

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI-600008**

DEPARTMENT OF PHYSICS

UG SYLLABUS



**CHOICE BASED CREDIT SYSTEM
OUTCOME BASED EDUCATION**

(OFFERED FROM THE ACADEMIC YEAR 2018-19)

DEPARTMENT OF PHYSICS

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS), CHENNAI – 600 008

MINUTES OF THE BOARD OF STUDIES MEETING

19.08.2019

UG

The Board of Studies Meeting of the Department of Physics was held on 19.08.2019 at 10.00 a.m. with Dr. A. V. Jhone Verjhula in the chair.

The members of the Board suggested the following ratifications:

1. Whilst a slight variation in the CA pattern conforming with the Outcome Based Education Template (OBE) was observed, the Department of Physics would retain the old template with Section A having 7 questions of 2 marks each, Section B having 2 questions of 8 marks each and Section C having 1 question of 20 marks each, in consultation with the members of the Board.
2. To mention explicitly whether the Journals specified at the end of each paper are National or International as required by the Outcome Based Education Template (OBE).
3. To boost up the Industrial tie up to enhance the provision of more internship opportunities for the students, to cater them to pursue higher studies and JRF Programmes in the respective Industrial Institutes.
4. To include “Introduction to Ceramics” by P. W. Kingery as one of the recommended textbooks in the elective subject Materials Science in the Sixth Semester.
5. An Elective paper “Acoustical Physics” with the Course Code PH18/5E/ACP is introduced in the Fifth Semester as an optional paper to Basic Electronics and Electronic Devices (PH18/5E/EED).
- 5.1. Second Elective paper “Advanced Electronics” with the Course Code PH18/6E/AEL is introduced in the Sixth Semester as an optional paper to Digital Electronics and Microprocessor (PH18/6E/DEM).

6. To include field trips to studios and other relevant places to augment the theoretical understanding of the elective paper Acoustical Physics introduced in the Fifth Semester through practical sessions.
7. To include one more unit with Mechanics concepts in the paper “Mechanics and Mathematical Physics “ in the Fifth Semester; while the Classical Mechanics concepts and its applications in the said paper to be incorporated in the paper “Quantum Mechanics and Relativity” offered in the Sixth Semester to observe more relevance in the respective papers. The name of the suggested paper would be “Classical Mechanics Quantum Mechanics and Relativity” with appropriate rearrangement of units in the paper.
8. Ehrenfest’s equations were removed from Unit IV of Heat and Thermodynamics in the Second Semester, for the benefit of the understanding of the students.
9. It was suggested by the Board to have one more theory paper in the First and Third Semesters to give more weightage to the Course and to cater to the inculcation of more Physics concepts from the students’ perspectives.
10. To specifically mention about the depth of concepts (Qualitative only/ Overview) mentioned in Units II, III and IV in the elective paper “Materials Science” offered in the Sixth Semester to add more clarity to the said units from the perspective of the External Examiners and Question Paper setters.
11. To mention explicitly the different Maxwell’s Equations in the paper “Electromagnetism” offered in the Sixth Semester.
12. Self Study papers for Advanced Learners (Students with more than 70% of marks as aggregate) “Medical Physics” with Course Code “PH18/3S/MPH and “Nanoscience and Nanotechnology” with Course Code “PH18/5S/NSN” are introduced in the III and V semesters respectively.

The syllabus for outcome based education was scrutinized and ratified by the board of studies and the following suggestions were given for M.Sc. Physics.

1. It was suggested that MoUs can be signed with hospitals for the Medical Technology elective paper so that the students can get hands on training and certification which will help them in career placement.
2. Industrial/ field visits should be conducted for relevant papers.
3. Feedback on student performance must be collected from the Institutions / Industries /R&D Labs where students take up internship.
4. Feedback on the facilities and guidance received from the Institutions / Industries /R&D labs must be collected from the students taking up the internships.
5. Data Bank of the Institutions / Industries / R & D Labs where students take up internship must be created by the department.
6. Fundamentals of Nano Graphene topic to be included in Nanoscience and Nanotechnology paper.
7. Course outcomes should highlight the relevance of the pertinent topic in research.
8. The components for evaluation pattern in continuous assessment for project were suggested.

The components are

- Selection of problem and review of Literature
 - Periodical review or reports evaluation
 - Seminar
 - Internal viva voce
9. The question paper pattern should specify that section A is EITHER/ OR type choice of questions.
 10. Changes for improvement of Programme Specific Outcome were suggested.

The syllabus for outcome based education was scrutinized and ratified by the board of studies and the following suggestions were given for M.Phil. Physics.

1. The components for evaluation pattern in continuous assessment for project were suggested.

The components are

- Selection of problem and review of Literature
- Periodical review or reports evaluation
- Seminar
- Internal viva voce

2. Nano Graphene topic to be included in Research Trends in Nanoscience and Nanotechnology paper.

3. Changes for improvement of Programme Specific Outcome were suggested.

4. Number of Recommended text books to be increase with the inclusion of books by foreign authors.

The following members were present in the meeting:

- 1) **Dr. A. V. Jhone Verjhula**
Chair Person
Head, Department of Physics
Ethiraj College for Women
Chennai – 08.

AV Jhone Verjhula
19/08/2019

- 2) **Dr. C. Venkateswaran**
University Nominee
Professor and Head
Department of Nuclear Physics
University of Madras (AC TECH Campus)
Chennai – 25.

C. Venkateswaran
19/8/2019

- 3) **Dr. G. Usha**
Subject Expert
Associate Professor
Department of Physics
Queen Mary's College
Chennai – 40.

G. Usha
19/8/19
Dr. G. USHA, M.Sc., M.Phil., B.Ed., Ph.D.,
Associate Professor of Physics
Queen Mary's College (A)
Chennai - 600 004

- 4) **Dr. P. A. Abdullah Mahaboob**
Subject Expert
Associate Professor
Department of Physics
The New College, Chennai – 14.

P. A. Abdullah Mahaboob
19/8/19

- 5) **Dr. B. Uma**
Assistant Professor
Department of Physics
Ethiraj College for Women
Chennai – 08.

B. Uma
19/8/19

- 6) **Dr. Viswa Bhaskaran**
Industry Nominee
VB Ceramic Consultant
Kottivakkam
Chennai – 45.

Viswa Bhaskaran

- 7) **Mrs. Dharma Swaminathan**
Old Student
Assistant Professor
Department of Physics
Quaid-e-Milleth College for Women
Chennai – 02.

D. Swaminathan
19/8/19

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RULES AND REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of B.Sc. Physics course shall be required to have passed the Higher Secondary Examinations conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Syndicate of the University of Madras.

2. ELIGIBILITY FOR THE AWARD OF DEGREE:

A candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study for a period of not less than three academic years, passed the examinations of all the Six Semesters prescribed and must have earned 140 credits.

3. COURSE OF STUDY:

The main subject of study for Bachelor Degree shall consist of the following:

PART – I : Foundation Courses exclusive for Languages.

PART – II : English

PART – III : Core courses

Allied Subjects I and II and Elective papers

PART – IV : Non Major Electives and Soft Skill Subjects

PART – V : Extension Activities / Sports / NCC

4. PASSING MINIMUM:

A candidate shall be declared to have passed in each paper / practical of the main subject of study wherever prescribed, if she secured NOT LESS THAN 40% of the marks prescribed for the examination.

5. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Part I, II, III & IV

Successful candidates passing the examination and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

Candidates who pass all the examinations (Parts I, II, III and IV) prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

On obtaining an undergraduate degree the students will be able to:

PEO1: Apply and advance the knowledge and skills acquired, to become a creative professional in their chosen field.

PEO2: Engage in self-directed continuous learning, aimed at global competency, which will promote professional and personal growth

PEO3: Develop management skills and entrepreneurial skills, by harnessing core competencies tempered by values and ethics

PEO4: Work towards achieving economic and social equity for women through application of relevant knowledge

PEO5: Contribute to promoting environmental sustainability and social inclusivity

PROGRAMME OUTCOMES (POs)

PO1- To promote and apply scientific knowledge for finding sustainable solution to solve the issues pertaining to the society/Industry.

PO2- Identify, Analyse and formulate novel ideas to yield, substantial results in the fields of research utilizing the principles of Physical and Biological Science.

PO3- Relate key concepts and scientific principles to various scientific phenomenon and their applications in day-to-day life.

PO4- Cultivate unparalleled comprehension of fundamental concepts relevant to basic sciences leading to an individual progress and career advancement at the National and Global levels.

PO5- To communicate effectively their views and ideas orally/ written in English and in other related languages.

PO6- Design solutions for complex problems and design system components or processes that meet the specific needs with appropriate consideration for public health and safety, cultural, societal and environmental conditions.

PROGRAMME SPECIFIC OUTCOME (PSOs)

PSO1: Apply the fundamental knowledge of Physics to appreciate, develop and test physical concepts, for applications in materials, analytical tools in medicine, engineering, technological devices, digitalized space communication etc.,

PSO2: Identify and access the diverse applications of Physics through the utilization of mathematical concepts to solve complex issues of environmental and safety requirements, enriching towards career advancement.

PSO3: Formulate the expertise in various domains of Physics acquired through the knowledge of experimental principles to demonstrate, innovate, design and develop the skills towards the futuristic needs of the industry/society.

PSO4: Compile research based knowledge and methods including design of experiments, analysis, interpretation and evaluation of information, to provide valid critique to the society.

PSO5: Communicate explicitly and exchange ideas with regard to theoretical and experimental aspects, the impacts of Physics on environment and society.

PSO6: Apply reasoning, informed by the contextual knowledge to access societal, health, safety, legal, ethical and cultural issues and consequent responsibilities relevant to Physics.

PROGRAMME PROFILE - B. Sc. PHYSICS

SEMESTER	PART	COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	TOTAL HOURS	MARKS		
							CA	SE	TOTAL
I	I		Tamil/Hindi/French/Sanskrit	3	6	90	40	60	100
	II		English	3	4	60	40	60	100
	III	PH18/1C/PMS	Properties of Matter & Sound	5	7	105	40	60	100
	III	PH18/2C/MPR1	Major Practical I	0	3	45	End of 2nd semester		
	III	MA18/1A/AM1	Allied Mathematics I	5	6	90	40	60	100
	IV		1a/1b/1c	2	2	30	NA	50	50
	IV		Soft Skill Subject #	3	2	30	NA	50	50
	Total W.Hrs/Credits				21	30			
II	I		Tamil/Hindi/French/Sanskrit	3	6	90	40	60	100
	II		English	3	4	60	40	60	100
	III	PH18/2C/HTD	Heat & Thermodynamics	5	7	105	40	60	100
	III	PH18/2C/MPR1	Major Practical I	4	3	45	40	60	100
	III	MA18/1A/AM2	Allied Mathematics II	5	6	90	40	60	100
	IV		1a/1b/1c	2	2	30	NA	50	50
	IV		Soft Skill Subject#	3	2	30	NA	50	50
	Total W.Hrs/Credits				25	30			
Total credits at the end of II sem				46					

1a - Basic Tamil

1b - Advanced Tamil

1c - Inter- Disciplinary NME Subject offered by the various Departments

SEMESTER	PART	COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	TOTAL HOURS	MARKS		
							CA	SE	TOTAL
III	I		Tamil/Hindi/French/ Sanskrit	3	6	90	40	60	100
	II		English	3	4	60	40	60	100
	III	PH18/3C/ETM	Electricity and Magnetism	5	7	105	40	60	100
	III	PH18/4C/MPR2	Major Practical II	0	3	45	End of 4th semester		
	III	CH18/3A/PGC1	Allied Chemistry-General Chemistry 1	4	4	60	40	60	100
	III	CH18/4A/PRA	Allied Chemistry Practical	0	2	30	End of 4th semester		
	III	PH18/3S/MPH	Medical Physics (Self Study/Advanced Learners Course)	2 (Additional)	NA	NA	NA	100	100
	IV		EVS	2	2	30	-	50	50
	IV		Soft Skill Subject #	3	2	30	-	50	50
	Total W.Hrs/Credits				20	30			
IV	I		Tamil/Hindi/French/Sanskrit	3	6	90	40	60	100
	II		English	3	4	60	40	60	100
	III	PH18/4C/OPT	Optics	5	7	105	40	60	100
	III	PH18/4C/MPR2	Major Practical II	4	3	45	40	60	100
	III	CH18/4A/PGC2	Allied Chemistry-General Chemistry 2	4	4	60	40	60	100
	III	CH18/4A/PRA	Allied Chemistry Practical - Volumetric & Organic Analysis	2	2	30	40	60	100
	IV		Value Education	2	2	30	-	50	50
	IV		Soft Skill Subject #	3	2	30	-	50	50
	Total W.Hrs/Credits				26	30			
Total credits at the end of IV sem				46					

Soft Skill Subject offered by the Department of English

Note: Internships undertaken by the students during I and II B. Sc. Programme will be treated as an extra credit and is not mandatory at the UG Level

SEMESTER	PART	COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	TOTAL HOURS	MARKS			
							CA	SE	TOTAL	
V	III	PH18/5C/NUP	Nuclear Physics	5	6	90	40	60	100	
	III	PH18/5C/MMP	Mechanics and Mathematical Physics	5	6	90	40	60	100	
	III	PH18/5C/ALP	Atomic and Laser Physics	5	6	90	40	60	100	
	III	PH18/5E/EED	Basic Electronics and Electronic Devices	5	6	90	40	60	100	
	Or									
	III	PH18/5E/ACP	Acoustical Physics	5	6	90	40	60	100	
	III	PH18/6C/MPR3	Major General Practical III	0	3	45	End of 6th semester			
	III	PH18/6E/EPR	Electronics Practical	0	3	45	End of 6th semester			
	III	PH18/5S/NSN	Nanoscience and Nanotechnology (Self Study/Advanced Learners Course)	2 (Additional)	NA	NA	NA	100	100	
	Total W.Hrs/Credits				25	36				
VI	III	PH18/6C/EMG	Electromagnetism	5	6	90	40	60	100	
	III	PH18/6E/DEM	Digital Electronics and Microprocessor	5	6	90	40	60	100	
	Or									
	III	PH18/6E/AEL	Advanced Electronics	5	6	90	40	60	100	
	III	PH18/6C/QMR	Quantum Mechanics and Relativity	5	6	90	40	60	100	
	III	PH18/6E/MAS	Material Science	5	6	90	40	60	100	
	Or									
	III	PH18/6E/ASP	Astrophysics	5	6	90	40	60	100	
	III	PH18/6C/MPR3	Major General Practical III	4	3	45	40	60	100	
	III	PH18/6E/EPR	Electronics Practical	3	3	45	40	60	100	
V		NCC/NSS/CSS/ Sports	1							
Total W.Hrs/Credits				28	30					
Total credits at the end of VI sem				48						
Overall Total credits				140						

Note: Students can take up MOOC/ NPTEL courses and earn extra credits.

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT-UG

INTERNAL VALUATION BY COURSE TEACHER/S

PART I, II AND III-THEORY PAPERS

COMPONENT	TIME	MAX.MARKS	CA MARK
1.TEST I	2 HRS	50 MARKS(TO BE CONVERTED)	10
2.TEST II	2 HRS	50 MARKS (TO BE CONVERTED)	10
3. ASSIGNMENT/SEMINAR/FIELD VISIT			10
4. PARTICIPATORY LEARNING			10
TOTAL			40

PART III- PRACTICAL PAPERS

COMPONENT	MAX.MARKS	CA MARK
1.TEST I	50 MARKS(TO BE CONVERTED)	10
2.TEST II	50 MARKS (TO BE CONVERTED)	10
3. RECORD		10
4. OBSERVATION		10
TOTAL		40

CA QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K1	A - 7x2 marks	One or two sentences	14	50
K1, K2	B - 2/3x8 marks	200	16	
K2, K3	C - 1/2x20 marks	500	20	

RUBRICS FOR CONTINUOUS ASSESSMENT

Assignment	Content/originality/Presentation/Schematic Representation and Diagram/Bibliography
Seminar	Organisation/Subject Knowledge/Visual Aids/Confidence level/presentation-Communication and Language
Field Visit	Participation/Preparation/Attitude/Leadership
Participation	Answering Questions/Clearing Doubts/Participating in Group Discussions/Regular Attendance
Problem Solving	Understanding Concepts/Formula and Variable Identification/Logical Sequence/Answer
Group Discussion	Preparation/Situation Analysis/Relationship Management/Information Exchange/Delivery Skills

END SEMESTER EVALUATION PATTERN - UG.

