
3. https://www.youtube.com/watch?v=OqNDFF1RsMU
4. https://www.youtube.com/watch?v=DEsTkXTtOLA
5. https://www.msajce-edu.in/academics/ece/ICTTools/EC8073-ICT.pdf

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	2	3	2	2	2	2
CO2	3	2	3	3	3	2	2	3	2	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2
CO4	3	2	3	3	2	2	2	3	2	2	2	2
CO5	3	2	3	3	3	2	2	3	2	2	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**15**	**10**	**10**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**3**	**2**	**2**	**2**	**2**

3– Strong,2-Medium,1-Low

SEMESTER V

CORE RESEARCH PROJECT

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
PU235RP1	-	-	5	-	4	5	75	Internal	External	Total
								25	75	100

Pre-requisite:

Identification of Research Problem.

Learning Objectives:

1. To empower students to design experiments, analyze data, and interpret results effectively.
2. To cultivate skills for identifying subject-related problems in the local community.

Course Outcomes

Upon completion of this course, the students will be able to:		
1.	Identify emerging areas of physics research.	**K1**
2.	Analyze research problems and develop appropriate data collection tools.	**K2**
3.	Apply scientific skills to contribute to industries and agencies related to science.	**K3**
4.	connect research findings with existing scientific literature and communicate results effectively.	**K4**

K1-Remember; **K2**-Understand;**K3**–Apply;**K4**-Analyze

Guidelines

- All the students must undertake project work at the final year (V semester)as a group (4 to 5 students per group).

Distribution of marks for project 25:75 **Internal Components**

Internal Viva= 15marks

Regularity and Systematic work= 10marks

External Components

Dissertation =30marks

Innovation =15marks

Presentation and Viva =30marks

*Mode of presentation by PowerPoint

Project frame work

1. The Project format should be in:
   - Font–Times New Roman
   - Heading–Fontsize14(Bold)– Uppercase
   - Subheadings–Fontsize12(Bold)—Lowercase; should be numbered.(Eg: Introduction 1; Subheading 1.1; 1.2)
   - Text, the content of the dissertation—Font size– 12 (Normal).
   - Linespace–1.5
   - Margin–2"ontheleftand1"ontheright,Gutter–0.5.
   - Page Numbering Bottom middle alignment; excluding initial pages and reference
   - Total number ofpagesMinimum30, Maximum40 (Excluding initial pages and reference).
   - The Tables and Figures should be included subsequently after referring them in the text of the Report.

II. Project Report must be completed within the stipulated time.
III. Submission of Project Report:

- ❖ One soft copy (PDF format in CD)
- ❖ Three hard copies (soft binding) duly signed and endorsed by the Supervisor and the Head.

The Project Report will have three main parts:

I. Initial Pages–in the following sequence

i). Title Page
ii). Certificate from the Supervisor
iii). Declaration by the candidate endorsed by the Supervisor and HOD
iv). Acknowledgement (within one page–signed by the candidate).
v). Table of Contents
vi). List of abbreviations

II. Main body of the dissertation

i) Introduction and Objectives
ii) Methodology
iii) Results
iv) Discussion

Summary

v) References

The guidelines for reference Journal Article: with Single Author

Waldron,S2008,"GeneralizedWelchboundequality sequences are tight frames", IEEE Transactions on Information Theory, vol.49, no. 9, pp. 2307 – 2309.

Journal Article: with Two Authors

Conley, TG & Galeson, DW 1998,"Nativity and wealth in mid–nineteenth century cities", Journal of Economic History, vol. 58, no.2, pp. 468– 493.

Journal Article: with more than two Authors

Alishahi, K, Marvasti, F, Aref, VA & Pad, P 2009, "Bounds on the sum capacity of synchronous binary CDMA channels", Journal of Chemical Education, vol. 55, no. 8, pp.3577– 3593.

Books

Holt, DH 1997, Management Principles and Practices, Prentice–Hall, Sydney. CentreforResearch,MSUniversity–Ph.D.RevisedGuidelinesPage|39/41

E–book

Aghion, P&Durlauf,S(eds.)2005,HandbookofEconomicGrowth,Elsevier,Amsterdam.Available from: Elsevier books. [4 November 2004].

SEMESTER V

PROFESSIONAL COMPETENCY SKILL I- CAREER SKILLS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG235PS1	1	1	-	-	2	2	30	25	75	100

Pre-requisite: A foundational understanding of the basic communication skills and computer literacy.

Learning Objectives

1. To develop effective communication and interpersonal skills to enhance workplace interactions and teamwork
2. To build job readiness skills such as resume writing, interview techniques, and professional ethics

Course Outcomes

On the successful completion of the course, students will be able to:		
1	**outline** key career skills such as communication, teamwork, and problem-solving	**K1**
2	explain the importance of professional ethics, workplace etiquette, and time management	**K2**
3	demonstrate effective resume writing, interview techniques, and job application strategies	**K3**
4	**a**ssess different workplace scenarios to determine appropriate communication and conflict resolution strategies	**K4**
5	develop a personal career plan with clear goals, skills assessment, and strategies for professional growth	**K5**

K1- Remember; **K2**- Understand; **K3**- Apply; **K4**- Analyse; **K5**- Evaluate

Units	Contents	No. of Hours
I	**Linguistic Skills** Vocabulary, Resume Writing, Report Writing, Technical Writing, Agenda Preparation, Preparing Minutes, E-mail.	**6**
II	**Employability Skills** Social Etiquette, Telephone Etiquette, Interview Skills, Types of Interviews, Mock Interview, Group Discussion.	**6**
III	**Digital Capabilities** Digital Learning, Digital Participation, ICT Proficiency, Creative Production, Digital Identity, Digital well-being	**6**
IV	**Body Language** Defining Body Language, Scope and Relevance, Proxemics, Oculesics, Haptics, Kinesics, Paralanguage, Chronemics, Chromatics and Olfactics	**6**
V	**Coping Mechanisms** Goal Setting, Emotional Intelligence, Team Management, Stress Management, Time Management, Leadership Skills, Problem solving Skills, Decision Making.	**6**
	Total	**30**

Self-study	Basic language skills and communication skills

Textbook

Virgin Nithya Veena. V & Jemi A.R. 2025. *New Age Career Skills*.

Reference Books

1. Herta A. Murphy and Herbert W. Hildebrandt. 1997. *Effective Business Communication*. 7th edition. McGraw- Hill.
2. Jeff Butterfield. 2020. *Soft Skills for Everyone*. Cengage India Pvt. Ltd.
3. Jayaprakash N Satpathy. 2024. *Soft Skills for Career*. Urania Publishing House.
4. S. Xavier Alphonse S. J. 2008. *Change or Be Changed*. ICRDCE. Sri Venkateswara Printers. Chennai.
5. AK. Xavier. 2025. *Employability Skills*. JKP Publications. Madurai.

Web Resources

1. https://exchange.nottingham.ac.uk/content/uploads/Professional-Competencies-Handbook-Sept-2018.pdf
2. https://vpge.stanford.edu/professional-development/competencies-grad-grow
3. https://vpge.stanford.edu/professional-development/competencies-grad-grow
4. https://www.indeed.com/career-advice/resumes-cover-letters/core-competencies-and-skills-valued-by-employers
5. https://resources.hrsg.ca/blog/what-s-the-difference-between-skills-and-competencies

SEMESTER V
INTERNSHIP

Course Code	L	T	P	S	Credits	Inst. Hours	Marks
CU235IS1	-	-	-	-	2	-	100

FRAMEWORK FOR INTERNSHIP

- Preparatory Inputs
- Industrial Visit
- Internship
- Periodic reviews by industry supervisor and faculty guide
- Report Writing
- Viva-voce

Note: Industries allowed – Govt./NGO/MSME/Rural Internship/Innovation / Entrepreneurship / Private Industry.

S.No.	Components	Marks
1	Industry Contribution	50
2	Report & Viva-voce	50

GUIDELINES FOR PREPARING INTERNSHIP REPORT

The training report should be presented in the following format only:

a) The report should be printed in A4 sheets.

b) Text Format in the report:
   - Times New Roman 12 Font size, with 1.5 line spacing.
   - Margins 1.5" left and 1" all other sides of the report.

c) Page numbers should be placed at the bottom middle position.

d) Chapters should be numbered as I, II, III and IV.

e) The tables and charts should be in the format of 1.1, 1.2, etc.

f) The training report should have a minimum of 25 pages and should not exceed 50 pages.

g) Students should submit 2 hard copies of report (department copy + student copy) duly signed by the faculty guide and the HOD.

h) The hard copy should be in bound format with soft binding as the cover page.

i) Students are eligible for training evaluation only if she has completed 25 days of training.