THEORY PAPERS

PART III (Offered by the Department)

SEMSTER I/II/III/IV/VVI

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARK: 40

PART IV

SINGLE VALUATION

ORAL TEST/WRITTEN TEST/PRACTICAL TEST

MAXIMUM MARKS: 50

PASSING MARK: 20

PRACTICAL PAPERS

PART III

SEMSTER I/II/III/IV/V/VI

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 60

PASSING MARKS: 24

SEMESTER I COURSE PROFILE-PROGRAMME OF STUDY

COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	L-T- P	TOTAL HOURS	MARKS		
						CA	SE	TOTAL
	Tamil/Hindi/French/ Sanskrit	3	6		90	40	60	100
	English	3	4		60	40	60	100
PH18/1C/PMS	Properties of Matter & Sound	5	7	4 – 3 - 0	105	40	60	100
PH18/2C/MPR1	Major Practical I	4	3	0 – 0 - 3	45	End of 2nd semester		
MA18/1A/AM1	Allied Mathematics I	5	6		90	40	60	100
	1a/1b/1c	2	2		30	NA	50	50
	Soft Skill Subject*	3	2		30	NA	50	50
Total W.Hrs/Credits		21	30					

SEMESTER – I

PROPERTIES OF MATTER AND SOUND

TOTAL HOURS: 105 HOURS
CREDITS: 5

COURSE CODE: PH18/1C/PMS
L-T-P: 4 - 3 - 0

COURSE OBJECTIVES

To enable the students to

1. Explore the basic laws governing the behavior of matter in everyday life.
2. Demonstrate practical knowledge and skill in understanding the elastic properties of solids.
3. Solve the mathematical principles of fluid flow and surface tension of liquids.
4. Identify the behavior of simple harmonic waves and Doppler Effect.
5. Access the importance of ultrasonics and acoustic properties towards architectural development.

UNIT I: Elasticity

Introduction- Hooke's law - Elastic constants - relation connecting elastic constants - Poisson's ratio – Torsion: twisting couple on a cylinder – work done in twisting – torsional oscillations – Rigidity modulus and moment of inertia by torsion pendulum - Rigidity modulus by static torsion. 15 hours

UNIT II: Bending of beams

Bending of beams – expression for bending moment – depression at the free end of a cantilever – Non-uniform bending – theory and experiment (microscope & telescope) – Uniform bending – theory and experiment: Pin and Microscope and Scale and Telescope – I-form girders -non – uniform bending by Koenig's method. 20 hours

UNIT III: Fluids

Viscosity of liquids: Poiseuille's Formula – correction to the pressure head – determination of viscosity by capillary flow method – lubrication.

Surface tension: Molecular theory of surface tension – surface energy - formation of drops - relation between curvature, pressure and surface tension – its application to spherical and cylindrical drops and bubbles – determination of surface tension and interfacial tension by drop weight method. 25 hours

UNIT IV: Waves and Oscillations

Simple Harmonic Motion (SHM) – energy of a particle executing SHM composition of 2 SHM in a straight line and perpendicular to each other (periods in the ratio 1:1) -Newton Laplace’s formula for the velocity of sound-effect of temperature, pressure and humidity. Laws of transverse vibration- velocity of transverse wave along a stretched string – frequency determination - a.c. sonometer - Melde’s experiment - Longitudinal waves in a rod - Kundt’s tube - Doppler Effect: Definition - Expression for apparent frequency - observer at rest and source in motion, source at rest and observer in motion, both source and observer in motion.

25 hours

UNIT V: Ultrasonics and Architectural Acoustics

Ultrasonics – definition - Production of ultrasonic waves – piezo – electric method - Applications of ultrasonics.

Architectural Acoustics: Musical sound and noise – Characteristics of musical sound – Reverberation - Sabine’s formula – Derivation – Determination of absorption coefficient - Condition for good acoustics in auditoriums.

20 hours

RECOMMENDED TEXTBOOKS:

1. R. Murugesan, Properties of Matter and Acoustics, 2nd Edition, S.Chand & Co. Ltd. Reprint 2017.
2. R. K. Gaur and S. L. Gupta, Engineering Physics, Dhanpat Rai Publications, 8th Edition, New Delhi, 2012.
3. Brijlal and N.Subrahmanyam, Properties of Matter, 3rd Edition, S.Chand & Co., 2005.*
4. Khanna and Bedi, A Textbook of Sound, Atma Ram & Sons, 2009.*
5. S. R. Govindarajan, T.Murugaiyan, T.Jayaraman, Sound, Rochouse & Sons, 1977.*
6. N.Subrahmanyam and Brijlal - A Textbook of Sound, 2nd Edition, Vikas publishing house Pvt. Ltd., 2008.*

REFERENCE BOOKS:

1. D.S. Mathur, Elements of Properties of Matter, 11th Edition, S.Chand & Co., 2010.
2. H. R.Gulati, Fundamentals of General Properties of Matter, S.Chand & Co, Delhi, 2012.
3. M.N.Srinivasan, A Textbook of Sound, Himalaya Publishing house, 1991.*
4. D. Halliday, R. Resnick and J. Walker, Principles of Physics, Wiley Eastern, 2015.

* Recent Editions are unavailable

JOURNALS:

1. Journal of Elasticity (International)
2. International Journal of Mechanical Engineering and Applications
3. International Journal of Fluid Mechanics & Thermal Sciences
4. Applied Acoustics (International)
5. Journal of Vibration and Acoustics (International)
6. Indian Journal of Public Health Research & Development

E-LEARNING RESOURCES:

1. <http://farside.ph.utexas.edu/teaching/301/lectures/node139.html> (Unit I)
2. https://www.tf.uni-kiel.de/matwis/amat/iss/kap_c/illustr/sc_2_3.html (Unit II)
3. <http://www.dataphysics.de/2/start/understanding-interfaces/basics/> (Unit III)
4. <http://hyperphysics.phy-astr.gsu.edu/hbase/Sound/dopp.html> (Unit IV)
5. <https://www.techglads.com/cse/sem1/production-of-ultrasonics-by-piezoelectric-methods/> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Define the fundamentals of elasticity and torsion effects.
CO2	Demonstrate the practical concepts of bending of beams through experimental setup and solve associated problems.
CO3	Categorize the nature of liquid flow and apply the laws of fluid dynamics in terms of viscosity and surface tension using mathematical tools.
CO4	Analyze the universal behavior of wave motion and Doppler effect.
CO5	Explore the production and application of ultrasonic waves and develop the knowledge of architectural acoustics.

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	2	2
CO2	3	2	3	3	2	3
CO3	3	3	3	3	3	2
CO4	3	2	3	2	3	2
CO5	3	3	3	3	2	3
Average	3	2.4	3	2.8	2.4	2.4

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
 Problem Solving
 Assignment
 E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER I
ALLIED PHYSICS – I
(for B. Sc Mathematics)

TOTAL HOURS: 60 Hours
CREDITS: 4

COURSE CODE: PH18/1A/AP1
L-T-P: 4 - 0 - 0

COURSE OBJECTIVES

To enable the students to

1. Define the general parameters like velocity and acceleration.
2. Analyze the behavior of elastic nature of matter and the principles of surface tension of liquid.
3. Explain the basic laws of thermodynamics.
4. Explore the mathematical idea behind the electrostatic field.
5. Apply the various phenomenon of geometrical optics.

UNIT I: Mechanics and Sound

Mechanics: Angular velocity – angular acceleration – acceleration of a particle in a circle – centripetal force – centrifugal force – motion of a bicycle around a circle.

Sound: Simple harmonic motion - composition of two simple harmonic motions at right angles (periods in the ratio 1:1) - transverse vibration of stretched string - expression for the velocity of transverse waves – verification of laws of transverse vibration of a string using sonometer - A.C. frequency measurement using sonometer - steel wire and electromagnet.

12 hours

UNIT II: Properties of Matter

Elasticity: Elasticity - Elastic constants - bending of beams - Young's modulus by non-uniform bending - I girders - energy stored in stretched wire - torsion of a wire - determination of rigidity modulus by torsion pendulum - Static torsion.

Surface Tension: Definition, unit and dimension of surface tension – excess of pressure inside a liquid drop and bubble – determination of surface tension of a liquid by drop weight method.

14 hours

UNIT III : Heat and Thermodynamics

Thermodynamical systems – Three classes of System- Zeroth law of thermodynamics - first law of thermodynamics – significance and limitation of first law - Isochoric, isobaric, isothermal and adiabatic processes - Statement and proof of Carnot's theorem - petrol engine.

12 hours

UNIT IV: Electricity and Magnetism

Current, current density, Ohm's law – resistance in series and parallel - calibration of ammeter and voltmeter using potentiometer – Definition of magnetic induction – Biot - Savart's law - magnetic field along the axis of the circular coil – peak, average and RMS value of AC voltage and current – power factor in AC circuits.

12 hours

UNIT V: Geometrical Optics

Refraction – laws of refraction - image formation by refraction - dispersion through a prism – rainbow – introduction to optical fibers - critical angle - total internal reflection - principle of light propagation in optical fibers. 10 hours

RECOMMENDED TEXTBOOKS:

1. R.Murugesan, Allied Physics, S.Chand & Co. Ltd., New Delhi, 1st edition, 2006.*
2. R. Murugesan, KiruthigaSivaprasath, Properties of Matter and Acoustics, S.Chand& Co Ltd. 3rd Edition, Reprint 2013
3. R.Murugesan, Electricity and Magnetism, S.Chand & Co. Ltd, reprint 2017.

REFERENCE BOOKS:

1. Robert F.Kingsbury, Elements of Physics, 1st edition, Van Nostrand Company Inc., London, 1966.
2. Nelkon and Parker, Advanced Level Physics, CBS Publishers & Distributors Pvt. Ltd.,7th edition, 2006.*
3. Brij Lal and N.Subrahmanyam, Properties of Matter, 3rd Edition, S.Chand & Co. Ltd.,2005.*
4. Brij Lal &N.Subrahmanyam, Heat Thermodynamics and Statistical Physics, S.Chand & Co. Ltd., 2012.
5. D.R. Kanna & R.S. Bedi, Textbook of Sound, 12th edition, Atma Ram & Sons, New Delhi, 1980.*
6. M. N Avadhanulu, N. Subrahmanyam, Brij Lal, Text Book of Optics S.Chand & Co. Ltd., 2012.

JOURNALS:

1. Journal of Applied Physics (National).
2. Indian Journal of Pure and Applied Physics (International).

E-LEARNING RESOURCES:

1. <https://physics.info/sound> (unit I)
<https://www.infoplease.com/encyclopedia/science/physics/concepts/centripetal-and-centrifugal-force> (unit I)
2. <http://hyperphysics.phy-astr.gsu.edu/hbase/surten.html> (unit II)
3. <https://www.livescience.com/50776-thermodynamics.html> (unit III)
4. <https://www.sciencebuddies.org/science-fair-projects/references/electricity-magnetism-electromagnetism-tutorial> (unit IV)
5. <https://www.cambridge.org/core/books/an-introduction-to-fiber-optics/sources-for-optical-fiber-communication>. (unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Analyze the behavior of sound waves and fundamental concepts of mechanics.
CO2	Demonstrate the elastic behavior of matter and the basic concepts of surface tension of a fluid.
CO3	Apply the fundamental thermodynamic properties and the associated laws to understand physical systems.
CO4	Illustrate the effects of electric and magnetic fields.
CO5	Explore the importance of the laws of refraction and reflection of visible light.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	2
CO2	3	2	3	2	2	2
CO3	3	2	3	2	3	2
CO4	3	3	3	3	2	2
CO5	3	2	3	3	2	2
Average	3	2.2	3	2.4	2.4	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Problem Solving
Assignment
E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER –I/II
INTRODUCTION TO MICROSOFT OFFICE

TOTAL HOURS: 30 HOURS

**COURSE CODE:PH18/1S/MSO//
PH18/2S/MSO**

CREDITS: 3

L-T-P: 0-0-2

COURSE OBJECTIVES:

To enable the students to

1. Expose the fundamentals of Microsoft Office Word Document.
2. Analyze and compute the usage of Microsoft Office Excel Sheet.
3. Acquire the practical knowledge of preparing Microsoft Office PowerPoint presentations.

UNIT I: MS-WORD

Introduction-File Menu-Cut, Copy and Moving Text-Find and Replace-Formatting the document (Font, Paragraph, Bullets & Numbering)-Inserting Page breaks-Page numbers-Pictures-Header & Footer – Creating tables. 10 hours

UNIT II: MS-EXCEL

Introduction-Managing Workbooks-Editing data-Formatting cells-Insert row, Column-Creating a table for payroll program using Formulas-Aligning text & numbers-simple chart-Sorting records. 10 hours

UNIT III: MS-POWERPOINT

Introduction-Creating new presentation-Custom animation-Slide transition-Rehearse timing-Setup show. 10 hours

RECOMMENDED TEXTBOOKS:

1. Sanjay Saxena, B. Basavaraj Computer Fundamentals (MH-01) Hiltron CALC and Vikas Publishing House, 2013.

E-LEARNING RESOURCES:

1. http://www.bcpls.org/Docs/Computer_Handouts/Word101.pdf (Unit I)
2. <http://www.cottagesofhope.org/module-5-0-introduction-to-microsoft-word-word-processing/> (Unit I)
3. <https://support.office.com/en-us/article/introduction-to-excel-starter-601794a9-b73d-4d04-b2d4-eed4c40f98be> (unit II)
4. <https://www.excel-easy.com/introduction.html> (Unit II)
5. <http://www.functionx.com/powerpoint/Lesson01.html> (Unit III)

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Analyze and explore the possibilities of using Microsoft office word document for documentation.
CO2	Utilize the Microsoft Excel Sheet application for computing arithmetic programmes.
CO3	Application of the Microsoft PowerPoint for the preparation of various presentations.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	2	3	2
Average	3	3	3	2.7	2.3	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Hands on Practical sessions

SEMESTER II COURSE PROFILE - PROGRAMME OF STUDY

COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	L - T - P	TOTAL HOURS	MARKS		
						CA	SE	TOTAL
	Tamil/Hindi/French/Sanskrit	3	6		90	40	60	100
	English	3	4		60	40	60	100
PH18/2C/HTD	Heat & Thermodynamics	5	7	4 - 3 - 0	105	40	60	100
PH18/2C/MPR1	Major Practical I	4	3	0 - 0 - 3	45	40	60	100
MA18/1A/AM2	Allied Mathematics II	5	6		90	40	60	100
	1a/1b/1c	2	2		30	NA	50	50
	Soft Skill Subject	3	2		30	NA	50	50
Total W.Hrs/Credits		25	30					

SEMESTER – II

HEAT AND THERMODYNAMICS

TOTAL HOURS: 105 HOURS

COURSE CODE:

PH18/2C/HTD

CREDITS: 5

L-T-P: 4 - 3 - 0

COURSE OBJECTIVES

To enable the students to

1. Demonstrate practical knowledge and skill in understanding the concepts of heat energy.
2. Apply the basic laws of thermodynamics and their applications in various fields.
3. Relate the laws of entropy in everyday life.
4. Apply Differential Calculus rules to observe thermodynamic relations.
5. Explore the knowledge of statistical mechanics and its relations to the diverse Physics domains.