FORMAT FOR INTERNSHIP REPORT

The report should be bound with pages in the following sequence:

1) Cover page - Outer cover of the report.
2) Front page - The format of cover page and front page should be one and the same.
3) Certificate
4) Company Certificate
5) Declaration
6) Acknowledgement
7) Contents
8) List of Tables if any
9) List of Figures/Charts if any
10) List of Abbreviations, if any
11) Chapter I, II, III and IV
12) Appendices
13) Bibliography

GUIDELINES FOR WRITING ACKNOWLEDGEMENT

The summer training report should contain acknowledgements in the following order:

- Principal & Secretary, College Management
- The Head of the Department
- Faculty guide and Industry supervisor
- Management of the organization in which training was taken up.

GUIDELINES FOR WRITING CHAPTERWISE REPORT

- **Chapter I** of the report should be titled as "**INTRODUCTION**". The Introduction chapter should include Introduction, Importance, Objectives, Scope and Period of the training.
- **Chapter II** of the report should be titled as "**COMPANY PROFILE**".
- **Chapter III** of the report should be titled as "**ACTIVITIES DONE."** The third chapter should cover the objectives of the different departments and its functioning and also the learning outcome.

  Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.
- **Chapter IV should be titled as "CONCLUSION".** The Conclusion part should include the observations made by the trainee in each department and the extent of fulfillment of training objectives and also reflections.

SEMESTER V

HUMAN RIGHTS, JUSTICE AND ETHICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG235HR1	1	-	-	-	1	1	15	50	50	100

Learning Objectives

1. To identify issues, problems, and violations of human rights.
2. To promote awareness of social justice, equality and human dignity.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	explain human rights principles and the role of the UN, with a focus on human rights issues in India.	**K1, K2**
2.	apply ethical principles in social, national, and professional contexts.	**K3**
3.	analyse social justice issues like untouchability, casteism, and discrimination.	**K4**
4.	examine legal frameworks for women's and child rights in India.	**K4**
5.	assess media's influence on values, digital rights, and consumerism.	**K5**

K1-Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

Units	Contents	No. of Hours
I	**Social Justice:** Concept and need for social justice-Parameters of social justice - Issues: untouchability, casteism, and discrimination	**3**
II	**Foundations of Human Rights:** Concept and principles of human rights- United Nations and Human Rights- Human rights concerns in India	**3**
III	**Women's Rights and Child Rights:** UN and women's rights – major issues - Constitutional and legal provisions for women in India - Child rights in India – Major Issues -legal framework and enforcement	**3**
IV	**Values and social media:** Media Power- Socio, cultural and political consequences of mass mediated culture - New media prospects and challenges - Role of media in value building -Digital Rights and Privacy- Consumerist culture	**3**
V	**Ethics:** Meaning and Importance- Social ethics: Tolerance, equity, justice for all -Nationalism: love for nation, pride for nature- Professional ethics: Dedication to work and duty**.**	**3**
	Total	**15**
Self-study	Mass Media: Effects and Influence on youth and children	

Reference Books

1. Baxi, Upendra. 2008 *The Future of Human Rights*. Oxford University Press,.
2. Donnelly, Jack. 2013. *Universal Human Rights in Theory and Practice*. Cornell University Press.
3. Agnes, Flavia. *Law and Gender Inequality: The Politics of Women's Rights in India*. Oxford University Press, 2001.
4. *State of the World's Children 2021*. UNICEF
5. McLuhan, Marshall. *Understanding Media: The Extensions of Man*. MIT Press, 1994.
6. Zuboff, Shoshana. *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. PublicAffairs, 2019.
7. Singer, Peter. *Practical Ethics*. Cambridge University Press, 2011.

Web Recourses

1. http://www.oxfordreference.com/views/BOOK_SEARCH.html?book=t286
2. http://globetrotter.berkeley.edu/humanrights/bibliographies/
3. https://libguides.princeton.edu/history/humanrights

SEMESTER VI

CORE COURSE VII: NUCLEAR AND PARTICLE PHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CC1	6	-	-	-	5	6	90	25	75	100

Prerequisites:

Basic knowledge on nuclear and particle physics to learn about the principles and properties.

Learning Objectives:

1. To acquire knowledge on static properties of nuclei and its stability.
2. To understand the background of various nuclear models.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand constituents, properties and models of nucleus.	**K1&K2**
2	give reason for radioactivity and study their properties.	**K1&K2**
3	learn about the principles of various particle detectors and accelerators.	**K2&K3**
4	acquire knowledge on different types of nuclear reactions and their applications.	**K3&K4**
5	Know the reason for cosmic rays and their effect on the surface of earth and also understand the classification of elementary particles.	**K4&K5**

K1-Remember;**K2**-Understand;**K3** -Apply;**K4** -Analyze;**K5** - Evaluate

Unit	Contents	No. of Hours
I	**PROPERTIES OF NUCLEUS** Constituents of nucleus – isotopes, isobars, isotones – nuclear size, mass, density, charge, spin, angular momentum, magnetic dipole moment, electric quadrupole moment (qualitative) – binding energy – mass defect – packing fraction – nuclear stability – binding energy per nucleon graph – properties of nuclear force – meson theory of nuclear forces – Yukawa potential. NUCLEARMODELS Liquid drop model–Weizacker's semi-empirical mass formula –shell model– magic numbers.	**18**
II	**RADIOACTIVITY** Radio activity – laws of radioactivity – radioactive disintegration, decay constant, half-life, mean-life– units of radioactivity–successive disintegration – transient and secularequilibrium–propertiesofalpha,betaandgammarays–Geiger-Nuttallaw– □-ray spectra –Gammow's theory of □-decay(qualitative)–□-ray spectrum– neutrino theory of □-decay– nuclear isomerism– K-shell capture– internal conversion – non-conservation of parity in weak interactions.	**18**
III	**PARTICLE DETECTORS AND ACCELERATORS DETECTORS** Gas detectors –ionization chamber – Geigger- Muller counter – scintillation counter – photo multiplier tube (PMT) – semiconductor detectors – neutron detector. ACCELERATORS Linear accelerators –cyclotron – synchrotron – betatron– electron synchrotron – proton synchrotron.	**18**
IV	**NUCLEARREACTIONS** Types of nuclear reactions –conservation laws in nuclear reaction – Q-value– threshold energy – nuclear fission – energy released in fission – chain reaction – critical mass – nuclear reactor –uses – atom bomb – nuclear fusion – sources ofstellar	**18**

	energy – proton-proton cycle –Carbon-Nitrogen cycle – thermonuclear reactions – controlled thermonuclear reactions - hydrogen bomb.	
V	**COSMICRAYSANDELEMENTARYPARTICLES** **COSMICRAYS** Discovery of cosmic rays –primary and secondary cosmic rays –cascade theory of cosmic ray showers – altitude and latitude effects –discovery of positron – pair production–annihilation of matter – Van-Allen radiation belts – big-bang theory– future of the Universe (elementary ideas only). ELEMENTARYPARTICLES Particlesandantiparticles–classificationofelementaryparticles–typesof fundamental interactions – quantum numbers of elementary particles – conservation laws and symmetry – quarks and types.	**18**
TOTAL		**90**

Self-study	half-life, mean-life , units of radioactivity, properties of alpha, beta and gammarays, Geiger-Nuttal law

Textbooks

1. Murugesan R., Kiruthiga Sivaprasath,2013, Modern Physics, S. Chand &Co, New Delhi.
2. Brijlaland N., Subramaniyan,2006,Atomic and Nuclear Physics, S. Chand &Co, New Delhi.

ReferenceBooks

1. Rajam J.B., 2018 ,ModernPhysics, S.Chand&Co, New Delhi.
2. Tayal D.C., 2006, NuclearPhysics, Himalayan Publishing House, Mumbai.
3. Bernard L.Cohen., 1998,Concepts of nuclear Physics,TataMcgrawHillNewDelhi.
4. Knoll G.F., 2000, Radiation detection and measurement, JohnWiley&Sons.
5. Roy R.R., Nigam B.,1997,NuclearPhysics,1st Edition,NewAgeInternational (P)Ltd, New Delhi.