UNIT I: Heat

Heat capacity - specific heat capacity - specific heat capacity of solids by Regnault's method of mixtures - specific heat of a liquid by Joule's electrical method - two specific heat capacities of a gas - Mayer's formula. Transmission of heat-propagation of heat waves in the earth's crust-conductivity of the earth's crust (K). Thermal radiation: application of heat radiation - solar constant-temperature of the sun - sources of solar energy-the green house effect. 20 hours

UNIT II: Laws of Thermodynamics

Thermodynamic systems – Three class of System- Zeroth law of thermodynamics -Concept of heat - Work and Internal energy - first law of thermodynamics – significance and limitation of first law – application of first law - Mayer's relation - Isochoric, isobaric, isothermal and adiabatic processes - PVdiagrams. Second law of thermodynamics - Heat engine - reversible and irreversible processes - Statement and proof of Carnot's theorem - Carnot engine - internal combustion engine – petrol and diesel engines. 20 hours

UNIT III: Entropy

Concept of entropy – Physical concept of entropy - Entropy and second law of thermodynamics - entropy of an ideal gas – entropy change in reversible and irreversible processes - Temperature-entropy diagram – Physical significance of entropy - Thermodynamic scale of temperature and its relation to perfect gas scale - Third law of thermodynamics – zero point energy – heat death of the universe. 20 hours

UNIT IV: Maxwell's Thermodynamic Relations

Thermodynamic variables – Extensive and intensive variables – Maxwell's thermodynamic relations - thermodynamic potentials - Internal energy - Gibb's, Helmholtz and Enthalpy functions – Significance of thermodynamic potentials: Derivation of Maxwell's equations from potentials – Application of Maxwell's thermodynamic equations – Specific heat relation - Mayer's relation – First and second Latent heat equation – Joule Kelvin effect - First and second TdS equations – Equilibrium between liquid and its vapour – First order phase transitions – Second order phase transitions.
20 hours

UNIT V: Statistical Thermodynamics

Phase Space - Micro and Macro states – Ensembles - different types of ensembles Definition of probability – relation between entropy and probability - Degrees of freedom – statement of theorem of equipartition of energy - Classical statistics - Maxwell - Boltzman statistics - expression for distribution of energy by Maxwell – Boltzman statistics – drawbacks of classical statistics - Quantum statistics – Bose-Einstein statistics - expression for distribution of energy for Bose Einstein gas – Fermi-Dirac statistics – expression for energy of Fermi-Dirac gas - comparison of three statistics.
25 hours

RECOMMENDED TEXTBOOKS:

1. Brijlal and N.Subramanyam, Heat Thermodynamics and Statistical Physics, S.Chand & Co, Revised Edition, 2012.
2. R.Murugesan & Kiruthiga Sivaprasath, Thermal Physics, S.Chand & Co., Revised Edition, 2015.
3. D.S. Mathur, Heat and Thermodynamics, Sultan Chand & Sons, New Delhi, 5th Edition, Reprint 2014.
4. D. Jayaraman and K. Illangovan, Thermal Physics and Statistical Mechanics, Viswanathan Printer and Publishers, Chennai, 2017.
5. B.K. Agarwal and M. Eisner, Statistical Mechanics, New Age International Pvt. Ltd., 2016.
6. Fundamentals of Statistical Mechanics by B.B. Laud, New Age International Publications, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Francis W.Sear and Gerhard S. Salinger, Thermodynamics, Kinetic Theory and Statistical Thermodynamics, 3rd Edition, Narosa Publishing House, New Delhi, 1986.*
2. Mark.W.Zemansky, Heat and Thermodynamics, 6th Edition, Mc Graw Hill Book Company Inc., Co., 1982.*
3. C.L. Arora and Dr. P.S. Hemne, Physics for degree students, First Edition, S. Chand and Co., Ltd., New Delhi, 2012.

JOURNALS:

1. International Journal of Mechanics and Thermodynamics (IJMT)
2. Journal of Thermal Physics and Calorimetry (International)
3. *Sankhya*, The Indian Journal of Statistics
4. Journal of Statistical Theory and Applications (International)

E-LEARNING RESOURCES:

1. <http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/heatra.html> (Unit I)
2. <https://www.thoughtco.com/laws-of-thermodynamics-p3-2699420> (Unit II)
3. <http://farside.ph.utexas.edu/teaching/sm1/lectures/lectures.html> (Unit III)
4. <https://devdude.me/blog/maxwellRelations> (Unit IV)
5. <http://www.damp.cam.ac.uk/user/tong/statphys.html> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Demonstrate thermal conductivity and concepts of specific heat capacity through practical experiments.
CO2	Identify the laws of thermodynamics and analyze its application to heat engines.
CO3	State and apply the concepts of entropy and the use of temperature scales.
CO4	Apply Maxwell's thermodynamic equations to comprehend phase transitions.
CO5	Illustrate the Statistical laws of thermodynamics and relate it to the study of Condensed Matter Physics.

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	2	3	2	2	3
CO3	3	2	3	2	2	2
CO4	3	3	3	3	2	2
CO5	2	3	2	3	2	2
Average	2.8	2.6	2.8	2.4	2	2.4

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
 Problem Solving
 Assignment
 Group Learning
 E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER – II
MAJOR PRACTICAL – I

TOTAL HOURS: 90 HOURS
CREDITS: 4

COURSE CODE: PH18/2C/MPR1
L-T-P: 0 - 0 - 3

COURSE OBJECTIVES

To enable the students to

1. Demonstrate the intricate electrical connections with standard safety measures.
2. Analyze the elastic nature of solids and apply its concepts in everyday life.
3. Outline methodical procedures to illustrate the properties of matter.
4. Analyze the concepts of heat and sound and conform the experimental results to the standard values.
5. Relate the behavior of light and the various phenomena associated with it in nature to practical procedures.

EXPERIMENTS

Orientation

1. Orientation I – Learning screw gauge, vernier calipers & microscope.
2. Orientation II – Learning spectrometer and electric circuit connections.

Electricity

3. Calibration of low range voltmeter - Potentiometer.

Properties of Matter

4. Young's Modulus of the material of a beam- By non-uniform bending using Scale and Telescope (Graphical method to determine q and mass of the unknown body).
5. Young's Modulus q of the material of a beam- By non-uniform bending using Pin and Microscope (Graphical method to determine q and mass of the unknown body).
6. Rigidity Modulus n of the material of a wire -Torsion Pendulum. (Graphical method to determine n of the material of the wire).
7. Rigidity Modulus n of the material of a rod by static torsion. (Graphical method to determine n and mass of the unknown body)

Mechanics of Rigid Bodies and Fluid Dynamics

8. Determination of acceleration due to gravity - Compound Pendulum.
9. Coefficient of viscosity of the given liquid by Poiseuille's method. (Measurement of radius of the capillary tube by microscope method).
10. Surface Tension and Interfacial surface tension of a liquid by drop weight method.

Heat and Sound

11. Specific Heat Capacity of solid and hence the liquid – Method of mixtures. (Half time correction)
12. Frequency of a tuning fork – using Sonometer.
13. Specific Gravity of solid and liquid - Sonometer (3sets of tuning forks given).
14. Frequency of AC mains - Sonometer using steel wire and electromagnet.
15. Velocity of longitudinal waves in a rod – Kundt's Tube.

Optics

16. Thickness of the given thin wire - Air Wedge
17. Refractive index of a solid prism – Spectrometer.
18. Refractive index of a hollow prism - Spectrometer.

RECOMMENDED TEXTBOOKS:

1. Balasubramanian. S, Ranganathan. R, Srinivasan M. N, A Textbook of Practical Physics, 2nd Revised Edition, S. Chand and Sons Pvt. Ltd., 2017.
2. C. C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics, 1st Edition, Viswanathan. S Printers and Publishers, Pvt. Ltd., 2015.

COURSE OUTCOMES

CO No.	CO Statement
CO1	Demonstrate the use of potentiometer for the calibration of electrical meters.
CO2	Apply the concepts of moduli of elasticity in a series of experiments.
CO3	Illustrate the underlying concepts of fluid dynamics and mechanics of rigid bodies and compare the results to the standard values.
CO4	Demonstrate the principles of specific heat capacity and laws of vibration through various experimental procedures.
CO5	Apply the phenomenon of interference and the concept of refractive index with the use of suitable optical set up.

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	3	2	2
CO4	2	2	2	2	2	2
CO5	3	3	3	2	2	2
Average	2.8	2.6	2.8	2.2	2	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

SEMESTER II

ALLIED PHYSICS -II

(for B. Sc Mathematics)

TOTAL HOURS: 60 Hours

CREDITS: 4

COURSE CODE: PH18/2A/AP2

L-T-P: 4 - 0 - 0

COURSE OBJECTIVES

To enable the students to

1. Discuss the principles of physical optics.
2. Analyze the behavior of lasers and its applications.
3. Evaluate the properties of nucleus and nuclear models on the basis of nuclear structure.
4. Identify the basic principles of relativity and quantum mechanics.
5. Formulate basic knowledge of digital electronic circuits.

UNIT I: Physical Optics

Interference - interference in thin films - Air wedge – determination of diameter of a thin wire by air wedge - Newton's rings: expression for radii of the rings – experimental determination of wavelength of sodium light.

Diffraction - Fresnel's explanation of rectilinear propagation of light - diffraction grating - theory of transmission grating – determination of wavelength of light using transmission grating (normal incidence). 15 hours

UNIT II: Laser Physics

Spontaneous and stimulated emission - population inversion – working of semiconductor laser and its applications. 9 hours

UNIT III: Nuclear Physics

Nuclear model - liquid drop model – semi-empirical mass formula - mass defect - binding energy – nuclear fission – chain reaction - controlled and uncontrolled chain reaction – nuclear reactor - nuclear fusion - thermonuclear reactions – nuclear radiation hazards. 12 hours

UNIT IV: Relativity and Quantum Mechanics

Frames of reference - postulates of theory of relativity - Galilean transformation equations - Lorentz transformation equation - derivation - length contraction - time dilation – mass - energy equivalence. Postulates of wave mechanics - Schrodinger's one dimensional wave equation - Time dependent and Time independent equations -physical significance of wave function. 10 hours

UNIT V: Electronics

Introduction to semi conductors - Junction diode - characteristics – Zener diode - voltage regulator - Junction transistor - CE mode – characteristics.

Boolean Algebra: AND,OR and NOT gates - construction using diodes – Demorgan's theorem – verification- NAND and NOR gates - universal building blocks. 14 hours

RECOMMENDED TEXTBOOKS:

1. R.Murugesan, Allied Physics,1st edition, S. Chand & Co. Ltd., New Delhi, 2006.*
2. M. N Avadhanulu, N.Subrahmanyam,Brij Lal, Text Book of Optics, S.Chand & Co. Ltd., 2012.
3. G. Senthil Kumar, Engineering Physics – I, VRB Publishers Pvt. Ltd., 2013.
4. R.Murugesan, Kiruthiga Sivaprasath, Modern Physics, S.Chand& Co. Ltd., 2016.
5. V.Vijayendran, Introduction to Integrated Electronics, Viswanathan, S., Printers & Publishers Pvt. Ltd.,2009.*

REFERENCE BOOKS:

1. Nelkon and Parker, Principles of Physics, Heinemann International literature and text books,7th revised edition, edition 2006.*
2. Donald P Leach, Albert Paul Malvino, Goutam Saha, Digital Principles and Applications,7thedition, Tata McGraw Hill Education Private Ltd., New Delhi, 2011.

JOURNALS:

1. Journal of Applied Physics(National)
2. Indian journal of Pure and Applied Physics(International)

E-LEARNING RESOURCES:

1. <https://www.khanacademy.org/test-prep/mcat/physical-processes/light-and-electromagnetic-radiation-questions/a/diffraction-and-constructive-and-destructive-interference> (unit I)
2. <https://www.rp-photonics.com/lasers.html> (unit II)
3. <https://www.studentenergy.org/topics/fission> (unit III)
4. https://www.sciencedaily.com/terms/introduction_to_quantum_mechanics.htm (unit IV)
5. <https://electronicspani.com/diode-and-gate-for-positive-and-negative-logic-and-gate/> (unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Explain the theory and experimental ideas of interference and diffraction to physical problems.
CO2	Discuss the applications of lasers and its types.
CO3	Apply the utility of nuclear fission and fusion and associated nuclear reactions.
CO4	Outline the concepts of relativity and postulates of wave mechanics to the solving of potential problems.
CO5	Analyze the characteristics of devices like PNP and NPN diodes and truth tables of different logic gates.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	2
CO2	3	3	3	3	2	2
CO3	3	3	3	2	2	3
CO4	3	2	2	2	3	2
CO5	3	3	3	3	2	2
Average	3	2.6	2.8	2.4	2.4	2.2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Problem Solving
Assignment
E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K 1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER II

ALLIED PHYSICS PRACTICAL

(for B. Sc Mathematics)

TOTAL HOURS: 60 Hours
CREDITS: 2

COURSE CODE: PH18/2A/PPR
L-T-P: 0 - 0 - 2

COURSE OBJECTIVES

To enable the students to

1. Demonstrate basic experiments to study the properties of matter.
2. Illustrate the concept of sound and verify its theoretical values experimentally.
3. Demonstrate the behavior of light and study its properties through practical experiments.
4. Apply the concepts of electricity to calibrate the voltmeter and ammeter.
5. Verify the truth tables using different logic functions.

EXPERIMENTS

Properties of Matter

1. Orientation I – Learning screw gauge, Vernier calipers, microscope and spectrometer.
2. Young's modulus of the material of a beam - non-uniform bending using pin and microscope.
3. Rigidity modulus of the material of a rod – static torsion apparatus.
4. Rigidity modulus of the material of a wire - torsion pendulum.
5. Surface Tension of a liquid by drop weight method.

Sound

6. Determination of frequency of AC mains - sonometer, steel wire and electromagnet.
7. Frequency of a tuning fork - sonometer.

Light

8. Thickness of a wire - Air Wedge.
9. Determination of radius of curvature of the lens - Newton's rings (Given - wavelength of sodium light).
10. Determination of wavelength of prominent lines of mercury spectrum - spectrometer and grating by normal incidence method.

Electricity & Magnetism

11. Calibration of a low range voltmeter - potentiometer.
12. Calibration of an ammeter - potentiometer.
13. Determination of B_H using the field along the axis of a circular coil carrying current - deflection magnetometer.

Electronics

14. Characteristics of a Zener diode.
15. Construction of AND, OR and NOT gates using junction diodes and using transistors.
16. Verification of De Morgan's theorem using ICs.
17. NAND and NOR gates as Universal building Blocks.

RECOMMENDED TEXTBOOKS:

1. Balasubramanian. S, Ranganathan. R, Srinivasan M. N, A Textbook of Practical Physics,
2nd Revised Edition, S. Chand and Sons Pvt. Ltd., 2017.
2. C. C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics, 1st Edition, Viswanathan. S
Printers and Publishers, Pvt. Ltd., 2015.

COURSE OUTCOMES

CO No.	CO Statement
CO1	Demonstrate the elastic nature of materials by static torsion, torsion pendulum and young's modulus methods.
CO2	Apply the concept of surface tension of liquid by drop weight method and determine the frequency of the given object.
CO3	Explore the phenomena of diffraction and interference using optical experiments.
CO4	Demonstrate the calibration of voltmeter and ammeter by potentiometer and B_H using deflection magnetometer.
CO5	Analyze and design various digital electronic circuits.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	2
CO2	3	2	3	2	2	2
CO3	3	2	3	2	2	2
CO4	3	2	2	2	2	2
CO5	3	3	3	3	2	2
Average	3	2.2	2.8	2.2	2	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

SEMESTER III COURSE PROFILE - PROGRAMME OF STUDY

COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	L - T - P	TOTAL HOURS	MARKS		
						CA	SE	TOTAL
	Tamil/Hindi/French/Sanskrit	3	6		90	40	60	100
	English	3	4		60	40	60	100
PH18/3C/ETM	Electricity and Magnetism	5	7	4 - 3 - 0	105	40	60	100
PH18/4C/MPR2	Major Practical II	-	3	0 - 0 - 3	45	End of 4 th semester		
CH18/4A/PGC2	Allied Chemistry- General Chemistry 1	4	4	4 - 0 - 0	60	40	60	100
CH18/4A/PRA	Allied Chemistry Practical -	-	2	0 - 0 - 2	30	End of 4 th semester		

	Volumetric & Organic Analysis							
	EVS	2	2		30	NA	50	50
	Soft Skill Subject	3	2					
PH18/3S/MPH	Medical Physics (Self Study/Advanced Learners course)	2 (Additional)	NA	NA	NA	NA	100	100
Total W.Hrs/Credits		20	30					

SEMESTER III

ELECTRICITY AND MAGNETISM

TOTAL HOURS: 105 HOURS
CREDITS: 5

COURSE CODE: PH18/3C/ETM
L-T-P: 4-2-0

COURSE OBJECTIVES

To enable the students to

1. Gain deeper understanding of electric charges and its applications needed for advanced studies in physics.
2. Relate charge on a capacitor to the potential of a capacitor leading to comprehension of dielectrics, dielectric breakdown, effect of dielectrics on capacitors.
3. Solve Mathematical problem using network theorem.
4. Appraise the physical accuracy of electrical measurements and thermoelectricity
5. Describe how magnetism is produced and list examples where its effects are observed.

UNIT I: Electric charges

Permittivity of free space – relative permittivity – electric intensity – intensity due to a point charge – normal electric induction – Gauss theorem in electrostatics – applications: insulated conductor - uniformly charged sphere (conducting and non-conducting spheres) and uniformly charged non-conducting cylinder – Coulomb's theorem – mechanical stress on unit area of a charged conductor – application to electrified soap bubble. 20 hours

UNIT II: Electric potential & Capacitors

Definition for potential, potential difference, equipotential surface-Relation between potential and intensity – potential and intensity due to a uniformly charged sphere - conducting and non-conducting spheres – Electric dipole – potential and intensity due to a dipole.

Principle of a capacitor - capacitor in series and parallel - uses of capacitor- capacitance of a spherical, parallel and cylindrical condensers – Dielectric constant - effect of dielectric on capacity – change in energy of a parallel plate condenser on introduction of a dielectric slab – Energy of a charged condenser – loss of energy on sharing of charges. 25 hours

UNIT III: Network theorems

Kirchoff's laws – Thevenin's theorem – Norton's theorem – Superposition theorem – Maximum power transfer theorem – simple problems. 20 hours

UNIT IV: Electrical Measurements and Thermoelectricity

Principle of Wheatstone Bridge – Carey Foster’s bridge and its applications – Potentiometer – principle – calibration of low range and high range voltmeter and low range ammeter – Thermoelectricity – Seebeck effect – Peltier and Thomson coefficients – Experiments to measure thermo e.m.f. using potentiometer – application of thermodynamics to a thermocouple – Peltier and Thomson coefficients – Thermo electric diagrams and its applications. 20

hours

UNIT V: Magnetism

Introduction - Magnetic induction- Magnetization-Susceptibility-Permeability – Relation between the magnetic properties -Different types of magnetic materials – Dia, Para, Ferro, Antiferro and Ferri magnetic materials- Langevin’s theory of dia and paramagnetism - Magnetic domain – Weiss’s theory of ferromagnetism-Hysteresis-Experiment to draw M-H curve - horizontal model – Energy loss due to hysteresis – Importance of hysteresis curves. 20

hours

RECOMMENDED TEXTBOOKS:

1. R. Murugesan, Electricity and Magnetism, S.Chand & Co. Ltd, reprint 2017.
2. Brij Lal & N. Subrahmanyam, Electricity and Magnetism, 8th edition, S. Chand & Co Ltd., 2017.
3. R. S. Sedha, A text book of Applied Electronics, reprint 2008, S. Chand & Company* .
4. Narayanmoorthy. M and Nagarathnam. N, Electricity and Magnetism, 4th edition,, Meerut, National publishing Co, 1995* .

REFERENCE BOOKS:

1. D. N. Vasudevan, Electricity and Magnetism, 12th Edition, S. Chand & Company, 2002* .
2. D. C. Pandey, Electricity and Magentism, revised edition, Arihant Prakashan publications, 2018.
3. Alan Giambattista, Richardson and Richardson, Fundamentals of Physics, Tata Mc Graw Hill Publishing Company, 2008* .
4. John Bird, Electrical Principles and Technology for Engineering, An imprint of Butterworth -Heinemann Ltd Linacre House, Jordan Hill, Oxford, 2003* .

JOURNALS:

1. The Electricity Journal (International)
2. Pramana – Journal of Physics (National)

E-LEARNING RESOURCES:

1. <https://www.khanacademy.org/science/in-in-class-12th-physics-india/in-in-electrostatic-potential-and-capacitance> (Unit I)
2. <http://www.physics.umd.edu/courses/Phys260/agashe/S08/notes/lecture34.pdf> (Unit II)
3. <https://www.elprocus.com/basics-of-network-theorems-in-electrical-engineering/>(Unit III)
4. <https://www.sciencedirect.com/topics/engineering/seebeck-effect> (Unit IV)
5. <https://www-spf.gsfc.nasa.gov/Education/Imagnet.html> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Apply the knowledge of Gauss law with various dimensions of the object between electrical charge physical principles to solve problems encountered in everyday life.
CO2	Acquire knowledge on the fundamentals of capacitors, evaluate the characteristics effect of a dielectric material in a capacitor. Develop, design and experiment with various dielectric circuits.
CO3	Using the basic laws that underlie in the properties of electric circuit elements and various network theorems to solve problems
CO4	Experiment various methods to evaluate electric potential, analyze, apply thermoelectric energy harvesting techniques.
CO5	Identify and apply Ampere's law and to relate to the force in magnetic field measurements.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	2
CO2	3	2	3	3	2	2
CO3	3	2	3	3	2	2
CO4	3	2	3	3	2	3
CO5	3	2	3	2	2	2
Average	3	2	3	2.6	2	2.2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-LCD)

E Content, Videos

Problem Solving

Seminar

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A-10x2 marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have two problems. Section C may have problems as a part of the question.
K1, K2	B-5/8x8 marks	200	40		
K2, K3	C-2/3x20 marks	500	40		

SEMESTER -III
ALLIED PHYSICS – I
(for B. Sc Chemistry)

TOTAL HOURS: 60 HOURS
CREDITS: 4

COURSE CODE: PH18/3A/AP1
L-T-P: 4-0-0

COURSE OBJECTIVES:

To enable the students to

1. Explore the properties of sound, the applications of ultrasonics and doppler Effect.
2. Study the basic properties of materials in a comprehensive manner.
3. Acquire fundamental knowledge of thermodynamical laws and specific heat capacity.
4. Analyze the basic concepts in electricity and magnetism.
5. Acquaint with the optical properties of materials and fiber optics.

UNIT I: Sound

Sound: Definition for longitudinal and transverse waves - transverse vibration of stretched string - expression for the velocity of transverse waves - laws of transverse vibration of a string using sonometer - A.C. frequency measurement using sonometer (steel wire and electromagnet) - Ultrasonics – production of ultrasonic waves by piezoelectric method – application.

Doppler Effect: Definition - Expression for apparent frequency- observer at rest and source in motion, source at rest and observer in motion, both source and observer in motion.

14 hours

UNIT II: Properties of Matter

Elasticity: Elasticity - Elastic constants - bending of beams - Young's modulus by non-uniform bending – I girders - energy stored in stretched wire - torsion of a wire - determination of rigidity modulus by torsion pendulum - Static torsion.

12 hours

UNIT III: Heat and Thermodynamics

Heat capacity - specific heat capacity- specific heat capacity of solids by the method of mixtures - thermodynamic systems – Three classes of System- zeroth law of thermodynamics- -first law of thermodynamics – significance and limitation of first law - isochoric, isobaric, isothermal and adiabatic processes.

12 hours

UNIT IV: Electricity and Magnetism

Current, current density, Ohm's law – calibration of ammeter and voltmeter using potentiometer – Definition of magnetic induction - Biot Savart's law - magnetic field along the axis of the circular coil – chemical effects of electric current: electrical conductivity of an electrolyte – Arrhenius theory of electrolytic dissociation – calculation of emf of a Danielcell.

12 hours

UNIT V: Geometrical Optics

Refraction – laws of refraction - image formation by refraction - dispersion through a prism – rainbow –introduction to optical fibers - critical angle - total internal reflection - principle of light propagation in optical fibers. 10 hours

RECOMMENDED TEXTBOOKS:

4. R.Murugesan, Allied Physics, S.Chand & Co. Ltd., New Delhi, 1st edition, 2006.*
5. Kiruthiga Sivaprasath, R. Murugesan, Properties of Matter and Acoustics, S.Chand& Co. Ltd. 3rd Edition, Reprint 2013.
6. R.Murugesan, Electricity and Magnetism, S.Chand & Co. Ltd, reprint 2017.

REFERENCE BOOKS:

1. Robert F.Kingsbury, Elements of Physics, 1st edition, Van Nostrand Company Inc., London, 1966.*
2. Nelkon and Parker, Advanced Level Physics, CBS Publishers & Distributors Pvt. Ltd.,7th edition, 2006.*
3. Brij Lal and N.Subrahmanyam, Properties of Matter, 3rd Edition, S.Chand & Co. Ltd.,2003.*
4. Brij Lal & N.Subrahmanyam, Heat Thermodynamics and Statistical Physics, S.Chand & Co. Ltd., 2012.
5. D.R. Kanna & R.S. Bedi, Textbook of Sound, 12th edition, Atma Ram & Sons, New Delhi, 1985.*
6. M. N Avadhanulu, N. Subrahmanyam, Brij Lal, Text Book of Optics, S.Chand & Co. Ltd., 2012.

JOURNALS:

1. Journal of Sound and Vibration (International)
2. Journal of Materials in Civil Engineering (International)
3. International Journal of Thermophysics
4. The Electricity Journal (International)
5. Optik (International)
6. Journal of Optics (National)

E-LEARNING RESOURCES:

1. <https://physics.info/sound/> (Unit I)
2. <https://physics.info/elasticity/> (Unit II)
3. <https://www.livescience.com/50776-thermodynamics.html> (Unit III)
4. <https://courses.lumenlearning.com/boundless-physics/chapter/specific-heat/> (Unit III)
5. <https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law/all>
6. <https://circuitglobe.com/calibration-of-voltmeter-ammeter-and-wattmeter-using-potentiometer.html> (Unit IV)
7. <https://www.livescience.com/38059-magnetism.html> (Unit IV)
8. <https://courses.lumenlearning.com/boundless-physics/chapter/reflection-refraction-and-dispersion/> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Study the various modes of propagation of sound waves with the study of ultrasonics and Doppler effect.
CO2	Appraise the basic and various properties of Matter via exploring some of its applications.
CO3	Illustrate the importance of study of Specific heat capacity and to study the different laws of thermodynamics.
CO4	Explore and study the basics of electricity and magnetism through various laws.
CO5	Demonstrate how light interacts with matter via studying dispersion through prism and Optical fiber application.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	3	2
CO2	3	2	3	2	2	2
CO3	2	2	3	2	2	2
CO4	3	3	3	3	2	3
CO5	3	3	3	2	2	2
Average	2.8	2.6	3	2.2	2.2	2.2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Problem Solving
Assignment
Seminar
e-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER – III

SELF STUDY COURSE / ADVANCED LEARNER COURSE

MEDICAL PHYSICS

CREDITS: 2

COURSE CODE: PH18/3S/MPH

COURSE OBJECTIVES:

To enable the students to

1. Analyse the fundamentals of various bio signals and devices to measure the bio potential signals used in medical field.
2. Assess the theory and instrumentation of bio signal measuring devices.
3. Formulate the basic principles of instrumentation used in clinical measurements.
4. Identify the basic concepts of Physics in medical imaging.
5. Discuss the various therapeutic techniques using Lasers in medical field.

UNIT I: BIOPOTENTIAL ELECTRODES AND TRANSDUCERS

Cell and its structure (overview) - action and resting potentials – Transducers -Different types - Piezoelectric ultrasonic, capacitive, inductive transducers – selection criteria.

UNIT II: BIOELECTRIC SIGNAL RECORDING

Bio Potential Recorder - characteristics of recording systems – principle and applications of Electrocardiography (ECG) - cardiac pacemakers -Defibrillator - Electroencephalography (EEG) - Nerve cell - Electromyography (EMG) – Electroretinography(ERG) and Electrooculography (EOG).

UNIT III: NON-ELECTRICAL PARAMETER MEASUREMENTS

Measurement of blood pressure - cardiac output measurements - cardiac rate –Heart sound – Respiratory rate – gas volume - Ventilators.

UNIT IV: MEDICAL IMAGING PHYSICS

X-rays in medicine – principle and applications of Computer Tomography, MRI, Ultrasonography and Thermography – Different types of bioelementary systems and patient monitoring – Electrical safety.

UNIT V: THERAPEUTIC EQUIPMENTS

Lasers in medicine – basic Principle of Laser action – instrumentation- effects of radiation exposure – safety.

RECOMMENDED TEXTBOOKS:

1. M.Arumugam, Bio medical Instrumentation, 2nd edition, Anuradha Agencies,Kumbakonam,India 1994*.
2. John G. Webster, Bio medical Instrumentation, , 1st edition, John Wiley &sons, 2003*.
3. Cromwell,Biomedical Instrumentation and measurements, 2nd Edition,Prentice Hall, 1980*.
4. Joseph J.Carr & John M. Brown, Introduction to Biomedical Equipment Technology, 4th Edition, Pearson Education, 2004*.

REFERENCE BOOKS:

1. A Handbook of Biomedical Instrumentation, Khandpur, 2nd edition,Tata Mc Graw Hill Publishing company Ltd., 2003*.
2. Jacobson & Webster, Clinical Engineering, 1st Edition, Prentice Hall, 1977*.
3. Geddes & Baker,Applied Biomedical Instrumentation, 3rd Edition, John wiley & son, New York.
4. Guyton and Hall , Medical Physiology, 10th Edition, Elsevier, 2004*
5. Maqbool Muhammad, An Introduction to medical Physics, 2nd Edition,Springer, 2017.

* Recent Editions are unavailable

JOURNALS:

1. Journal of Medical Physics (National)
2. Journal of Medical Engineering and Physics (International)

E- LEARNING RESOURCES:

1. [https://biomedical-engineering online.biomedcentral.com/articles/10.1186/1475-925X-3-25\(unit I\)](https://biomedical-engineering online.biomedcentral.com/articles/10.1186/1475-925X-3-25(unit I))
2. [https://sourceforge.net/projects/biosig/\(unit II\)](https://sourceforge.net/projects/biosig/(unit II))
3. [http://eedrmcet.zohosites.com/files/III%20Year/SEM%206/BME/BME-Unit%20III.pdf \(unit III\)](http://eedrmcet.zohosites.com/files/III%20Year/SEM%206/BME/BME-Unit%20III.pdf (unit III))
4. [https://onlinelibrary.wiley.com/doi/book/10.1002/0471221155\(unit IV\)](https://onlinelibrary.wiley.com/doi/book/10.1002/0471221155(unit IV))
5. [https://hms.co.in/laser-therapy-equipments/ \(unit V\)](https://hms.co.in/laser-therapy-equipments/ (unit V))

COURSE OUTCOMES

CO No.	CO Statement
CO1	Explain the basic structure of the cell, and assess the various bio electric signals and devices used in medicine.
CO2	Analyse the functions, principles and instrumentation of various biomedical equipments used in the study of the functions of the heart, brain, eye and skeletal muscles
CO3	Discuss the determination of various clinical non electrical measurements and its relevant procedures.
CO4	Evaluate the basic principle and application of various medical imaging systems and its safety measures.
CO5	Discuss the fundamentals of laser and its application for diagnosis and therapy in medicine.

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

Note: Only those students with more than 70% of marks as aggregate may opt for Self Study / Advanced Learner Paper.

SEMESTER IV COURSE PROFILE - PROGRAMME OF STUDY

COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	L - T - P	TOTAL HOURS	MARKS		
						CA	SE	TOTAL
	Tamil/Hindi/French/Sanskrit	3	6		90	40	60	100
	English	3	4		60	40	60	100
PH18/4C/OPT	Optics	5	7	4 - 3 - 0	105	40	60	100
PH18/4C/MPR2	Major Practical II	4	3	0 - 0 - 3	45	40	60	100
CH18/4A/PGC2	Allied Chemistry-	4	4	4 - 0 - 0	60	40	60	100

	General Chemistry 2							
CH18/4A/PRA	Allied Chemistry Practical - Volumetric & Organic Analysis	2	2	0 - 0 -2	30	40	60	100
	Value Education	2	2		30	NA	50	50
	Soft Skill Subject*	3	2					
Total W.Hrs/Credits		26	30					

SEMESTER IV OPTICS

TOTAL HOURS: 105 Hours
CREDITS: 5

COURSE CODE: PH18/4C/OPT
L-T-P: 4 – 3 - 0

COURSE OBJECTIVES:

To enable the students to

1. Understand the behaviour and properties of light
2. Study the basic concepts of optical phenomenon of interference.
3. Understand the theory of diffraction for its application in various fields.
4. Gain knowledge on various types of diffraction and its mathematical approach
5. Build up their knowledge on polarization, nicol prism, optical activity and specific rotator power.

UNIT I: Geometrical Optics and Fibre Optics

Refraction – refraction through narrow angled prism - dispersion through a thin prism – achromatism in prisms: dispersion without deviation and deviation without dispersion – aberration in lenses: spherical aberration in a lens – methods of minimizing spherical aberration – condition for minimum spherical aberration of two thin lenses separated by a distance – chromatic aberration in a lens: longitudinal and lateral chromatic aberration – coma – astigmatism and its minimization.