Web Resources

1. http://hyperphysics.phy-astr.gsu.edu/hbase/nuccon.html
2. https://www.kent.edu/physics/nuclear-physics-links
3. https://www2.lbl.gov/abc/links.html
4. https://www.youtube.com/watch?v=OqNDFF1RsM
5. https://www.youtube.com/watch?v=DEsTkXTtOLD

MAPPINGWITHPROGRAMMEOUTCOMESAND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	2	3	2	2	2
CO2	2	3	3	2	3	2	3	2	3	3
CO3	2	2	2	3	2	3	3	3	2	2
CO4	3	3	2	2	3	2	2	2	2	3
CO5	2	3	2	3	3	2	3	2	3	2
TOTAL	**12**	**14**	**11**	**12**	**14**	**11**	**14**	**11**	**12**	**12**
AVERAGE	**2.4**	**2.8**	**2.2**	**2.4**	**2.8**	**2.2**	**2.8**	**2.2**	**2.4**	**2.4**

3– Strong,2-Medium,1-Low

SEMESTERVI

CORE COURSE VIII: SOLID STATE PHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CC2	6	-	-	-	5	6	90	25	75	100

Pre-requisite:

Students should understand the bonding, crystal structure, lattice dynamics, thermal, magnetic, dielectric properties, ferroelectric and superconducting properties of materials.

Learning Objectives:

1. To understand the fundamental concepts of bonding, crystal structures, lattice dynamics, and their impact on material properties, including electrical, thermal and optical behavior.
2. To analyze the magnetic, dielectric, ferroelectric and superconducting properties of solids, along with their theoretical models and technological applications.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	classify bonding types and crystal structures and analyze crystal structures using X-ray diffraction techniques.	**K1**
2.	understand lattice dynamics and their role in determining the electrical and thermal properties of materials.	**K2**
3.	explain the classification of magnetic materials based on their behavior and underlying physical principles.	**K3**
4.	comprehend the dielectric behavior of materials including polarization mechanisms and dielectric breakdown.	**K3&K4**
5.	appreciate the properties of ferroelectric and superconducting materials, including their applications in modern technology.	**K5**

K1-Remember;**K2**-Understand;**K3** -Apply;**K4** -Analyze;**K5** -Evaluate

Units	Contents	No.of Hours
I	**BONDINGIN SOLIDS:** Types of bonds in crystals -Ionic, covalent, Metallic, Vander waal's and Hydrogen Bonding Bond energy of sodium chloride molecule - variation of inter atomic force with inter atomic spacing- cohesive energy – cohesive energy of ionic solids - application to sodium chloride crystal Evaluation of Madelung constant for sodium chloride	18

II	**CRYSTALSTRUCTURE:** crystal lattice – lattice translational vectors – lattice with basis – unit cell– Bravais' lattices – Miller indices – procedure for finding them–packing of BCC and FCC structures – structures of NaCl and diamond crystals – reciprocal lattice – reciprocal lattice vectors – properties – reciprocal lattices to SC, BCC and FCC structures – X-rays – Bragg's law(simple problems)–experimental methods: Laue method, powder method and rotating crystal method.	**18**
III	**C PROPERTIES OF SOLIDS:** permeability, susceptibility, relation between ssification of magnetic materials – properties of dia, para, ferro, ferri and anti tism – Langevin's theory of diamagnetism – Langevin's theory of paramagnetism – s law–Weiss theory of ferromagnetism (qualitative only)–domains– discussion of B-H curve –hysteresis and energy loss – soft and hard magnets.	**18**
IV	**DIELECTRIC PROPERTIES OF MATERIALS:** polarization and electric susceptibility –local electric field of an atom – dielectric constant and polarisability – polarization processes: electronic polarization– calculation of polarisability – ionic, orientational and space charge polarization –internal field – Clausius Mosotti relation –frequency dependenceofdielectricconstant– dielectricloss–effectoftemperature on dielectric constant–dielectric break down and itstypes.	**18**
V	**FERROELECTRIC&SUPERCONDUCTINGPROPERTIESOF MATERIALS:** Ferroelectric effect: Curie-Weiss Law – ferroelectric domains - conductor, semiconductor (P and N type) and insulator – conductivity of semiconductor – mobility – Hall effect – measurement of conductivity (four probe method) - Hall coefficient. *Superconductivity:* Experimental results –critical temperature –critical magnetic field–Meissner effect–type-I and type-II superconductors– London's equation and penetration depth – isotope effect – idea of BCS theory (no derivation)	**18**
	Total	**90**
Self Study	**Soft and Hard Magnets**	

Textbook

1. Kittel ,2003.Introduction to Solid State Physics, Willey Eastern Ltd
2. RitaJohn. 2014. Solid state Physics, 1stedition,TataMcGraw Hill publishers

ReferenceBooks

1. RL Singhal, Kedarnath Ram Nath .2003.Solid State Physics, &Co., Meerut
2. J.P. Srivastava .2006.Elements of Solid State Physics, , 2ndEdition, Prentice-Hallof India
3. LeonidV. Azaroff. 2004. Introduction to Solids, TataMc-GrawHill
4. Raghavan.2013 .Materials science and Engineering, PHI
5. S.O.Pillai. 2019. Solid State Physics, Narosa publication

Web Resources

1. MIT Open Course Ware – Solid State Physics https://ocw.mit.edu/courses/physics/8-231-physics-of-solids-fall-2005/ Comprehensive lecture notes, assignments, and exams from MIT.
2. NPTEL (IIT Lectures) – Solid State Physics https://nptel.ac.in/courses/115/103/115103108/ Video lectures from IITs covering bonding, crystal structures, X-ray diffraction and more.
3. University of Cambridge – Condensed Matter Physics https://www.phy.cam.ac.uk/teaching/teaching-materials

Solid State Physics resources, lecture notes and problem sets.

4. BYJU's–Application of Basic Solid State Physics
5. NPTEL Online Course–Solid State Physics

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	2	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	3	3	3	3	1	3	3	2	3	3	3
TOTAL	**15**	**15**	**15**	**15**	**13**	**12**	**12**	**14**	**14**	**15**	**15**	**15**
AVERAGE	**3**	**3**	**3**	**3**	**2.6**	**2.4**	**2.4**	**2.8**	**2.8**	**3**	**3**	**3**

3– Strong,2-Medium,1-Low

SEMESTER VI

CORE LAB COURSE VII: GENERAL PHYSICS LAB VII

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CP1	-	-	2	-	**2**	**2**	**30**	**25**	**75**	**100**

Pre-requisite:

Knowledge on Basic principles of diffraction, spectroscopy, fundamentals of electromotive force (EMF), magnetic field and thermoelectric effects.

Learning Objectives:

1. To understand the working principles of optical instruments, potentiometers, and magnetometers for precise experimental measurements in physics.
2. To develop skills in measuring optical constants, resistance, EMF, and magnetic moments using standard laboratory techniques.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall and understand fundamental principles of optics, electromagnetism, and thermal physics applied in various experimental setups.	**K1&K2**
2.	apply experimental techniques to determine optical constants, resistance, EMF, and magnetic field intensity in laboratory conditions.	**K3**
3.	analyze data from spectroscopic and electrical experiments to determinephysical properties such as Rydberg's constant, temperature coefficients, and magnetic moments.	**K4**
4.	evaluate sources of error in precision measurements and propose improvements to experimental methodologies.	**K5**
5.	create models and experimental setups based on fundamental physics principles.	**K6**

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

Contents(Any six experiments)

1. **Spectrometer – (i-d) curve.**
2. **Spectrometer – (i-i′) curve.**
3. **Spectrometer** – Cauchy's constant
4. Spectral response of photoconductor (LDR).
5. Potentiometer – Resistance and Specific resistance of the coil.
6. Potentiometer – Calibration of high range voltmeter.
7. Potentiometer – E.M.F of a thermocouple.
8. Carey Foster's bridge-Temperature coefficient of resistance of the coil.
9. Deflection Magnetometer – Determination of Magnetic moment of a bar magnet and B_H using circular coil carrying current.
10. Vibration magnetometer-Determination of B_H using circular coil carrying current– Tan B position.
11. M.G-Thermo emf
12. High resistance by leakage-B.G

Text Books:

1. Chauhan S. P., and C. L. Arora. 2021. B.Sc. Practical Physics, S. Chand Publishing, New Delhi, India.

2. Singh R. K., 2019. Practical Physics: A Laboratory Manual, Pearson Education, New Delhi, India.

Reference Books:

1. Shukla R.P., AnchalSrivastava, 2016. Experimental Physics:Principles and Methods, New Age International, New Delhi, India.
2. Arthur Beiser, 2003.Concepts of Modern Physics, McGraw-Hill, NewYork, United States.
3. Eugene Hecht, 2017. Optics, Pearson, Harlow, United Kingdom.
4. David Halliday, Robert Resnick, JearlWalker, 2013. Fundamentals of Physics, Wiley, Hoboken, United States.
5. Francis Jenkins, Harvey E.White, 2001. Fundamentals of Optics, McGraw-Hill, New York, United States.