Fibre Optics: Introduction to Optical Fibre - basic structure of optical fiber - total internal reflection – introduction to the principle of light propagation in optical fibers. 20 hours

UNIT II: Interference

Introduction - Analytical treatment of interference – Expression for intensity - Theory of interference fringes - Interference by reflected light - wedge shaped film - Newton's rings- Determination of wavelength of sodium light - Determination of refractive index of a liquid- Michelson's Interferometer and applications : Determination of wavelength of light – separation of spectral lines. 22 hours

UNIT III: Diffraction

Introduction- Fresnel explanation of rectilinear propagation of light- zone plate- Fresnel diffraction at a straight edge, circular aperture - Fraunhofer diffraction at a single slit- double slit - Plane transmission diffraction grating- dispersive power of grating- determination of wavelength of light using transmission grating. 22 hours

UNIT IV: Resolving power

Definition - Rayleigh's criterion for resolution – Resolving power of Telescope: derivation, relation between magnifying power and resolving power of a telescope - resolving power of Microscope: derivation - resolving power of Prism and Grating – Comparison of prism and grating spectra. 18 hours

UNIT V: Polarization

Introduction - polarization by reflection - double refraction – Principle and Construction of Nicol prism – Polaroids and their uses - theory of the production of elliptically and circularly polarized light - Quarter wave plate - Half wave plate - production and detection of plane, circular and elliptically polarized light - optical activity - Biot's law - specific rotation – Laurent's half shade polarimeter – Faraday effect. 23 hours

RECOMMENDED TEXTBOOKS:

1. R. Murugesan, Optics and Spectroscopy, 6th edition, S.Chand & Co., Pvt Ltd, New Delhi, Reprint 2010.
2. N. Subrahmanyam & Brij Lal, A text book of Optics, 22nd edition, S. Chand & Co., Pvt. Ltd., New Delhi, 2012.
3. Senthil Kumar, Engineering Physics, 6th Edition, VRB Publishers Pvt. Ltd., 2013.

REFERENCE BOOKS:

1. Jenkins A. Francis and White E Harvey, Fundamentals of Optics, McGraw Hill Inc., New Delhi, 2001*.
2. Raj M.G., Fundamentals of Optics, Anmol Publication Pvt. Ltd., New Delhi, 2002*.
3. Subir Kumar Sarkar, Optical Fibres and Fibre Optic Communication Systems, 6th edition, S. Chand & Co. Ltd., 2007*.
4. R.Murugesan, Allied Physics, S. Chand & Co. Ltd., New Delhi, 1st edition, 2006*.

JOURNALS:

1. Journal of Optics (National)
2. Optical materials (International)

E-LEARNING RESOURCES:

1. <https://www.khanacademy.org/science/physics/geometric-optics> (Unit I)
2. <https://www.khanacademy.org/test-prep/mcat/physical-processes/light-and-electromagnetic-radiation-questions/a/diffraction-and-constructive-and-destructive-interference> (Unit II)

3. <https://www.khanacademy.org/test-prep/mcat/physical-processes/light-and-electromagnetic-radiation-questions/a/diffraction-and-constructive-and-destructive-interference> (Unit III)
4. https://www.youtube.com/watch?v=sKO8n_-xtDc (Unit IV)
5. <https://www.youtube.com/watch?v=guqs0uXFpiU> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Illustrate the concept of dispersion, aberration in prism and light propagation in optical fibers.
CO2	Explore the theoretical and practical ideas of interference.
CO3	Analyze and apply the knowledge of diffraction in the laboratory experiments.
CO4	Comprehend the resolution of optical instruments and analyze the resolving power of prism and grating.
CO5	Illustrate the concept of polarization and nicol prism and to study the laws of optical activity and specific rotation.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	2
CO2	3	2	3	2	2	2
CO3	3	2	3	2	2	2
CO4	3	2	3	2	3	2
CO5	3	3	3	2	2	2
Average	3	2.2	3	2	2.4	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk

Over Head Presentation

Problem Solving

Assignment

E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No. is compulsory Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER IV

MAJOR PRACTICAL II

TOTAL HOURS: 90 Hours
CREDITS: 4

COURSE CODE: PH18/4C/MPR2
L-T-P: 0 – 0 - 3

COURSE OBJECTIVES:

To enable the students to

1. Understand the behavior of properties of matter and sound by determining the moduli of elasticity and frequency respectively.
2. Enhance the knowledge on the various laws of resistance by using different methods.
3. Study the refractive index of the material of optical instruments and wavelength of mercury spectrum.
4. Understand the working of ballastic galvanometer and deflection galvanometer.
5. Analyze the principle of Joules calorimeter.

EXPERIMENTS:

Properties of Matter and Sound

1. Young's Modulus of the material of a beam - By uniform bending using Pin and Microscope. (Graphical method to determine q and mass of the unknown body).
2. Young's Modulus of the material of a beam - By uniform bending using Scale and Telescope. (Graphical method to determine q and mass of the unknown body).
3. Rigidity modulus of the material of a wire - Torsion Pendulum (with symmetrical masses).
4. Frequency of A.C mains (Using Brass wire and Horse shoe Magnet) - Sonometer.
5. Frequency by tranverse and longitudinal modes of vibration – Melde's Apparatus.

Electricity

6. Verification of laws of resistance - P.O. Box.
7. Specific resistance & verification of laws of resistance - Carey Foster's Bridge.

8. Comparison of Resistances and Specific Resistance of a wire - Potentiometer.
9. Calibration of low range ammeter - Potentiometer.

Optics

10. Refractive index of the material of a lens - Newton's Rings.
11. Refractive index of the material of a prism - i-d curve - Spectrometer.
12. Determination of wavelength of prominent lines of mercury spectrum by Normal Incidence
Method – Grating and Spectrometer.

Magnetism

13. Field along the axis of a coil B_H - Deflection Magnetometer.
14. Figure of Merit – B.G.
15. Charge sensitivity – B.G.

Heat

16. Specific heat capacity of liquid (Resistance of the coil to be found by Post office Box) – Joule's Calorimeter.

RECOMMENDED TEXTBOOK:

1. Balasubramanian. S, Ranganathan. R, Srinivasan M. N, A Textbook of Practical Physics, 2nd Revised Edition, S. Chand and Sons Pvt. Ltd., 2017.
2. C. C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics, 1st Edition, Viswanathan. S Printers and Publishers, Pvt. Ltd., 2015.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Impart the basic idea about the Youngs modulus, rigidity modulus and frequency of A.C. mains, transverse and longitudinal vibrations in stretched strings.
CO2	Analyze the laws of resistance using Potentiometer, P.O. box and Carey Foster's bridge and calibration of low range voltmeter using potentiometer.
CO3	Determine the refractive index of material of lens, prism and to infer the wavelength of mercury vapour lamp.
CO4	Apply the ballastic galvanometer to determine figure of merit and charge sensitivity to observe field along axis of a coil
CO5	Strengthen the idea of electrical heating using Joules calorimeter

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	2
CO2	3	2	3	2	2	2
CO3	3	2	3	2	2	2
CO4	3	2	3	3	2	2
CO5	3	2	2	2	2	2
Average	3	2	2.8	2.2	2	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

SEMESTER -IV
ALLIED PHYSICS – II
(for B. Sc Chemistry)

TOTAL HOURS: 60 Hours
CREDITS: 4

COURSE CODE: PH18/4A/AP2
L-T-P: 4-0-0

COURSE OBJECTIVES:

To enable the students to

1. Analyse the optical properties and polarization techniques.
2. Get broader idea about atomic interactions with matter.
3. Acquire knowledge regarding nuclear science and its impact.
4. Study the postulates and transformation equations in relativity.
5. Acquaint with the basic electronic properties of materials with practical applications.

UNIT I: Physical Optics

Interference - Interference in thin films - Air wedge – determination of diameter of a thin wire by air wedge - Newton's rings: expression for radii of the rings – determination of wavelength of sodium light.

Polarization - Double refraction - Nicol prism - Optical activity – Laurent's half shade polarimeter. 15 hours

UNIT II: Atomic Physics

Vector atom model – spatial quantization, spinning electron - various quantum numbers - coupling schemes: LS and jj coupling - Pauli's exclusion principle – electronic configuration and periodic table.. 11 hours

UNIT III: Nuclear Physics

Nuclear model - liquid drop model – semi-empirical mass formula - mass defect - binding energy – nuclear fission – chain reaction - controlled and uncontrolled chain reaction – nuclear reactor - nuclear fusion - thermonuclear reactions – nuclear radiation hazards. 12 hours

UNIT IV: Relativity

Frames of reference - postulates of theory of relativity - Galilean transformation equations - Lorentz transformation equation - derivation - length contraction - time dilation - mass energy equivalence. 10 hours

UNIT V: Electronics

Introduction to semi conductors - Junction diode - characteristics – Zener diode - Voltage regulator - Junction transistor - CE mode – characteristics.

Boolean Algebra: AND, OR and NOT gates - construction using diodes – Demorgan's theorem – verification- NAND and NOR gates - universal building blocks. 12 hours

RECOMMENDED TEXTBOOKS:

1. R. Murugesan, Allied Physics, 1st edition, S. Chand & Co. Ltd., New Delhi, 2005.*
2. M. N. Avadhanulu, N. Subrahmanyam, Brij Lal, Text Book of Optics, S.Chand & Co. Ltd., 2012.
3. G. Senthil Kumar, Engineering Physics – I, VRB Publishers Pvt. Ltd., 2013.
4. R. Murugesan, Kiruthiga Sivaprasath, Modern Physics, S.Chand& Co. Ltd., 2016.
5. V.Vijayendran, Introduction to Integrated Electronics, Viswanathan, S., Printers & Publishers Pvt. Ltd., 2009.*

REFERENCE BOOKS:

1. Nelkon and Parker, Principles of Physics, Heinemann International literature and text books, 8th edition 1995.*
2. Donald P Leach, Albert Paul Malvino, Goutam Saha, Digital Principles and Applications, 7th edition, Tata McGraw Hill Education Private Ltd., New Delhi, 2011.

JOURNALS:

1. Optik (International)
2. Physics of Atomic Nuclei (International)
3. Nuclear Physics B (International)
4. General Relativity and Gravitation (International)
5. International Journal of Electronics
6. Indian Journal of Pure and Applied Physics (Indian)

E-LEARNING RESOURCES:

1. <https://physics.info/light/> (Unit I)
2. <http://www.nat.vu.nl/~wimu/Atom.html> (Unit II)
3. http://electron6.phys.utk.edu/phys250/modules/module%205/nuclear_models.htm (Unit III)
4. <https://ieer.org/resource/factsheets/basics-nuclear-physics-fission/> (Unit III)
5. <https://www.space.com/17661-theory-general-relativity.html> (Unit IV)
6. <http://hyperphysics.phy-astr.gsu.edu/hbase/Relativ/ltrans.html> (Unit IV)
7. <https://www.electronicshub.org/tutorials/> (Unit V)

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Realize the concept of interference in optics and to apply in designing optical elements useful in day to day lives.
CO2	Explain the basics of atomic physics and study of atomic interactions with electric and magnetic fields.
CO3	Analyze the importance of nuclear science in the current era via studying its theory and limitations.
CO4	Study the revolutionized concept called relativity with the better understanding of general and special theory of relativity.
CO5	Exploration of semiconductor physics and applies the knowledge of digital electronics and logic gates in designing of various applications.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	2
CO2	3	2	3	2	2	2
CO3	3	2	3	3	2	3
CO4	3	2	2	2	2	2
CO5	3	3	3	3	2	2
Average	3	2.2	2.8	2.4	2	2.2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Problem Solving
Assignment
Seminar
e-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER -II
ALLIED PHYSICS PRACTICAL
(for B. Sc Chemistry)

TOTAL HOURS: 60 HOURS
CREDITS: 2

COURSE CODE: PH18/4A/PPR
L-T-P: 0-0-2

COURSE OBJECTIVES:

To enable the students to

1. Perform basic experiments to study the properties of matter.
2. Illustrate the concepts of heat and sound and verify its theoretical values experimentally.
3. Demonstrate the behavior of light and study its properties through practical experiments.
4. Calibrate the voltmeter and ammeter based on the concept of electricity.
5. Verify the truth tables using different logic functions.

EXPERIMENTS:

Properties of Matter

1. Orientation I – Learning screw gauge and vernier calipers, microscope and telescope.
2. Young's modulus of the material of a beam - non-uniform bending using pin and microscope.
3. Rigidity modulus of the material of a rod – static torsion apparatus.
4. Rigidity modulus of the material of a wire - torsion pendulum.

Sound and Heat

5. Specific heat capacity of a given solid – method of mixtures.
6. Frequency of a tuning fork - sonometer.
7. Determination of frequency of AC mains - sonometer, steel wire and electromagnet.

Light

8. Thickness of a wire - air wedge.
9. Determination of radius of curvature of the lens - Newton's rings (given - wavelength of sodium light).

Electricity & Magnetism

10. Calibration of a low range voltmeter - potentiometer.
11. Calibration of an ammeter - potentiometer.
12. Determination of B_H using the field along the axis of a circular coil carrying current - deflection magnetometer.

Electronics

13. Characteristics of a Zener diode.
14. Construction of AND, OR and NOT gates using junction diodes and transistors.
15. Verification of De Morgan's theorem using ICs.
16. NAND and NOR gates as Universal building Blocks.

RECOMMENDED TEXTBOOKS:

1. Balasubramanian. S, Ranganathan. R, Srinivasan M. N, A Textbook of Practical Physics, 2nd Revised Edition, S. Chand and Sons Pvt. Ltd., 2017.
2. C. C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics, 1st Edition, Viswanathan. S Printers and Publishers, Pvt. Ltd., 2015.

COURSE OUTCOMES:

CO No	CO Statement
CO1	Demonstrate the elastic nature of materials by static torsion, torsion pendulum and young's modulus methods.
CO2	Illustrate the concepts of specific heat capacity through solids and determination of frequency of the given object.
CO3	Explore the phenomena of diffraction and interference using optical experiments.
CO4	Analyze the calibration of voltmeter and ammeter by potentiometer and B_H using deflection magnetometer.
CO5	Perform the analysis and design of various digital electronic circuits.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	2
CO2	3	2	3	2	3	2
CO3	3	2	3	2	2	2
CO4	3	3	3	2	3	2
CO5	3	2	3	3	3	2
Average	3	2.2	3	2.2	2.8	2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

SEMESTER V COURSE PROFILE - PROGRAMME OF STUDY

COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	L - T - P	TOTAL HOURS	MARKS		
						CA	SE	TOTAL
PH18/5C/NUP	Nuclear Physics	5	6	4 - 2 - 0	90	40	60	100
PH18/5C/MMP	Mechanics and Mathematical Physics	5	6	4 - 2 - 0	90	40	60	100
PH18/5C/ALP	Atomic and Laser Physics	5	6	4 - 2 - 0	90	40	60	100
PH18/5E/EED	Basic Electronics and Electronic Devices	5	6	4 - 2 - 0	90	40	60	100
Or								
PH18/5E/ACP	Acoustical Physics	5	6	4 - 2 - 0	90	40	60	100
PH18/6C/MPR3	Major General Practical III	4	3	0 - 0 - 3	45	40	60	100
PH18/6E/EPR	Electronics Practical	3	3	0 - 0 - 3	45	40	60	100
PH18/5S/NSN	Nanoscience and Nanotechnology (Self Study/Advanced Learners course)	2 (Additional)	NA	NA	NA	NA	100	100
Total W.Hrs/Credits		20	30					

SEMESTER V
NUCLEAR PHYSICS

TOTAL HOURS: 90 HOURS
CREDITS: 5

COURSE CODE: PH18/5C/NUP
L-T-P: 4-2-0

COURSE OBJECTIVES

To enable the students to

1. Gain insight into the dimensions, stability and various other properties of the nucleus.
2. Explore the applications of beam dynamics technique.
3. Learn about various types of radiations, their interaction with matter and study the various separation techniques
4. Understand about various types of nuclear reactions and their energetics.
5. Impart the knowledge of fundamental particles, fundamental interaction, range and strength of these interactions with the concept of particle antiparticle or matter antimatter.

UNIT I: Introduction to the nucleus

Classification of nuclei - Properties of nucleus - nuclear size - charge- mass - density - Mass defect – Binding energy of a nucleus – Packing fraction – Nuclear models : liquid drop model – Weizacker’s semi empirical mass formula – Shell model and magic numbers – Nuclear forces – Meson theory of nuclear forces. 15 hours

UNIT II: Particle accelerators

Principle and working of accelerators - Linear accelerators – Cyclotron – Synchrocyclotron – Betatron – Synchrotrons: electron synchrotron and proton synchrotron. 15 hours

UNIT III: Radioactivity

Alpha rays – Properties - Alpha ray spectra – Gamow’s theory of alpha decay – Beta rays – Characteristics - Beta ray spectra – Neutrino theory of beta decay – k-electron capture - Gamma ray – Properties - Nuclear isomerism – Internal conversion.

Radiation Hazards: Radiation levels for safety - Radiation protection methods - Nuclear disasters - Nuclear waste disposal. 20 hours

UNIT IV: Nuclear fission and fusion

Nuclear reaction – energy balance in nuclear reaction and Q-value – threshold energy – Laws of radioactivity: Soddy - Fajan’s Displacement Law – Half - life period – Mean - life - Nuclear fission – Chain reaction, critical mass and size, controlled chain reaction – nuclear reactor – construction and working - Fast Breeder – nuclear fusion – thermonuclear reactions – source of stellar energy. 20 hours

UNIT V: Elementary particles

Introduction to elementary particles – Particles and Anti-particles – Antimatter - Fundamental interactions - gravitational, electromagnetic, strong and weak – Elementary particle quantum numbers – conservation laws and symmetry – Quark Model (basic ideas).
20 hours

RECOMMENDED TEXTBOOKS:

1. R. Murugesan, **Kiruthiga Sivaprasath**, Modern Physics, S.Chand & Co. Ltd., 2016.
2. Sehgal and Chopra, Modern Physics, 11th edition, Sultan Chand & Sons, 2014.
3. D. C Tayal, Nuclear Physics, 5th edition, Himalaya Publishing House, Mumbai, 2013.
4. Irving Kaplan, Nuclear Physics, 4th edition, Oxford & IBH Publish & Co., New Delhi, 2002*.

REFERENCE BOOKS:

1. S. M. Ghoshal, Atomic and Nuclear Physics, S. Chand & Company, 2008*.
2. H. S. Mani, G.K. Metha, Introduction to Modern Physics, Affiliated East-West Pvt. Ltd., New Delhi, 1999*.
3. Roy And Nigam, Nuclear Physics, First edition, Wiley Eastern Limited, New Delhi, 1986.
4. Blatt and Weisskopf, Theoretical Nuclear Physics, First Edition, John Wiley and Sons New York, 1979*.
5. Segre W. A. Benjamin, Nuclei & Particles, 2nd edition, USA, 1977*.

JOURNALS:

1. The Electricity Journal (International)
2. Pramana – Journal of Physics (National)

E-LEARNING RESOURCES:

1. [http://physicsanduniverse.com/introduction-to-nucleus/\(Unit I\)](http://physicsanduniverse.com/introduction-to-nucleus/(Unit I))
2. <https://www.slideshare.net/IshaMahar1/particle-accelerator-71329786> (Unit II)
3. <https://www.khanacademy.org/science/in-in-class-12th-physics-india/nuclei/in-in-nuclear-physics/a/radioactive-decay-types-article> (Unit III)
4. <https://www.its.caltech.edu/~chem2/NuclearEnergySlides%204-21-09.pdf> (Unit IV)
5. <https://www.physics.upenn.edu/~pgl/e27/E27.pdf> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	After taking this course, students are able to demonstrate a knowledge of fundamental aspects of the structure of the nucleus, perform basic calculations using the models to derive the observed stable nuclei.
CO2	Explain the operation of the technical components and diagnose accelerating methods, explain limitations of different types of accelerators
CO3	This course has led the students to assess interaction of various types of radiation with matter evaluate their occurrence in their daily life. Acquiring skills in analyzing, interpreting radiation spectra and communicating the result of such investigation in writing.
CO4	Students would be able to apply various aspects of nuclear reactions in view of compound nuclear dynamics. Account for fission and fusion processes of the reactors.
CO5	Classify elementary particles and nuclear states in terms of their quantum numbers, develop and communicate analytical skills in subatomic physics

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	3	2	3
CO4	3	3	3	2	2	3
CO5	3	2	2	3	2	3
Average	3	2.8	2.6	2.6	2	2.6

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-LCD)
 E Content, Videos
 Problem Solving-Group Discussion
 Seminar

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A-10x2 marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have two problems. Section C may have problems as a part of the question.
K1, K2	B-5/8x8 marks	200	40		
K2, K3	C-2/3x20 marks	500	40		

SEMESTER- V

MECHANICS AND MATHEMATICAL PHYSICS

TOTAL HOURS: 90 HOURS
CREDITS: 5

COURSE CODE: PH18/5C/MMP
L-T-P: 4 - 2 - 0

COURSE OBJECTIVES

To enable the students to

1. Apply the underlying forces in the motion of rigid bodies.
2. Analyze the gravitational laws and its application in everyday life.
3. Analyze the concepts of impact of colliding bodies and the related change in kinetic energies.
4. Explore the fundamentals of vector calculus using Cartesian coordinates.
5. Formulate the mathematical tools of matrices for the understanding of Advanced Physics.

UNIT I: Dynamics of Rigid Bodies

Translatory and rotatory motion – uniform circular motion-centripetal force – banking of tracks – motion in a vertical circle – centrifugal force – theorem of perpendicular axes, theorem of parallel axes – moment of inertia of a ring, uniform circular disc - kinetic energy of a body rolling in a horizontal plane – acceleration of a body rolling down an inclined plane. 15 hours

UNIT II: Gravity and Gravitation

Kepler's laws of motion – derivation of law of gravitation – Newton's universal law of gravitation – compound pendulum, bar pendulum – variation of g at the poles and equator, variation of g with altitude, depth and variation of g with rotation of the earth.

Satellites – types of satellites – orbital velocity – escape velocity – parking orbits. 15 hours

UNIT III: Vector analysis

Gradient of a scalar field - line, surface, volume integrals- Divergence of a vector function- expression for divergence in cartesian coordinates- Curl of a vector function - expression for curl in cartesian coordinates - physical significance of curl - Important Vector Identities - Gauss Divergence Theorem - Stoke's Theorem- Green's Theorem (derivation only).

20 hours

UNIT IV: Matrices

Matrices in Physics - Characteristic Equation of a Matrix - Cayley Hamilton Theorem- Special Types of Matrices and their Properties - square matrix - diagonal matrix - scalar matrix- identity matrix - null matrix- upper and lower triangular matrices - transpose of a matrix- Hermitian matrix - symmetric and anti symmetric matrices - orthogonal matrix - adjoint of a matrix - inverse of a matrix. 15 hours

UNIT V: Classical Mechanics

Classical Mechanics- Mechanics of a system of Particles- Conservation theorems: linear momentum, angular momentum, energy - Degrees of freedom- Constraints- Generalised Coordinates- Generalised displacement, velocity, momentum, force, potential - Transformation Equations - Configuration Space - Principle of Virtual work - D'Alembert's Principle - derivation of Lagrange's equation from D'Alembert's principle for a conservative system.

Applications of Lagrange's Equations: Atwood's machine and simple pendulum - Hamiltonian Formulation – derivation of Hamilton's equation from Lagrange equation and application of Hamiltonian equation to harmonic oscillator. 25 hours

RECOMMENDED TEXTBOOKS:

1. R. Murugesan, Mechanics and Mathematical Physics, 3rd Edition, S. Chand & Co. Ltd., 2017.
2. B. D. Gupta, Mathematical Physics, 4th Edition, Vikas Publishing House Pvt.Ltd., 2009.*
3. Brij Lal and N. Subrahmanyam, Properties of Matter, 3rd Edition, S.Chand & Co. Ltd., 2005.*
4. Herbert Goldstein, Charles P. Poole, John Safko, Classical Mechanics, 3rd Edition, Pearson New International Edition, New Delhi, 2014.

REFERENCE BOOKS:

1. H.K.Dass, Rama Verma, Mathematical Physics, 7th Revised Edition, S.Chand & Co. Ltd., 2014.
2. Satya Prakash, Mathematical Physics with Classical Mechanics, 6th Edition, Sultan Chand & Sons Pvt. Ltd., 2015.
3. D. S. Mathur, P. S. Hemne, Mechanics, S. Chand & Co. Ltd., 2014.

JOURNALS:

1. Journal of Applied Mechanics
2. Journal of Science Education
3. Indian Journal of Pure and Applied Mathematics
4. SIAM Journal on Matrix Analysis and Applications
5. International Journal of Classical Physics
6. American Journal of Physics

E-LEARNING RESOURCES:

1. <https://study.com/academy/topic/systems-of-particles-and-rigid-body-dynamics.html> (Unit I)
2. <http://hyperphysics.phy-astr.gsu.edu/hbase/kepler.html> (Unit II)
3. <http://www.simplylearnt.com/notes/Vectors-1> (Unit III)
4. <https://www.khanacademy.org/math/algebra-home/alg-matrices> (Unit IV)
5. <https://www.physics.rutgers.edu/~shapiro/507/book3.pdf> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Compute problems relating to the laws of mechanical forces and determining physical quantities like moment of inertia of rigid bodies.
CO2	Demonstrate the laws of gravity through experimental setup and explore the concepts of satellite motion.
CO3	Explore the nature of colliding bodies and the change in the associated kinetic energies.
CO4	Apply Vector Calculus in the fields of fluid and electrodynamics.
CO5	Apply matrix rules in quantum and classical physics domains.

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2
CO2	3	2	3	2	2	2
CO3	3	3	3	3	2	2
CO4	2	3	2	3	2	2
CO5	2	2	2	2	2	2
Average	2.6	2.4	2.4	2.4	2	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
 Problem Solving
 Assignment
 E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER V

ATOMIC AND LASER PHYSICS

TOTAL HOURS: 90 Hours

COURSE CODE:

PH15/5C/ALP

CREDITS: 5

L-T-P: 4 - 2 - 0

COURSE OBJECTIVES

To enable the students to

1. Explain the important concepts of atomic and molecular physics.
2. Understand the structure and nature of matter.
3. Formulate the concepts of Zeeman Effect and Stark effect.
4. Analyze the various X-rays techniques.
5. Outline the laser level system and its applications.

UNIT I: Structure of Atom

Atom model - vector atom model - spatial quantization - spinning electron - quantum numbers associated with the vector atom model - coupling schemes: LS and jj coupling - Pauli's exclusion principles - Periodic classification of elements - examples of electron configuration. 18 hours

UNIT II: Application of Vector Atom Model

Magnetic dipole moments due to orbital motion and electron spin - Bohr magneton - experimental conformity of the vector atom model - Stern and Gerlach experiment: principle and experimental procedure - interpretation of the result - Spin-Orbit Coupling - Optical spectra- spectral terms and their notations - selection rules - Fine structure of sodium D - line. 18 hours

UNIT III: Effect of atoms in electric and magnetic fields

Zeeman effect - experimental arrangement for the normal Zeeman effect - Lorentz classical theory of normal Zeeman effect- Larmor's theorem - quantum mechanical explanation of the normal Zeeman effect -anomalous Zeeman effect - Stark effect - derivation. 18 hours

UNIT IV: X- rays

Introduction- Production of X-rays - Coolidge Tube - diffraction of X-rays by crystals- Bragg's law - Bragg's spectrometer - verification of Bragg's law- powder crystal method. **X-Ray Spectra:** Continuous and characteristic X-ray spectra -Moseley's law-its importance - Compton effect - experimental demonstration of Compton effect. 18 hours

UNIT V: Lasers

Stimulated and Induced Emission and Induced Absorption - Population inversion -Three level system - Ruby Laser - Four level Laser - Helium-Neon laser - Applications of Lasers in industry, medicine and communication. 18 hours

RECOMMENDED TEXTBOOKS:

1. C. Kittel, An Introduction to Solid State Physics, 8th Edition, John Wiley and Sons, 2008.*
2. R. Murugesan, Kiruthiga Sivaprasath, Modern Physics, S.Chand& Co. Ltd., 2016.
3. Laud B. B, Laser and Non-Linear Optics, 3rd edition, Willey Eastern, Ltd., New York, 2011.
4. Avadhanulu, An Introduction to Laser Theory and Applications, 2nd Edition, S Chand & Co., New Delhi, 2001.*
5. Richard S. Quimby, Photonics and Lasers, first edition, Wiley Publishers, March 2007.*

REFERENCE BOOKS:

1. J.B. Rajam, Atomic Physics, S Chand and Co., 2007.*
2. Arthur Beiser, Concepts of Modern Physics, 6th Edition, Mc Graw Hill, Inc., 2002.*

JOURNALS:

1. Journal of Physics B: Atomic, Molecular and Optical Physics (National)
2. Journal of Physical Review A: Atomic, Molecular and Laser Physics.(International)

E-LEARNING RESOURCES:

1. <https://www.toppr.com/guides/chemistry/structure-of-atom/introduction-to-structure-of-atom/> (unit I)
2. <http://www.physics-assignment.com/vector-atom-model> (unit II)
3. https://www.researchgate.net/publication/300785036_Atoms_in_Electric_and_Magnetic_Fields (unit III)
4. <https://www.livescience.com/32344-what-are-x-rays.html> (unit IV)
5. <https://www.rp-photonics.com/lasers.html> (unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Analyze the structure of atoms and the origin of the observed spectra.
CO2	Utilize the applications of vector atom model and the optical spectral terms.
CO3	Evaluate the atomic behaviour in external applied electric and magnetic fields.
CO4	Formulate the concepts of X-rays production and the experiments to find X-ray spectra.
CO5	Analyze the laser principles, Laser behaviour, different types of lasers and its applications.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2
CO2	3	2	2	2	2	2
CO3	3	3	3	3	2	2
CO4	3	3	3	3	2	2
CO5	3	3	3	3	2	2
Average	3	2.6	2.6	2.6	2	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
 Problem Solving
 Assignment
 Seminar
 Group Learning
 E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER V

BASIC ELECTRONICS AND ELECTRONIC DEVICES

TOTAL HOURS: 90 Hours
CREDITS: 5

COURSE CODE: PH18/5E/EED
L-T-P: 4 – 2 - 0

COURSE OBJECTIVES:

To enable the students to

1. Strengthen the basics of electronics and electronic devices.
2. Enhance the knowledge on the working of various semiconductor devices.
3. Study the working, characteristics and applications of special devices.
4. Understand the feedback circuits and their types.
5. Study the operation of OP-AMPS and wave generation oscillators.

UNIT I: Introduction to Semiconductors

Introduction – Definition and properties- intrinsic, extrinsic semiconductors – n type and p type - PN junction - properties– biasing – current flow- V-I characteristics - important terms- limitations on the operating conditions - diode volt-ampere equation- Fermi level in a semiconductor - EBD of p - type and n-type semiconductors - EBD of PN junction under thermal equilibrium - EBD for a forward bias, reverse bias junction diode . 15 hours

UNIT II: Semiconductor devices

Half wave rectifier –Full wave center tap rectifier –full wave bridge rectifier — nature of rectifier output – efficiency - ripple factor – filter circuits – types. Voltage stabilization – Zener diode – equivalent circuit - Zener diode as a voltage regulator.

Junction Transistor - construction and working of a transistor – Transistor connections and Characteristics in CB, CE and CC mode - Comparative study of the parameters in different configuration. Transistor as an amplifier in CE mode - load line analysis: AC and DC - operating point –Biasing – voltage divider bias. 20 hours

UNIT III: Special Devices

Field Effect Transistor (FET) – types – JFET - construction and working – parameters- characteristics-expression for saturation drain current- Uni Junction Transistor (UJT) – construction and working - equivalent circuit - characteristics - UJT as relaxation oscillator - Silicon Controlled Rectifier (SCR) – construction and working - equivalent circuit - important terms-characteristics- SCR as a half wave and full wave rectifier. 18 hours

UNIT IV: Oscillators using Transistors

Concept of feedback - negative and positive feedback- principles of negative voltage feedback in amplifiers – gain – advantages – feedback circuit – Sinusoidal oscillators: types – oscillatory circuit – undamped oscillations from tank circuit – positive feedback oscillator – essentials - Barkhausen condition for oscillation –Hartley and Colpitt’s oscillator. 15 hours

UNIT V: Operational amplifier

Introduction to operational amplifier - Characteristics and parameters – Op-Amp circuits: comparator, inverting and non-inverting amplifier, adder and subtractor, voltage follower, integrator, differentiator, Schmitt trigger. Wave form generators: Phase Shift and Wein Bridge Oscillators. 22 hours

RECOMMENDED TEXTBOOKS:

1. V. K. Mehta, Principles of Electronics, 11th Edition , S Chand and Co. Ltd., 2017.
2. Bagde and Singh, Elements of Electronics, S. Chand and Co Ltd., 1993*.
3. R.S. Sedha, A text book of Applied Electronics, 3rd edition, S. Chand and Co. Ltd., 2008*.
4. V.Vijayendran, Introduction to Integrated Electronics , S.Vishwathan Publishers Ltd.,Chennai, 2nd edition, 2009*.
5. Gupta Kumar, Hand Book of Electronics, 2nd edition, Pragati Prakashan, 2012.