Web Resources:

1. https://ocw.mit.edu/courses/physics/
2. https://nptel.ac.in/courses/115/101/115101005/
3. http://hyperphysics.phy-astr.gsu.edu/
4. https://phet.colorado.edu/en/simulations/category/physics
5. https://www.khanacademy.org/science/physics/light-waves

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	2	2	2	2	2	2	3	3	2
TOTAL	**15**	**15**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**15**	**15**	**14**
AVERAGE	**3**	**3**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**3**	**3**	**2.8**

3– Strong,2-Medium,1-Low

SEMESTER VI

CORE LAB COURSEVIII: GENERAL PHYSICS LAB VIII

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CP2	-	-	2	-	1	2	30	25	75	100

Prerequisite:

Knowledge on basic concepts of ICs, Diodes and Op-amps

Learning Objectives:

1. To perform basic experiments on characteristics of electronic devices and then get into the applications such as amplifiers, oscillators, multivibrators.
2. To analyse the functioning of Logic gates and ICs and understand their applications.

Course Outcomes

On the successful completion of the course, students will able to:		
1.	recall the basic concepts of transistors, diodes and operational amplifiers.	**K1& K2**
2.	design and analyze operational amplifier-based circuits such as differentiators, integrators, inverting, non-inverting, summing, adder, and subtractor circuits.	**K3**
3.	implement and verify Boolean expressions and demonstrate NAND as a universal gate using logic gates.	**K3**
4.	construct and analyze diode-based clipping and clamping circuits.	**K3**
5.	examine the characteristics of a transistor in CE and CB configurations.	**K4**

K1–Remember; **K2**–Understand;**K3**-Apply;**K4**-Analyze

Contents (Any Six Experiments)	
1.	Operational amplifier-differentiator & integrator.
2.	Operational amplifier-inverting amplifier and summing.
3.	Operational amplifier -non-inverting amplifier and summing.
4.	NAND as universal building block.
5.	Verification of Boolean Expression
6.	Regulatedpowersupply-IC-7909 &7809or equivalent
7.	Decoder
8.	Op-amp: Adder and Subtractor
9.	Clipping and clamping circuits using diodes.
10.	Characteristics of a transistor–(CE mode)
11.	RC coupled CE transistor amplifier-single stage.
12.	Transistor Emitter follower.

Text Books

1. Gayakwad, Ramakant A.2000.*Op-Amps and Linear Integrated Circuits.* Pearson Education, India.
2. Boylestad, Robert L.,and Louis Nashelsky.2017. *Electronic Devices and Circuit Theory.* Pearson Education, India.

Reference Books

1. Bell, DavidA.2015. *Electronic Devices and Circuits.* Oxford University Press, India.
2. Mano, M.Morris, and MichaelD.Ciletti.2018. *Digital Design.* Pearson Education, India.
3. Jain, R. P. 2010. *Modern Digital Electronics.* Mc Graw Hill Education, India.
4. Malvino, Albert Paul, and Donald P.Leach.2006. *Digital Principles and Applications.*

Mc Graw Hill Education, India**.**
5. Millman, Jacob, and Christos C.Halkias.2010. *Electronic Devices and Circuits.* Mc Graw Hill Education, India.

Web Resources:

1. https://www.allaboutcircuits.com/
2. https://www.electronics-tutorials.ws/
3. https://nptel.ac.in/courses/108/108/108108111/
4. https://learn.sparkfun.com/tutorials
5. https://circuitdigest.com/

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	2	2	2	2	2	2	3	3	2
TOTAL	**15**	**15**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**15**	**15**	**14**
AVERAGE	**3**	**3**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**3**	**3**	**2.8**

3– Strong,2-Medium,1-Low

SEMESTER VI

CORE LAB COURSE IX: GENERAL PHYSICS LAB IX (C++PROGRAMMING)

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CP3	-	-	2	-	1	2	30	25	75	100

Prerequisites:

Knowledge on C++Programming in basic Physics

Learning Objectives:

1. Toapplyobjectorientedprogrammingtechniquestosolvephysicsproblems.
2. To develop programs using functions and classes (objects, array of objects, friend functions, passing and returning objects).

Course Outcomes

On the successful completion of the course, student will be able to**:**		
1	understand the principles of object oriented program to construct computer programs and modeling of experimental data for the solution of problems in physics.(period of a pendulum and Young's modulus of a material).	**K1&K2**
2	apply object oriented programming techniques to solve computing problems. (addition, subtraction, multiplication and division)	**K1&K2**
3	develop programs using functions and classes.(objects, array of objects, friend functions, passing and returning objects, function declaration with/without using the return statement).	**K2&K3**
4	Formulate the applications of pointers and virtual functions. Distinguish formatted and unformatted I/O operations.	**K3&K4**
5	develop programs using constructor, destructor, operator overloading and inheritance. (generate a series of Fibonacci numbers using constructor in the scope of class definition/out of the class definition using the scope resolution operator).	**K4&K5**

K1-Remember;**K2**-Understand;**K3**-Apply;**K4** -Analyze;**K5**-Evaluate

Contents

(Any Eight Experiments)

1. To read any two numbers through the keyboard and to perform simple arithmetic operation (addition, subtraction, multiplication and division) and display the results using Cinand Coutfunctions. Use do-while loop.
2. To display the name of the day in a week, depending upon the number entered through key board using Switch-Case statement
3. To test the validity of any entered character whether it belongs to the alphabetical set or a number or a special character the data obtained from uniform bending method.
4. Solve quadratic equation
3. Write a simple C++program to find the path travelled by a body

4. To find the sum of the series using for loop.
   - Sum=1+3+5+ .....n
   - Sum=1+ 2^2+4^2+.....+n^2

5. To find the factorial of a number by using function declaration with/without using the return statement

6. To read a set of numbers from a standard input device and to find out the largest number in the given array using function declaration. Also sort them in the ascending or the descending order.
7. To read the elements of the given two matrices of order mx n and to perform the matrix addition and display the transpose of the result.
8. To generate a series of Fibonacci numbers using constructor where the construct or member function has been defined in the scope of class definition/ out of the class definition using the scope resolution operator.
9. To write a LOOP programme to find the period of a pendulum of given length L, in a gravitational field. Accept the required values using the keyboard. Also display the result.
10. Develop a program in C++to calculate the Young's modulus of a material from

Reference Books

1. Manual prepared by the department
2. Balagurusamy, E.(2015*),Object Oriented Programming with C++*. 6th edition.New Delhi: McGraw Hill Education (India) Private Limited.
3. Ravichandran, D.(2008),*Programming with C++*.3rd edition. NewDelhi: TataMcGrawHillPublishingcompany Ltd.

Web Resources

1. https://www.youtube.com/watch?v=3j0c_FhOt5U
2. https://www.youtube.com/watch?v=7eHuQXMCOvA&pp=ygUII25ld3RvbnI%3D
3. https://www.youtube.com/watch?v=vA7ShWJdfrg
4. https://www.slideshare.net/slideshow/algebraic-and-transcendental-equations/55260970
5. https://www.scribd.com/document/367146646/Complete-Lab-Manual-Lab-VII

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	2	2	2	2	2	2	3	3	2
TOTAL	**15**	**15**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**15**	**15**	**14**
AVERAGE	**3**	**3**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**3**	**3**	**2.8**

3– Strong,2-Medium,1-Low

SEMESTERVI

DISCIPLINE SPECIFIC ELECTIVE III: a) NUMERICAL METHODS AND C++PROGRAMMING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236DE1	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Students should have basic knowledge in mathematics and computer programming

Learning Objectives:

1. To understand the methods in numerical differentiation and integration and to develop the problem solving skills of the student.
2. To introduce and explain the basic structure, rules of compiling and execution of C++ programming.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	recall fundamental numerical methods and their applications in scientific computing and to identify the syntax, data-types, and control structures used in C++ programming.	**K1**
2	understand the numerical techniques for solving algebraic and differential equations and to describe object-oriented programming (OOP) concepts in C++ and their significance in numerical computations.	**K2**
3	Apply numerical algorithms in C++ to solve mathematical problems like interpolation, differentiation and integration.	**K3**
4	Compare different numerical techniques based on accuracy, efficiency, and convergence.	**K4**
5	Justify the selection of an appropriate numerical method for a given problem based on its computational efficiency and develop optimized C++ programs integrating numerical methods for real-world scientific and engineering problems.	**K5&K6**