REFERENCE BOOKS:

1. Dennis Le Croisette, Transistors, 5th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1998*.
2. Millman and Halkias, Integrated Electronics, Mc Graw Hill Book Co., 2010.

JOURNALS:

1. Journal of Electronic materials (International)
2. Journal of Semiconductor Devices and Circuits (National)

E-LEARNING RESOURCES:

1. <https://www.slideshare.net/Kawsarahmed73/prestation-on-half-and-full-wave-ractifier> (Unit I)
2. <https://www.physics-and-radielectronics.com/.../transistors/bipolarjunctiontransistor/> (Unit II)
3. https://www.tutorialspoint.com/basic.../basic_electronics_types_of_transistors;<https://www.allaboutcircuits.com> › Textbook › Vol. III - Semiconductors › Thyristors (Unit III)
4. <https://www.slideshare.net/forwardblog4u/feedback-amplifiers> (Unit IV)
5. <https://www.electronics-ts.html> (Unit IV)
6. <https://www.electronicstutorials.ws/opamp;>[https://www.slideshare.net/razzor2013/op-amp-final-ppt main](https://www.slideshare.net/razzor2013/op-amp-final-ppt-main) (Unit V)

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Assess the basic idea about semiconductors and their energy band diagrams
CO2	Analyze the concept of semiconductor devices, their working and applications
CO3	Formulate the construction and applications of FET, JFET, SCR and UJT
CO4	Utilize the mathematical calculations to study the electrical circuits and to comprehend the concept of feedback circuits
CO5	Design various operational amplifier circuits and analyze the working of wave generating oscillators

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	2
CO2	3	2	3	3	2	2
CO3	3	2	3	3	3	2
CO4	3	3	3	3	2	2
CO5	3	3	3	2	3	2
Average	3	2.6	2.8	2.8	2.6	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk

Power Point Presentation

Problem Solving

Assignment

Seminar

E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No.- is compulsory Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

Note: Elective Paper will be offered only when atleast 20% of the students opt for it.

SEMESTER V ACOUSTICAL PHYSICS

TOTAL HOURS: 90 HOURS
CREDITS: 5

COURSE CODE: PH18/5E/ACP
L-T-P: 4-2-0

COURSE OBJECTIVES

To enable the students to

1. Understand the classical background of quantum mechanics, study the basic principles of quantum mechanics.
2. Study role of uncertainty in quantum physics and comprehend the formulation of quantum mechanics.
3. Learn the concept of wave function, through Schrodinger equation and their applications.
4. Analyze the fundamental concepts of space and time, of mass and of force in relativity.
5. Provide conceptual skills, analytical tools necessary for astrophysical and cosmological applications of the general theory of relativity.

Unit I: Introduction to Acoustic waves

Acoustics waves – Vibrations, resonance and frequency- Linear wave equation – sound in fluids – Harmonic plane waves – Energy density – Acoustics intensity – Specific acoustic impedance – spherical waves – decibel scales 18 hours

Unit II: Acoustic Wave Propagation

Transmission through different media - reflection from solid surfaces - radiation and reception of acoustic waves- absorption and attenuation of sound - Cavities and wave guides. 18 hours

Unit III: Pipes, Resonators, And Filters

Resonance in pipes - standing wave pattern absorption of sound in pipes - Helmholtz resonator - acoustic impedance -- reflection and transmission of waves in pipe - acoustic filters - low pass, high pass and band pass 18 hours

Unit IV: Damping Attenuation And Absorption

Viscous attenuation of sound - absorption by atmosphere - attenuation in water - absorption in fluid filled pipes - damping in solids. 18 hours

Unit V: Architectural Acoustics And Noise Control

Sound in enclosures - direct and reverberant sounds - sound absorption materials - acoustic factors in architectural design - standing waves and normal modes in enclosures.

The auditory system - Effects of noise on humans - noise measurement and criterion - treatment at source and treatment of transmission path - Analysis and design of mufflers for automotive applications. 18 hours

RECOMMENDED TEXTBOOKS:

1. Introduction to acoustics, Robert D Finch, Prentice Hall of India, 2008* .
2. Fundamentals of Acoustics, Lawrence E. Kinsler, Austin, R. Frey, Alan B. Coppens, James V. Sanders, 4th edition, Wiley, 2000* .
3. Engineering Acoustics: An introduction to Noise Control, Michael Moser, Michael Maser, S. Zimmermann, 2/e, Springer, 2009* .
4. Foundations of Engineering Acoustics, Frank J Fahy, Academic Press, 2000* .

REFERENCE BOOKS:

1. L. Berarek, "Acoustics" - McGraw-Hill, 1986* .
2. An Introduction to acoustics, Robert H. Randall, Cambridge published – Addison Wesley 1951* .
3. Architectural Acoustics, Marshall Long, Academic Press, 2nd Edition, 2014.

JOURNALS:

1. Applied Acoustics (International)
2. Journal of the Acoustical Society of India (National)

E-LEARNING RESOURCES:

1. https://www.feis.unesp.br/Home/departamentos/engenhariamecanica/gmsint/lecture1_intro-to-acoustics.pdf <https://www.thoughtco.com/the-compton-effect-in-physics-2699350> (Unit I)
2. [http://ultrasound.ee.ntu.edu.tw/classnotes/us1/Chapter 2.pdf](http://ultrasound.ee.ntu.edu.tw/classnotes/us1/Chapter%202.pdf) (Unit II)
3. <https://www.sciencedirect.com/topics/engineering/resonators> (Unit III)
4. <https://www.ndeed.org/EducationResources/CommunityCollege/Ultrasonics/Physics/attenuation.html>. (Unit IV)
5. <https://www.bksv.com/media/doc/bn1329.pdf>. (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Predict wave propagation, absorption, transmission, reflection and radiation.
CO2	Formulate acoustic problems for reduction of sound levels.
CO3	Analyze and design resonant systems including pipes, mufflers, Helmholtz resonators.
CO4	Evaluate architectural acoustics reverberation time, direct echoes and acoustical amplification.
CO5	Analyze the acoustic levels and analytical predictions.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2
CO2	3	3	3	2	3	2
CO3	3	2	2	2	2	2
CO4	3	2	2	2	2	2
CO5	3	3	3	2	2	3
Average	3	2.4	2.4	2	2.2	2.2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture (Chalk and Talk -LCD)

E Content, Videos

Problem Solving

Seminar

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A-10x2 marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B-5/8x8 marks	200	40		
K2, K3	C-2/3x20 marks	500	40		

Note: Elective Paper will be offered only when atleast 20% of the students opt for it.

SEMESTER – V

SELF STUDY COURSE / ADVANCED LEARNER COURSE

NANOSCIENCE AND NANOTECHNOLOGY

CREDITS: 2

COURSE CODE: PH18/5S/NSN

Course Objectives

To enable the students to

1. Acquaint themselves to work with nanomaterials in their future careers
2. Evaluate the importance of the synthesis methods addressed in the material properties.
3. Assess the various factors that influence the properties of nanomaterials, optimizing procedures, and implementations to the new designs.
4. Analyze the principles of nanotechnology, characterization of nano structured materials; and tools and equipment for producing and assembling at the nano scale.
5. Demonstrate the knowledge of the sources of energy and the methods of energy

Conversion in Nanotechnology thereby highlighting the industrial applications of nanotechnology

UNIT- I Fundamentals of Nanoscience

Nanotechnology Basics- fundamental of nanotechnology- significance and its impact- Classification of nanomaterials- zero dimension - one dimension- two dimension- three dimension- techniques of production - Bottom - up approach - top - down approach - fullerenes-types of fullerenes- carbon nanotubes- single walled- multiwalled carbon nanotubes.

UNIT- II Synthesis by Physical processes

Fabrication of Nanomaterials by Physical Methods - Plasma arc technique - Ion sputtering, Laser ablation, Ball Milling, Molecular beam epitaxy (MBE), Chemical vapour deposition (CVD) method – sol gel technique\electrodeposition – chemical bath deposition.

UNIT- III Nanomaterials Characterization Techniques – I

Scanning probe microscopy- types of scanning microscopy-advantages and disadvantages-atomic force microscopy- parameters measured by AFM – imaging modes – advantages and disadvantages – scanning tunnelling microscopy – tunnelling instrumentation procedure.

UNIT-IV Nanomaterials Characterization Techniques – II

Impedance analysis – micro hardness-fatigue – abrasion and wear resistance –vibrating sample magnetometer- FTIR – principle and applications - Differential scanning calorimeter- thermogravimetric analyser

UNIT- V Applications of nanotechnology

Information storage- nano computer, molecular switch- nano probes in medical diagnostics – nanomedicines –targetted drug delivery – nanosensors – nanoparticles for solar cell – battery.

RECOMMENDED TEXTBOOKS:

- 1.Introduction to Nanoscience and Nanotechnology, K.K.Chattopadhyay and A N Banerjee , Eastern Economy Edition, 2009.
2. Nanotechnology,S.Shanmugam, MJP Publishers; 1 edition (28 April 2019).
3. Nanomaterials, B.Viswanathan, alpha science Intl Ltd; 1 edition (February 17, 2009)
4. Chemistry of Nanomaterials: Synthesis, properties and applications, Wiley-VCH Verlag GmbH & Co. KGaA CNR Rao et. Al, 2007

REFERENCE BOOKS:

1. Text book of Nanoscience and Nanotechnology, T. Pradeep 2003*
2. Introduction to nanotechnology, Charles P Poole and Frank J Owens 2003*
3. Introduction to Nanoscience and Nanotechnology, Alain Nouailhat, 2006.*
4. Properties of Materials, Robert E.Newnham,Oxford University Press, 2005.*
5. Nanochemistry , G.B Sergeev, elsevier,2006*

* Recent Editions are unavailable

E- LEARNING RESOURCES:

1. <https://www.khanacademy.org/science> (UNIT I,II,III)
2. <https://www.coursera.org/learn/nanotechnology1> (Unit IV,V)

JOURNALS:

1. Journal of Materials Science and Nanomaterials (National)
2. Journal of Advanced Dielectrics (International)

Course Outcomes

CO No.	CO Statement
CO 1	Apply engineering and physics concepts to the nano-scale and non-continuum domain.
CO 2	Identify and compare state-of-the-art nanofabrication methods
CO 3	Formulate appropriate tools for measurements of relevant physical properties
CO 4	Discuss and evaluate state-of-the-art characterization methods for nanomaterials
CO 5	Acquire the knowledge in applications of nanotechnology in various fields

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

Note: Only those students with more than 70% of marks as aggregate may opt for Self Study / Advanced Learner Paper.

SEMESTER VI COURSE PROFILE - PROGRAMME OF STUDY

COURSE CODE	TITLE OF THE PAPER	CREDITS	Hrs/Wk	L - T - P	TOTAL HOURS	MARKS		
						CA	SE	TOTAL
PH18/6C/EMG	Electromagnetism	5	6	4 - 2 - 0	90	40	60	100
PH18/6E/DEM	Digital Electronics and Microprocessor	5	6	4 - 2 - 0	90	40	60	100
Or								
PH18/6E/AEL	Advanced Electronics	5	6	4 - 2 - 0	90	40	60	100
PH18/6C/QMR	Quantum Mechanics and Relativity	5	6	4 - 2 - 0	90	40	60	100
PH18/6E/MAS	Material Science	5	6	4 - 2 - 0	90	40	60	100
Or								
PH18/6E/ASP	Astrophysics	5	6	4 - 2 - 0	90	40	60	100
PH18/6C/MPR3	Major General Practical III	4	3	0 - 0 - 3	45	40	60	100
PH18/6E/EPR	Electronics Practical	3	3	0 - 0 - 3	45	40	60	100
	NCC/NSS/CSS/ Sports	1						
Total W.Hrs/Credits		28	30					

SEMESTER – VI
ELECTROMAGNETISM

TOTAL HOURS: 90 HOURS
CREDITS: 5

COURSE CODE: PH18/6C/EMG
L-T-P: 4 - 2 - 0

COURSE OBJECTIVES

To enable the students to

1. Define the basic concepts of electromagnetic effects and enhance problem solving skills.
2. Demonstrate the use of ballistic galvanometer for various studies.
3. Analyze the transient behavior of current.
4. Explore the concepts and applications of alternating current in everyday life.
5. Analyze electromagnetic wave propagation in free space.

UNIT I: Magnetic effect of Electric Current

Magnetic field around a current carrying conductor – Biot - Savart law - Magnetic field intensity at a point on the axis of a circular coil carrying current - Magnetic field intensity due to a solenoid carrying current - Effect of iron core in a solenoid - Force on a current carrying straight conductor placed in a magnetic field - Force between two current carrying infinitely long parallel conductors - Definition of ampere – Torque on a current loop in a uniform magnetic field - Moving coil ballistic galvanometer- Theory – Damping correction – current and voltage sensitivity of a moving coil ballistic galvanometer – Applications – Absolute capacitance of a capacitor – comparison of two capacitances using B.G.- Comparison of e.m.f's of two cells using B.G. 20 hours

UNIT II: Electromagnetic Induction

Faraday's laws - Expression for self-induction – Self-inductance of a solenoid - Determination of self - inductance by Anderson method - Mutual induction – Experiment to determine mutual inductance between a pair of co-axial coils - Co-efficient of coupling – Eddy currents and its uses. 15 hours

UNIT III: Transient Currents

Growth and decay of current in a circuit containing inductance L and resistance R with steady EMF - Growth and decay of charge in a CR circuit -Determination of high resistance by leakage - Growth and Decay of charge in a LCR circuit - Condition for the discharge to be oscillatory - Frequency of Oscillation. 15hours

UNIT IV: Alternating Currents

EMF induced in a coil rotating in a magnetic field - Peak, average and RMS value of AC voltage and current - Power and power factor - Wattless current - reactance and impedance - Impedance of AC circuit containing L, C and R - series and parallel resonance circuits – j operator method and its applications to LR, CR and LCR circuits - Three phase AC – Star and delta connection – Skin effect.

20 hours

UNIT V: Motion of particles

Motion of charged particles in (a) uniform electric field (Longitudinal, Transverse electric field), (b) in alternating electric field, (c) in a uniform constant magnetic field, (d) in a crossed electric and magnetic fields.

Maxwell equations: Current density - equation of continuity - Maxwell's equations (Gauss's law of electrostatics, Gauss's law of magnetic induction, Ampere's law, Faraday's law of induction) - Displacement currents –Magnitude of displacement current - Maxwell's equation in material media - Velocity of electromagnetic waves - Poynting vector.

20 hours

RECOMMENDED TEXTBOOKS:

1. Brijlal & N. Subramaniam, Electricity and Magnetism, 8th Edition, S.Chand & Co. Ltd., 2006.*
2. R. Murugesan, Electricity and Magnetism, 10th Edition, S.Chand & Co. Ltd., 2017.
4. David. J. Griffiths, Introduction to Electrodynamics, 4th Edition, Pearson Education India Learning Pvt., Ltd., 2015.

REFERENCE BOOKS:

1. Sehgal and Chopra Sehgal, Electricity and Magnetism, S.Chand & Co. Ltd., Revised edition, 2013.
2. K.K. Tewari, Electricity and Magnetism, S. Chand & Co. Ltd., Revised Edition 2011.
3. B.D. Duggal and C.L. Chhabra, Fundamentals of Electricity and Magnetism, Vishal Publishing Co., Fifth Edition, 2004.*

JOURNALS:

1. Journal of Electrical & Electronic Systems (International)
2. Journal of Electromagnetic Analysis and Applications (International)
3. Journal of Electromagnetic Waves and Applications (International)
4. International Journal of Magnetics and Electromagnetism
5. Indian Journal of Physics

E-LEARNING RESOURCES:

1. <https://www.embibe.com/study/magnetic-effects-of-current-chapter> (Unit I)
2. <https://www.toppr.com/guides/physics/magnetic-effects-of-electric-current/electromagnetic-induction-and-its-applications/> (Unit II)
3. <https://www.slideshare.net/mhmdenab/chp-22-46886265> (Unit III)
4. <https://www.electronics-tutorials.ws/accircuits/series-circuit.html> (Unit IV)
5. <http://www.maxwells-equations.com/> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Analyze the magnetic effect of electric current and demonstrate the associated concepts with ballistic galvanometer.
CO2	Demonstrate the practical concepts of magnetic induction through experimental setup.
CO3	Analyze the growth and decay of transient currents through mathematical techniques.
CO4	Illustrate the practical purposes of alternating current and the related laws.
CO5	Apply vector calculus to study the behavior of electric and magnetic fields in various media.