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

Units	Contents	No.of Hours
I	**NUMERICALSOLUTIONS:** Determination of zeros of polynomials – roots of linear equations and nonlinear algebraic equations and transcendental equations – bisection and Newton-Raphson methods	**15**

II	**NUMERICALDIFFERENTIATIONANDCURVEFITTING:** Newton's forward difference formula- first and second order derivatives – Maximum and Minimum values of a tabulated function-Fitting a straight line–Non-linear Curve fitting: Polynomial and exponential curve.	**15**
III	**INTRODUCTION TO C++:**Importance of C++ –basic structure of C++ programming – constants, variables and data types – character set, key words and identifiers – declaration of variables and data types – operators – expressions: arithmetic, relational, logical, assignment – increment and decrement – conditional operators **Control Structures in C++:**decision making with if, if-else, nested if – switch –go to – break – continue –while, do while, for statements	**15**
IV	**Arrays and Functions:** arrays, one dimensional and two dimensional – declaring arrays –functions-returning values from function-reference argument-overloaded function-inline function- Return by reference	**15**
V	**ALGORITHM,FLOWCHARTANDPROGRAM:** development of algorithm – flow chart for solving simple problems– average of set of numbers – greatest, smallest – conversion ofFahrenheit to Celsius and Celsius to Kelvin, miles to kilometer – sorting set of numbers in ascending and descending order.	**15**
	Total	**75**

Text book

1. Singaravelu, 1999, Numerical methods, Meenakshi publication, 4thEdn, Chennai.
2. Balagurusamy (2012) Programming in C++,7thEdn. Tata McGraw Hill,NewDelhi.

Reference Books

1. M.K.Venkatraman,2013,Numerical Analysis,NPH
2. B.D.Gupta,2013,Numerical Analysis,Konark Publishers, New Delhi,2013
3. C.Byron&S.Gottfried,2003,Theory and Problems of programming in C++, Schaum's outline series, Tata McGraw Hill 2003
4. P.Kandasamy, K.Thilagavathy, K.Gunavathi, 2016, Numerical methods, S.Chand, New Delhi.
5. Balagurusamy(2020) ProgramminginC++,8thEdn.TataMc Graw Hill, New Delhi.

Web Resources

1. https://www.youtube.com/watch?v=3j0c_FhOt5U
2. https://www.youtube.com/watch?v=7eHuQXMCOvA&pp=ygUII25ld3RvbnI%3D
3. https://www.youtube.com/watch?v=vA7ShWJdfrg

4. https://www.slideshare.net/slideshow/algebraic-and-transcendental-equations/55260970
5. https://www.scribd.com/document/367146646/Complete-Lab-Manual-Lab-VII

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	2	3	2	2	2	2
CO2	3	2	3	3	3	2	2	3	2	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2
CO4	3	2	3	3	2	2	2	3	2	2	2	2
CO5	3	2	3	3	3	2	2	3	2	2	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**15**	**10**	**10**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**3**	**2**	**2**	**2**	**2**

3– Strong,2-Medium,1-Low

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE III: b) DIGITAL ELECTRONICS AND MICROPROCESSOR 8085

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236DE2	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Basic knowledge of Electronics and Circuit Theory, Understanding of Boolean Algebra and Logic Gates, Fundamentals of Number Systems and Binary Arithmetic.

Learning Objectives:

1. To understand the fundamental principles of digital logic circuits and their applications in computing.
2. To gain in-depth knowledge of Microprocessor 8085architecture, instruction set, and programming for embedded system applications.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember combinational and sequential digital circuits using logic gates and flip-flops.	**K1**
2.	comprehend the architecture and functioning of the Intel8085 microprocessor, including its addressing modes and instruction set.	**K2**
3.	apply digital and microprocessor concepts in real-world applications like automation, robotics, and embedded systems.	**K3**
4.	analyze assembly language programs for the 8085 microprocessor to perform basic arithmetic, logical, and control operations.	**K4**
5.	evaluate the working of peripheral devices such as memory units, I/O devices, and display units with the microprocessor.	**K5**

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyse;**K5**–Evaluate

Units	Contents	No.of Hours
I	**NUMBER SYSTEMS AND BOOLEAN ALGEBRA** Decimal, binary, octal, hexadecimal numbers systems and their conversions–codes: BCD, gray and excess-3 codes –code conversions –complements (1's, 2's, 9's and 10's) –binary addition, binary subtraction using 1's & 2's complement methods – Boolean laws – De-Morgan's theorem –basic logic gates-universal logic gates(NAND&NOR)–standard representation of Logic functions(SOP&POS)	**15**
II	**SEQUENTIAL CIRCUITS AND MEMORY DEVICES** Adders – half and full adder –subtractors - half& full subtractor –Concept - Logic circuit and truth table - Sum and Carry equations - parallel binary adder – magnitude comparator – multiplexers (4:1) & demultiplexers (1:4), encoder (8-line-to-3- line) and decoder (3-line-to-8-line), BCD to seven segment decoder.	**15**
III	**LOGIC GATES AND SIMPLIFICATION TECHNIQUES** Flip-flops: S-R Flip-flop , J-K Flip-flop, T and D type flip-flops, master- slave flip-flop, truthtables, registers:- serial in serialout and parallel in and parallel out – counters asynchronous:-mod-8, mod-10, synchronous - 4-bit &ring counter – general memory operations, ROM, RAM (static and dynamic).	**15**
IV	**8085 MICROPROCESSOR** 8085 Microprocessor: introduction to microprocessor – INTEL 8085 architecture – register organization –pin configuration of 8085, interruptsand its priority – Program Status Word (PSW) –instruction set of 8085 –	**15**

	addressingmodesof8085–assemblylanguageprogrammingusing8085–programmes for addition (8-Bit & 16-Bit), subtraction (8-Bit & 16-Bit), multiplication (8- Bit), division (8- Bit).	
V	**I/O INTERFACES** Serialcommunication interface (8251-USART) –FunctionalBlock Diagram Data Buffer Register, Control & Status Registers - Mode, Command, and StatusWords programmable peripheralinterface (8255-PPI) –programmable intervaltimers(8253)–keyboardanddisplay(8279),DMAcontroller (8237)Need for High-Speed Data Transfer - CPU vs. DMA-Based Data Transfer.	**15**
	Total	**75**
Self-study	Karnaugh map,,EPROM ,Multiplexers ,PSW, 8085interfaces	

Textbooks:

1.Ronald J, 1999. DigitalSystems:Principles and Applications, PHI, New Delhi.

2.Morris Mano M., Michael D.Ciletti, 2017. Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog, Pearson, Harlow, United Kingdom**.**

3. Ramesh S. Gaonkar., 2013. Microprocessor Architecture, Programming, and Applications with the 8085, Penram International Publishing, Mumbai, India.

Reference Books:

1. Herbert,Donald Schilling,1985.Digital Integrated Electronics, McGraw Hill, New York, United States.
2. Bose S.K, 1992. DigitalSystems, NewAgeInternational, NewDelhi, India.
3. Anvekar D.K., Sonade, 1994. Electronic DataConverters:Fundamentals& Applications, TMH, New Delhi, India.
4. Malvino, Albert Paul, Donal Leach, 1993. Digital Principles and Applications, TMG Hill, New York, United States.
5. DouglasV,1992.Microprocessors and Interfacing, McGrawHill,NewYork, UnitedStates.

Web Resources:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/
2. https://www.khanacademy.org/computing/computer-science/cryptography/logic-gates-and-boolalg/v/logic-gates
3. https://www.allaboutcircuits.com/
4. https://www.geeksforgeeks.org/microprocessor-tutorial/
5. https://www.ti.com/logic-circuit.html

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMES PECIFICOUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	2	3	2	2	3	2	3	3	3	3	3
TOTAL	**15**	**14**	**15**	**14**	**14**	**15**	**14**	**15**	**15**	**15**	**15**	**15**
AVERAGE	**3**	**2.8**	**3**	**2.8**	**2.8**	**3**	**2.8**	**3**	**3**	**3**	**3**	**3**

3–Strong,2-Medium,1-Low

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE III: c) COMMUNICATION SYSTEMS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236DE3	5	-	-	-	3	5	75	25	75	100

Pre-requisite:

Students should know the fundamentals of transmission and reception of radio waves and the different types of communication like fibre optic, radar, satellite and cellular

Learning Objectives:

1. To understand the principles and technologies used in various communication systems, including radio, fiber optic, radar, satellite, and mobile communication.
2. To gain practical knowledge of the working of communication systems, including modulation, radar systems, satellite communication, and mobile communication technologies.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	recall the fundamental concepts of radio transmission and reception, including types of modulation (AM, FM)and the essential components of radio receivers.	**K1**
2	explain the principles of fiber optic communication,the structure of optical fibers,and the different classifications based on refractive index profiles and modes of propagation.	**K2**
3	apply the knowledge of radar systems to understand different types of radar, Doppler effect, and principles like MTI in communication systems.	**K3**
4	analyze satellite communication systems,including their orbits,frequency usage, multiple access communication, and how satellite communication systems operate in India.	**K4**
5	integrate knowledge of mobile communication technologies, including 4G, Wi- i,andVSATsystems,andproposeinnovativesolutionsorimprovementsfor communication systems.	**K5**

K1-Remember;**K2**-Understand;**K3** -Apply;**K4** -Analyze;**K5** - Evaluate

Units	Contents	No. of Hours
I	**Radio Transmission and Reception:** transmitter – modulation types of modulation – amplitude modulation – limitations of amplitude modulation – frequency modulation – comparison of FM and AM – demodulation- essentials in demodulation – receivers: AM radio receivers – types of AM radio receivers – stages of super heterodyne radio receiver, advantages–FM receiver–difference between FM and AM receivers.	15
II	**Fiber Optic Communication:** introduction – basic principle of fiber optics – advantages – construction of optical fiber – classification based on the refractive index profile – classification based on the number of modes of propagation– losses in optical fibers–attenuation– Advantages of fiber optic communication	15

III	**RADAR Communication: i**ntroduction - basic radar system –radar range – antenna scanning –pulsed radar system– search radar –tracking radar–moving target indicator Doppler effect-MTI principle–CW Doppler radar	**15**
IV	**Satellite Communication:** introduction history of satellites – satellite communication system – satellite orbits – basic components of satellite communication system – commonly used frequency in satellite – communication–multiple access communication–satellite Communication in India	**15**
Self Study	satellite communication in India ,application of facsimile	

Text books

1. Metha.V. K, 2013,Principles of Electronics (Seventh Edition), S.Chand &Co Ltd.,
2. Anokh Singh and Chopra A.K, 2013, Principles of communication Engineering (Fifth Edition), S.Chand & Co.

Reference Books

1. Chitode.J. S, 2020), Digital Communications (First Edition),Unicorn publications
2. Senior John.M, 2009,Optical Fiber Communications: Principles and Practice (Third Edition), Pearson Education.
3. Singh.R.P, 2017,Communication Systems: Analog and Digital(Third Edition), McGraw Hill Education.
4. Herbert Taub,DonaldL.Schiling, 2014, Principles of Communication Systems (Second Edition), McGraw Hill Publishing Company
5. George Kennedy, Bernard Davis, 2009,Electronic Communication Systems(Fourth Edition), Tata McGraw-Hill

Web Resources

1. https://www.vedantu.com/physics/communication-systems
2. https://eedmd.weebly.com/uploads/9/6/6/9/96692532/carlson.pdf
3. https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/
4. https://onlinelibrary.wiley.com/journal/10991131
5. https://archive.nptel.ac.in/courses/108/104/108104091/

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	2	2	3	2	2
CO2	3	2	3	3	3	2	2	2	3	2	2
CO3	3	2	3	3	3	2	2	2	3	2	2
CO4	3	2	3	3	2	2	2	2	3	2	2
CO5	3	2	3	3	3	2	2	2	3	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**10**	**15**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**2**	**3**	**2**	**2**

3– Strong,2-Medium,1-Low

SEMESTERVI
DISCIPLINE SPECIFIC ELECTIVE IV: a) ELECTRONICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236DE4	**5**	–	–	–	**3**	**5**	**75**	**25**	**75**	**100**

Pre-requisite:

Good knowledge in basic Electronics

Learning Objectives:

1. To study and analyze the basic concepts and action of semiconductor diodes transistors and operational amplifiers.
2. To analyze the working of electronic circuits and applications.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	gain knowledge in semiconductor diodes, transistor, oscillator and amplifier.	**K1**
2.	infer the operation of semiconductor physics for intrinsic and extrinsic materials.	**K2**
3.	apply feedback in amplifiers and oscillator circuit.	**K3**
4.	analyze the types of oscillator based on the circuit design; characteristic and applications of the op-amp.	**K4**
5.	justify the function of semiconductor diodes in filter and bridge circuit.	**K5**

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

Units	Contents	No.of Hours
I	**Semiconductor diodes and transistors:** Semiconductor materials – Intrinsic semiconductors – Extrinsic semiconductors – N-type semiconductor – P-type semiconductor – P-N Junction – P-N Junction with no external voltage – P-N junction with forward bias–P-N junction with reverse bias–V-I characteristics of a P-N junction diode–Static and dynamic resistance of a diode–Half wave	**15**
	rectifier – Bridge Rectifier – Calculation of ripple factor and rectification efficiency– Filters (π filter) – Zener diode – Voltage regulator – Junction transistor structure–Working of transistor–Amplifying action–Three configurations–Transistor characteristics(CE configuration only).	
II	**Transistor amplifier:** Transistor biasing – Selection of operating point – Bias stabilization – Fixed bias and Voltage divider bias – Single stage transistor amplifier – Equivalent circuit method – Development of transistor AC equivalent circuit – h-parameter equivalent circuit – Analysis of a single state CE amplifier using hybrid models: Input and output impedance, current-Voltage and power gain.	**15**
III	**Feedback in amplifiers:** Concept of feedback in amplifiers – Types of feedback – Voltage gain of amplifier– Effect of negative feedback on gain stability, distortion and noise, input impedance, output impedance and bandwidth–Amplifier circuits with negative feedback – RC coupled amplifier without bypass capacitor – Emitter follower.	**15**
	Oscillator: Need for an oscillator – Generating sine wave using tuned oscillator circuit – Frequency of oscillations in LC circuit – Sustained oscillations – Positive	

IV	feedback amplifier as an oscillator (Barkhausen criterion) – Starting voltage – LC oscillators – Hartley and Colpitt's oscillators –Basic principle of RC oscillator – RC phase shift oscillator.	**15**
V	**Operational amplifier:** Parameters of a general amplifier – Ideal operational amplifier – Inverting amplifier – Non-inverting amplifier – Difference amplifier – Operational amplifier circuits – Voltage follower – Summing amplifier – Integrator – Differentiator–Log and antilog amplifiers–Comparators and Schmitt trigger.	**15**

Self-study	Zener diode, Voltage regulator.

Text Books:

1. Bhargava, N.N., Kulshreshtha, D.C., Gupta, S.C. (2002).*Basic Electronics and Linear circuits*. (35th reprint),Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Rajiv Kapadia.(2012). *Operational Amplifiers and Linear Integrated Circuits*, Jaico Publishing House.

Reference Books:

1. Albert Malvino, David J. Bates,(2017). *Electronic Principles*, (7thEditionPaperback), McGraw-Hill Higher Education, USA.
2. Mehta,V.K, Rohit Mehta,(2014).Principles of Electronics, S Chand Publication.
3. Millman, J. Halkias, C.C. (1991). *Integrated Electronics*. New Delhi: Tata McGraw-Hill Publishing Company Limited.
4. Ryder,J.D.(2004).*Electronics:FundamentalsandApplications*.PrenticeHall International, INC., Englewood Cliffs.
5. Salivahanan,S.,Kumar,N.S.(2012).*ElectronicDevicesandCircuits*.(3rded.).New Delhi: Tata McGraw-Hill Publishing Company Limited.

Web Resources:

1. https://www.renesas.com/en/support/engineer-school/electronic-circuits-02-diodes-transistors-fets?srsltid=AfmBOoqgfCzycBX9ACVSLGbYz93yduIsbTC2KJ10BfNixKSepqqcBbf3
2. https://www.electrical4u.com/what-is-an-oscillator/
3. https://www.electronics-tutorials.ws/amplifier/amp_1.html
4. https://www.jntua.ac.in/gate-online-classes/registration/downloads/material/a159298350984.pdf
5. https://testbook.com/electrical-engineering/transistor-as-an-amplifier-principles-and-working

MAPPINGWITHPROGRAMMEOUTCOMESAND PROGRAMMESPECIFICOUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	2	3	2	3	3	3	3	3
CO2	3	2	3	1	2	3	2	3	3	3	3	3
CO3	3	2	3	1	2	3	2	3	3	3	3	3
CO4	3	2	3	1	2	3	2	3	3	3	3	3
CO5	3	2	3	1	2	3	2	3	3	3	3	3
TOTAL	**15**	**10**	**15**	**5**	**10**	**15**	**10**	**15**	**15**	**15**	**15**	**15**
AVERAGE	**3**	**2**	**3**	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**

3–Strong,2-Medium,1-Low

SEMESTER VI
DISCIPLINE SPECIFIC ELECTIVEI V: b) GEO PHYSICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236DE5	5	-	-	-	3	5	75	25	75	100

Pre-requisite:
Knowledge of forces, motion, and energy.

Learning Objectives:
1. To develop an understanding of the Universe's formation, structure, and the dynamic processes shaping planetary systems, including Earth.
2. To analyze Earth's geological and biological evolution, and assess human activities' effects on climate, ecosystems, and natural resources.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall the origin of the Universe, the Solar System, and Earth's physical characteristics.	**K1**
2.	outline the composition and features of the geosphere, hydrosphere, atmosphere, cryosphere, and biosphere.	**K2**
3.	understand platetectonics, earthquakes, volcanoes, ocean currents, and Atmospheric circulation.	**K2**
4.	Apply knowledge of Earth's geological and biological evolution to analyze human impacts like pollution, climate change, and biodiversity loss.	**K3**
5.	Analyze Earth's climate, historical changes, natural cycles, and the Indian Monsoon system.	**K4**

K1-Remember;**K2**-Understand;**K3**–Apply;**K4**-Analyse

Units	Contents	No.of Hours
I	**THE EARTH AND THE UNIVERSE:** Origin of universe - Creation of elements and earth - Introduction to various branches of Earth Sciences – General characteristics and origin of the Universe - The Milky Way galaxy - Solar system - Earth's orbit and spin - The Moon's orbit and spin - The terrestrial and Jovian planets – Meteorites & Asteroids-Earth in the Solar system– Origin-size–shape – mass– density-Rotational and revolution parameters and it sage.	**15**
II	**STRUCTURE OF EARTH:** Mass – Dimensions - Shape and topography - Internal structure - Magnetic field - Geothermal energy. The Hydrosphere: The oceans, their extent, depth, volume, chemical composition. River systems - The Atmosphere: variation of temperature-Density and composition with altitude - clouds. The Cryosphere: Polar caps and ice sheets. Mountain glaciers. The Biosphere: Plants and animals. Chemical composition-	**15**

	mass. Marine and land organisms.	
III	**DYNAMICAL PROCESSES:** Origin of the magnetic field – Source of geothermal energy - Convection in Earth's core and production of its magnetic field – Mechanical layering of the Earth - Introduction to geophysical methods of earth investigations - Concept of plate tectonics - continental drift - Origin of oceans-Continents-Mountains and rift valleys-Earthquake and Volcanoes—Oceanic current system and effect of Coriolis forces.	**15**
IV	**CLIMATE:** Earth's temperature and Greenhouse effect -Greenhouse gas emissions - Climate change – Paleo climate and recent climate changes - The Indian monsoon system - Biosphere: Water cycle - Carbon cycle - Nitrogen cycle - Phosphorous cycle - The role of cycles in maintaining a steady state-Atmospheric circulation-Weather and climatic changes-Earth's Heat budget-Cyclones.	**15**
V	**EVOLUTION:** Time line of major geological and biological events - Origin of life on Earth - Role of the biosphere in shaping the environment - Future of evolution of the Earth and solar system: Disturbing the Earth – Contemporary dilemmas - Human population growth - Atmosphere: Air pollution - Hydrosphere: Fresh water depletion - Geosphere: Chemical effluents-Nuclear waste-Biosphere: Biodiversity loss–Deforestation-Robustness and fragility of eco systems.	**15**

Self-study	Green house effect-Green house gas emissions-Climate change-Deforestation-Robustness and fragility of ecosystems.

Text Books:

1. Jay Melosh H, 2011. *Planetary Surface Processes*, Cambridge University Press, Cambridge.
2. Emiliani C, 2007. *Planet Earth-Cosmology,Geology and the Evolution of Life and Environment*, Cambridge University Press, New York.
3. Fowler CMR, 2004.*The Solid Earth:An Introduction to Global Geophysics*, University of London, Royal Holloway.
4. FrankD. Stacey, PaulM. Davis,2008. Physics of the Earth, Cambridge University Press, Cambridge.

Reference Books:

1. JohnHarte,1988. *Consider a Spherical Cow:A course in environmental problem solving*, University Science Books, New Jersey.
2. Peter McLaren, Donald Duff, Arthur Holmes,1 993. *Holme's Principles of Physical Geology.* Chapman & Hall, NewYork.
3. Telford WM, GeldartLP,SheriffRE,1990. *Applied Geophysics*, Cambridge University Press, Cambridge.
4. William Lowrie,1998. *Fundamentals of Geophysics*, Cambridge University Press, Cambridge.
5. John M. Reynolds,2011. *An Introduction to Applied and Environmental Geophysics*, Wiley Publications, New Jersey.

WebResources:

1. https://www.ncbi.nlm.nih.gov/books/NBK230211/
2. https://chem.libretexts.org/Bookshelves/Environmental_Chemistry/Geochemistry_(Lower)/02%3A_The_Hydrosphere/2.02%3A_The_hydrosphere_and_the_oceans
3. https://cluin.org/characterization/technologies/default2.focus/sec/Geophysical_Methods/cat/Overview/
4. https://bio.libretexts.org/Bookshelves/Ecology/Environmental_Science_(Ha_and_Schleiger)/02%3A_Ecology/2.04%3A_Ecosystems/2.4.03%3A_Biogeochemical_Cycles

5. https://earth.org/the-biggest-environmental-problems-of-our-lifetime/

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	3	2	3	2	2	2
CO2	3	1	3	3	2	3	1	2	2	1	1	2
CO3	3	3	3	2	2	3	2	2	3	2	2	2
CO4	3	2	3	2	3	3	2	2	2	2	2	2
CO5	3	3	3	2	2	3	2	2	3	2	2	2
TOTAL	**15**	**11**	**15**	**12**	**11**	**15**	**10**	**10**	**13**	**9**	**9**	**10**
AVERAGE	**3**	**2.2**	**3**	**2.4**	**2.2**	**3**	**2**	**2**	**2.6**	**1.8**	**1.8**	**2**

3– Strong,2-Medium,1-Low

SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE IV: c) BIOPHYSICS

Course Code	L	T	P	S	Credits	Inst.Hours	Total Hours	Marks		
								CIA	External	Total
PU236DE6	5	–	–	–	3	5	75	25	75	100

Pre-requisite:

Fundamental concepts of Physics and Biology.

Learning Objectives:

1. To understand the fundamental principles involved in cell function maintenance, macromolecular structures involved in propagation of life and the biophysical function of membrane and neuron.
2. To understand the physical principles behind the various techniques available for interrogating biological macromolecules.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	recall fundamental concepts of computational, quantum, and soft matter Biophysics and quantum effects in biological systems.	**K1**
2	understand and explain the principles behind biophysical imaging techniques And biomechanics of cytoskeletal structures.	**K2**
3	apply Monte Carlo methods, molecular docking techniques, and artificial intelligence tools to model biomolecular interactions.	**K3**
4	analyze the impact of extreme environmental conditions on biomolecular stability and evolutionary adaptations.	**K4**
5	Integrate biophysical principles to design innovative applications in drug delivery, bio engineering, and quantum sensors.	**K5**

K1-Remember; **K2**-Understand; **K3** -Apply; **K4** -Analyze; **K5** - Evaluate

Units	Contents	No.of Hours
I	**COMPUTATIONAL BIOPHYSICS:** Introduction to Molecular Dynamics Simulations-Monte Carlo Methods in Biophysics-Bioinformatics: Protein Structure Prediction & Molecular Docking – Modeling Biomolecular Interactions - Applications of Artificial Intelligence (AI) in Biophysics.	**15**
II	**SOFTMATTER BIOPHYSICS:** Basics of Colloids, Gels, and Liquid Crystals-Self-Assembly in Biological Systems (Micelles, Liposomes)-Biopolymer Physics (Mechanical Properties of DNA & Proteins)-Biomechanics of Cytoskeleton - Applications in Drug Delivery & Bioengineering.	**15**

III	**QUANTUM BIO PHYSICS:** Quantum Mechanics in Biology: Quantum Tunneling in Enzymes- Role of Quantum Coherence in Photosynthesis-Spin Chemistry & Magnetic Effects on Biochemical Reactions-Quantum effects inDNA Mutation & Replication-Future Applications:Quantum Sensors in Biology.	**15**
IV	**BIO FLUID MECHANICS&BIOPHYSICAL IMAGING:** Blood Flow Dynamics &Viscosity-Fluid Mechanics in Respiratory and Circulatory Systems-MRI, PET, CT & Ultrasound in Biological Imaging-Optical Tweezers & Laser Trapping inBiophysics-Advanced Imaging: Super-Resolution Microscopy & Atomic Force Microscopy (AFM**).**	**15**
V	**EVOLUTIONARY&ENVIRONMENTALBIOPHYSICS:** Biophysics of Evolution: Natural Selection & Molecular Evolution-Extreme Biophysics: Adaptation to Extreme Environments (Deep-Sea, High Altitude, Space)- Climate Change & Biophysics: Impact on Biomolecular Stability- Biodiversity & Biophysical Adaptations-Astro biophysics: Possibilities of Life in Extra terrestrial Environments.	**15**
	Total	**75**

Self Study	Protein Structure, Colloids, Quantum Sensors ,Advanced Imaging Biomolecular Stability

Textbooks:

1. Chandran, K.B.2007. Biofluid Mechanics: The Human Circulation. CRC Press.
2. Bejan, A. 2016.The Physics of Life:The Evolution of Everything. St. Martin's Press.

Reference Books:

1. Phillips, R. 2012. Computational Biophysics of the Cell. Cambridge University Press.
2. Cooper,G.M. 2013.The Cell:A Molecular Approach. ASM Press,Washington.
3. Jones, R.A.L. 2002. Soft Condensed Matter.Oxford University Press.
4. Bassereau, P., & Sens,P. 2018. Physics of Biological Membranes. Springer.
5. Bejan,A. 2016.The Physics of Life:The Evolution of Everything. St. Martin's Press.

Web Resources:

1. https://www.nature.com/subjects/biophysics
2. https://pdb101.rcsb.org/
3. https://www.ks.uiuc.edu/Research/membranes/
4. https://www.nist.gov/pml/radiation-biophysics
5. https://www.ks.uiuc.edu/Research/biophysics/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	2	2	2	3	3	3	3	2
CO2	3	3	3	2	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3	3	3
TOTAL	**14**	**15**	**15**	**14**	**14**	**14**	**14**	**14**	**15**	**15**	**15**	**14**
AVERAGE	**2.8**	**3**	**3**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**3**	**3**	**3**	**2.8**

3-Strong, 2-Medium, 1-Low

SEMESTER VI

PROFESSIONAL COMPETENCY SKILL II: BASIC ELECTRICALCIRCUITTROUBLESHOOTING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236PS1	1	-	1	-	2	2	30	25	75	100

Pre-requisite: Understanding of the basic troubleshooting skills in electrical circuits and programming language

Learning Objectives

1. To acquire knowledge on the basic electrical parameters, circuits and wiring.
2. To understand the concept of electrical devices and fundamentals needed for electrical circuit trouble shooting skills.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recall the basic definitions and units of electrical quantities	**K1,K2**
2	analyze the circuit elements and their connections and develop their own circuits using electrical wiring	**K4**
3	compare the Physics concepts behind various electrical instruments and appliances (Voltmeter, Ammeter, Incandescent lamp, fluorescent bulb, choke and Starter) and work with open-source Arduino Software Integrated Development Environment(IDE).	**K3**
4	demonstrate uses of tester and Multimeter, LDR, Microphone, loudspeaker, etc.	**K4**
5	test for the working of electrical circuits and appliances(musicbell, Lamp controlled by switch, etc.,)	**K5**

K1–Remember;**K2**-Understand;**K3**–Apply;**K4**–Analyse;**K5**–Evaluate

Units	Contents	No.of Hours
I	**Basic Electrical Circuits and Components** Symbols of electrical elements - Resistors - Conductors - Inductor – Capacitor and transformer –Single phase and three phase-Star and delta connections - Rules of electric connections - Study of motors and Generators.	**6**
II	**Electrical Wiring** Systems of supply – Systems of wiring – Testing of wiring installation – Materials used for wiring–A lamp controlled by a switch–Earthing-Lamp holders, sockets-Fuse base- Distribution box–Trip switches	**6**
III	**Interfacing Sensors and Actuators** Arduino Humidity Sensor-Arduino Temperature Sensor-Arduino Water Detector Sensor-Arduino PIR Sensor-Arduino Ultrasonic Sensor.	**6**
IV	**Hands on trainingI** a. Uses of tester & Multimeter. b. A lamp controlled by a switch with fuse circuit and lamp controlled by two switches. c. Calling bell.(demo) d. Florescent lamp wiring and testing. e. Music bell.	**6**
V	**Hands on training II**	**6**

	f. LDR application. g. Working of a relay. h. Microphone–amplifier –Loudspeaker setup. i. Blinking LED j. Domestic sensors	
	Total	**30**

Self-study	Number of lamp search controlled by its switch

Textbook

Course material prepared by the Department of Physics, Holy Cross College (Autonomous), Nagercoil.

Reference Books

1. Arnold R.B.(1986). *A first electronics course*.(1st ed.).Cheltenham,England: Stanley Thornes (Publishers) Ltd.
2. Theraja B. L., *A text book in Electrical Technology*(23rd ed.). NewDelhi:S. Chand and Company.

Web Resources

1. https://BasicElectricalTroubleshooting(youtube.com)
2. https://www.skillcatapp.com/post/electrical-troubleshooting-a-complete-guide
3. https://thecircuitdetective.com/

MAPPINGWITHPROGRAMMEOUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	3	2	2	3	3	2	2	2
CO2	2	3	2	2	3	2	2	3	3	2	2	2
CO3	2	2	3	2	2	2	3	2	3	2	2	2
CO4	2	2	2	2	2	2	2	3	2	2	2	2
CO5	2	2	2	2	2	2	2	3	3	2	2	2
TOTAL	**10**	**11**	**11**	**10**	**12**	**10**	**11**	**14**	**14**	**10**	**10**	**10**
AVERAGE	**2**	**2.2**	**2.2**	**2**	**2.4**	**2**	**2.2**	**2.8**	**2.8**	**2**	**2**	**2**

3– Strong,2-Medium,1-Low

SEMESTER VI

GENDER EQUITY AND INCLUSIVITY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG236GE1	1	-	-	-	1	1	15	50	50	100

Learning Objectives

1. To understand the challenges faced by women in the society.
2. To analyze the legitimate rights and laws that aid women to march towards emancipation and empowerment.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	interpret the life struggles of women and to promote equality	K1
2	identify the socio-cultural and religious practices that subjugate women	K2
3	probe deep into the root cause of marginalization of women and to promote an inclusive nature	K3
4	investigate the challenges faced by women in practical life	K4
5	evaluate exploitation of women as commercial commodities in advertisements and media	K5

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

Unit	Contents	No. of Hours
I	**Life Struggle of a Woman:** Challenges faced by girl students, education and religion, woman and society, working environment.	3
II	**Cultural Traits:** Myths and religious texts, opposition and rebuttal, contemporary literature, cultural decay, opportunities provided by social media.	3
III	**Women's Rights:** Democratic women's association, Laws for women's rights, essential legal rights of girl child in India, gender justice, millennium development goals, Political parties**.**	3
IV	**Women's Liberation:** Struggle for social rebirth, role of government and NGO's- self-help group for women, Indian political of legal profession and gender representation. the supreme courts efforts, challenging patriarchal narratives, global responsibility, women in sustainable development.	3
V	**Inclusivity:** Equal opportunities for women and men, equal access and opportunities for disabled people, indigenous populations, refugees and migrants - Importance of challenging and redefining gender roles - value and respect towards all gender identities.	3
	TOTAL	15

Reference Books

1. Hosoda, M. 2021. Promoting Gender Diversity and Inclusion at Workplace: A Case Study of Japanese Retail and Financial Service Company. Rikkyo University
2. Palo, S., Jha, K. K. 2020. Introduction to Gender. Tata Institute of Social Sciences.
3. Debois, E. and L. Dumenil. 2005. Through Women's Eyes: An American History With Documents. St. Martin Press.
4. Carter, Sarah. Mansell, 1990. Women's Studies: A Guide to Information Sources
5. .Datchana Moorthy Ramu.2020. Gender Equality and Sustainable development Goals,Notion Press.

Web Resources

1. https://en.wikipedia.org/wiki/Women%27s_studies
2. https://libguides.berry.edu/wgs/reference
3. https://www.albany.edu/~dlafonde/women/wssresguide9602
4. https://openbooks.library.umass.edu/introwgss/chapter/references-feminist-movements/
5. https://libguides.niu.edu/womensandgenderstudies/ReferenceSources