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	2
CO2	3	3	3	3	2	3
CO3	2	3	3	3	2	3
CO4	3	3	3	3	2	3
CO5	3	3	3	3	2	2
Average	2.8	2.8	3	2.8	2.2	2.6

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
 Power Point Presentation
 Problem Solving
 Assignment
 Seminar
 E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

SEMESTER VI

DIGITAL ELECTRONICS AND MICROPROCESSOR 8085

TOTAL HOURS: 90 Hours
CREDITS: 5

COURSE CODE: PH18/6E/DEM
L-T-P: 4 - 2 - 0

COURSE OBJECTIVES:

To enable the students to

1. Illustrate combinational and logical digital circuits and their differences.
2. Identify basic concepts of various digital circuits.
3. Discuss the interfacing with 8085 using peripheral devices.
4. Outline the basic architecture of 8 bit microprocessor.
5. Compile programs on 8085 microprocessor based systems.

UNIT I: Digital Electronics

Binary, decimal and hexadecimal number system – inter conversion - binary addition, subtraction, Multiplication and Division – signed binary numbers – Binary Codes: Gray code and ASCII codes - logic gates: AND, OR, NOT and Exclusive OR gates - Boolean algebra - De Morgan's theorems – NAND and NOR as universal logic gates - simplification of logic expressions using Boolean algebra and Karnaugh map method - pair, quad and octet - upto 4 variables. 18hours

UNIT II: Counters and registers

Flip flops: RS Flip Flop, D Flip Flop, JK Flip Flop – racing condition - JK Master slave Flip Flop – Asynchronous/Ripple counter: Mod 2, 4, 8, 16 counters, Mod 10/BCD counter using decoding gates- synchronous counter: Design, Mod 3,5 counters, Random sequence generator and BCD counter - Shift registers: Shift left, shift right and shift left- shift right registers – applications of counters and registers. 18 hours

UNIT III: D/A & A/D converters and Interfacing with 8085

D/A converter: binary weighted resistor method – R-2R ladder method - A/D converter: Counter type- successive approximation techniques. Programmable peripheral interface and applications: 8255 – pin diagram and internal architecture of 8255 - modes of operation – Interfacing LED – seven segment display interface – D/A converter interface to 8085 - A/D converter interface to 8085. 18 hours

UNIT IV: Architecture and pin configuration

Introduction to Microprocessors - Intel 8085: Pin configuration and functions, architecture of 8085 – registers - flags - address - data and control bus – Interrupts –overall interrupt structure – hardware and software interrupts- maskable and non maskable interrupts - Priorities- RIM, SIM instructions. 18 hours

UNIT V: Instruction and programming

Assembly language and machine language -Instruction set and Programme of 8085: data transfer, arithmetic, logic, branching and machine control group of instructions- addressing modes – simple programming exercises for addition - subtraction, multiplication and division of two 8-bit numbers with carry - Arranging in Ascending order / descending order. 18 hours

RECOMMENDED TEXTBOOKS:

1. V. Vijayendran, Introduction to Integrated Electronics , S.Vishwathan Publishers Ltd., Chennai, 2nd edition, 2009.*
2. V. K. Mehta , Principles of Electronics S.Chand & Co. Ltd., Revised edition 2014.
3. R.S. Sedha, A text book of Applied Electronics, First Edition, S Chand and Co. Ltd., Revised edition 2017.
4. V. Vijayendran, Fundamentals of Microprocessors 8085, 1st edition, S.Vishwathan Publishers Ltd., Chennai, 2009.*
5. A.P. Godse & D.A. Godse, Microprocessors & Applications, 3rd edition , Technical Publications, Pune, 2010..

REFERENCE BOOKS:

1. Thomas L.Floyd, Digital Fundamentals 5th edition, Universal Book Stall, New Delhi, 2014.
2. Albert Paul Malvino, Digital Computer Electronics, TMH, 1992.*
3. Millman and Halkias, Integrated Electronics, Mc Graw Hill Book Co., 2010.
4. R.S.Goenkar, Penram, Microprocessor architecture, programming and applications with the 8085/8080, 5th Edition., 2013

JOURNALS:

1. International journal of Electronics and Communication Engineering.
2. Journal of Advanced Electrical Engineering and Technology (National).

E-LEARNING RESOURCES:

1. <https://www.sciencedirect.com/topics/engineering/digital-electronics>(unit I)
2. <http://tiicitiit.com/profanurag/counters.pdf> (unit II)
3. <http://www.zseries.in/embedded%20lab/8085%20microprocessor/adc%20interfacing.php> (unit III)
4. <https://www.wisdomjobs.com/e-university/microprocessor-tutorial-2391/microprocessor-8085-architecture-25816.html> (unit IV)
5. <https://www.javatpoint.com/programming-in-8085> (unit V)

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Explain the structure of various number systems and its applications in digital design.
CO2	Demonstrate the various digital electronic circuits like flip flops, shift registers and counters.
CO3	Formulate interfacing of 8085 using programmable peripheral interface and its applications.
CO4	Evaluate the basic architecture, pin configuration and interrupts of 8085 microprocessor system.
CO5	Analyze the design and coding knowledge on 8085 microprocessor family.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	2
CO2	3	2	3	3	2	2
CO3	3	2	3	2	2	2
CO4	3	2	2	2	2	2
CO5	3	2	3	2	2	2
Average	3	2.2	2.8	2.2	2	2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY
CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Power Point Presentation
Problem Solving
Assignment
Seminar
E-content.

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

Note : Elective papers will be offered only when atleast 20% of the students opt for it

SEMESTER -VI

ADVANCED ELECTRONICS

TOTAL HOURS: 90 Hours
CREDITS: 5

COURSE CODE: PH18/6E/ AEL
L-T-P: 4 - 2 - 0

COURSE OBJECTIVES:

To enable the students to

6. Assess the operation of 555 timer and generation of wave forms using it.
7. Explain the different types of amplifiers and their efficiency for various applications.
8. Apply the knowledge of the working of multivibrators using transistors.
9. Analyse the different wave shaping circuits and its applications.
10. Discuss the basic concepts of modulation and demodulation.

UNIT I: Wave form generators using 555 Timer

555 Timer – Internal Structure – Pin configuration – 555 Timer as Schmitt Trigger – 555 Timer as Astable multivibrator – theory – 555 timer as Monostable multivibrator. (15 hrs)

UNIT II: Amplifiers

Different coupling schemes used in amplifiers – RC coupled amplifier – calculation of voltage Gain –frequency response-Transformer coupled amplifier – calculation of voltage gain – frequency response – Darlington amplifier- characteristics- Darlington pair .
Power amplifiers – classification- class A amplifier –characteristics - class B push pull amplifier – efficiency- advantages. (25 hrs)

UNIT III: Multivibrators using Transistors

Types of Multivibrators : Astable multivibrator – circuit operation- switching time and frequency of Oscillation -Monostable multivibrator– circuit operation - Bistable – Circuit operation — Applications of multivibrators. (15 hrs)

UNIT IV: Wave shaping circuits

Linear wave shaping circuits: Differentiating circuit - Integration Circuit - Mathematical operations and applications. Non linear wave shaping circuits: Clipping circuit – Positive and Negative clipper- input and output waveforms. Clamping circuit – Biased Clampers – Practical clamper circuit. (15 hrs)

UNIT V: Elements of communication Electronics

Modulation : Definition – Types of modulation - Amplitude modulation – modulation factor - Analysis of amplitude modulated wave – frequency modulation wave – Demodulation – Definition and Essentials in Demodulation - Principle and working of TV camera- TV transmitter – Block diagram.

(20 hrs)

RECOMMENDED TEXTBOOKS:

1. V. Vijayendran, Introduction to Integrated Electronics , S.Vishwathan Publishers Ltd., Chennai, 2nd edition, 2009.*
2. V. K. Mehta , Principles of Electronics S.Chand & Co. Ltd., Revised edition 2014.
3. R.S. Sedha, A text book of Applied Electronics, First Edition, S Chand and Co. Ltd., Revised edition 2017.
4. Kennedy. Davis. Electronic Communication Systems,Tata Mc Graw Hill Edition 2010.

REFERENCE BOOKS:

1. Bagde and Singh, Elements of Electronics, S. Chand and Co Ltd., 2002*.
2. Gupta Kumar, Hand Book of Electronics, 2nd edition, Pragati Prakashan, 2012.
3. Millman and Halkias, Integrated Electronics, Mc Graw Hill Book Co.Second edition, 2017

*** Recent Editions are unavailable**

JOURNALS:

1. International journal of Electronics and communication.(International)
2. Journal of Electronics.(National)

E-LEARNING RESOURCES:

1. <https://www.google.com/url %F555-timer-working-specifications>
2. https://www.electronics-tutorials.ws/amplifier/amp_1.html
3. <https://electrosome.com/astable-multivibrator-transistors/>
4. <http://machineryequipmentonline.com/electric-equipment/waveshaping-circuitswave>
5. <https://www.sciencedirect.com/topics/computer-science/electronic-communication>

Note : Elective papers will be offered only when atleast 20% of the students opt for it

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Explain the internal structure and pin configuration of 555 timer and use it to generate wave forms.
CO2	Demonstrate the various coupling schemes used in amplifiers and draw its frequency response curve.
CO3	Analyse the circuit operation and applications of different multivibrators using transistor.
CO4	Evaluate the mathematical operation and the applications of linear and non-linear wave shaping circuits.
CO5	Discuss the modulation and demodulation processes. Application of amplitude and frequency modulation in TV transmission

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	2
CO2	3	3	3	2	2	2
CO3	3	3	3	2	2	2
CO4	3	3	3	3	2	2
CO5	3	3	3	3	2	2
Average	3	3	3	2.6	2	2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2
WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Power Point Presentation
Problem Solving
Assignment
Seminar
E-content.

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

Note: Elective Paper will be offered only when atleast 20% of the students opt for it.

SEMESTER VI QUANTUM MECHANICS AND RELATIVITY

TOTAL HOURS: 90 Hours
CREDITS: 5

COURSE CODE: PH18/6C/QMR
L-T-P: 4-2-0

COURSE OBJECTIVES

To enable the students to

1. Analyze the Classical routes and its applications in Mechanical fields.
2. Understand the classical background of quantum mechanics, study the basic principles of quantum mechanics.
3. Study role of uncertainty in quantum physics and comprehend the formulation of quantum mechanics.
4. Learn the concept of wave function, through Schrodinger equation and their applications.
5. To provide conceptual skills, analytical tools necessary for astrophysical and cosmological applications of the general and special theory of relativity.

UNIT I: Origin of quantum mechanics

Failure of classical physics - Black body radiation -Planck's Quantum theory- Photo electric effect- Einstein's explanation of the photoelectric effect- Compton effect- the Ritz combination principle in spectra- stability of an atom- Bohr's Quantization of angular momentum and its application to the hydrogen atom. 18 hours

UNIT II: Wave properties of matter

Wave particle - duality- De-Broglie's Hypothesis for matter waves- concept of wave velocity and group velocity- velocity of de -Broglie wave- diffraction of particles- interference of electrons- consequences of de- Broglie's concepts - Heisenberg's uncertainty principle-its illustration by thought- experiments- consequences of the uncertainty relation. 18 hours

UNIT III: Schrodinger's wave equation and its application

Postulates of Quantum Mechanics- physical interpretation of the wave function - operators in quantum mechanics, Eigen function, Eigen value and Eigen value equation- expectation values- transition probability-Schrodinger's one dimensional time-dependent, time - independent wave equation.

Application of Schrodinger equation: Particle in one dimensional box- Simple harmonic oscillator. 18 hours

UNIT IV: Special Theory of Relativity:

Galilean Transformation - Ether Hypothesis – Michelson Morley experiment - significance of the results - postulates of special theory of relativity – Lorentz transformation – simultaneity- length contraction – time dilation – relativistic addition of velocities - relativistic mass – mass energy equivalence. 18 hours

UNIT V: General Theory of Relativity:

Geometric representation of space and time - Space – time diagrams – simultaneity – contraction – dilation - Time order and space separation of events – General relativity - Principle of equivalence – gravitational red shift – fundamental ideas of general relativity.

18 hours

RECOMMENDED TEXTBOOKS:

1. Robert Resnick, Introduction to special theory of relativity, John Wiley Eastern Ltd., Reprint 2003* .
2. Kamal singh, S.P.Singh ,Elements of Quantum Mechanics , First Edition, S.Chand & co Ltd, New Delhi-110055, 2005* .
3. R.Murugesan, KiruthigaSivaprasath, Modern Physics, S.Chand& Co. Ltd., 2016.
4. Gupta. Kumar and Sharma, Quantum mechanics, 25th edition, Jai Prakash Nath & Co. Meerut,2005* .
5. Mathews and Venkatesan, Text book on quantum mechanics , 2nd edition,,Tata Mc Graw Hill, New Delhi 2010.

REFERENCE BOOKS:

1. Ghatak and Loganathan, Quantum Mechanics, Macmillan India Pvt Ltd, 2004* .
2. Beiser, Concepts of modern Physics, 6th edition A,Tata MC Graw Hill, New Delhi,1997* .
3. V. Devanathan, Quantum Mechanics, Narosa Publications, New Delhi, 2011.

JOURNALS:

1. The Electricity Journal (International)
2. Pramana – Journal of Physics (National)

E-LEARNING RESOURCES:

1. <http://physics.mq.edu.au/~jcresser/Phys201/LectureNotes/EarlyHistory.pdf> (Unit I)
2. https://qudev.phys.ethz.ch/phys4/PHYS4_lecture02v1_2page.pdf (Unit II)
3. <http://physics.mq.edu.au/~jcresser/Phys201/LectureNotes/SchrodingerEqn.pdf> (Unit III)
4. <https://www.space.com/36273-theory-special-relativity.html> (Unit IV)
5. <http://iontrap.umd.edu/wp-content/uploads/2016/01/WudkaGR-7.pdf> (Unit V)

COURSE OUTCOMES

CO No.	CO Statement
CO1	Explain the classical concepts of Newtonian laws to mechanical systems through the use of intense mathematical and problem solving skills.
CO2	Explain the historical aspects of development of quantum mechanics and the differences between classical and quantum mechanics.
CO3	Formulate the idea of wave function and interpret the fundamental concepts of uncertainty relations.
CO4	Evaluate the physical interpretation of wave function, analyse time dependent and independent Schrodinger wave equation devise it for simple potential well
CO5	Demonstrate an understanding of the basic principles of Special and General theory of relativity and explain the true nature of Newtonian mechanics and Lorentz Transformation equations.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2
CO2	3	3	2	2	2	2
CO3	3	3	2	3	2	2
CO4	3	2	3	3	2	2
CO5	3	2	2	2	2	2
Average	3	2.4	2.2	2.4	2	2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture (Chalk and Talk -LCD)

E Content, Videos

Problem Solving-Group Discussion

Seminar

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A-10x2 marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have two problems. Section C may have problems as a part of the question.
K1, K2	B-5/8x8 marks	200	40		
K2, K3	C-2/3x20 marks	500	40		

SEMESTER VI

MATERIALS SCIENCE

TOTAL HOURS: 90 Hours
CREDITS: 5

COURSE CODE: PH18/6E/MAS
L-T-P: 4 – 2 - 0

COURSE OBJECTIVES:

To enable the students to

1. Acquire the basic ideas on bonding of atoms and their energies and forces.
2. Study the different methods of crystal growth.
3. Understand the preparation and properties of ceramics and polymers.
4. Gain knowledge on various types of dielectric polarization and their mathematical approach.
5. Appraise the basic techniques of nanomaterials and their properties.

UNIT I: Interatomic Forces and Bonding in Solids

Forces between atoms – Cohesion of atoms and Cohesive energy – Calculation of Cohesive energy – Different types of chemical bonds: Ionic bond- Bond energy of NaCl molecule - Covalent bond – Metallic bond – Dispersion bond – Dipole bond – Hydrogen bond – Lattice energy of ionic crystals – compressibility and modulus of elasticity.

18 hours

UNIT II: Crystal Growth and Characterization

Introduction to crystal growth – Spontaneous nucleation - Methods of crystallization - Solution growth (demonstration)- Slow cooling - Slow evaporation (demonstration)- Temperature gradient method - Gel growth - Crystal growth from melt - Czochralski technique and floating zone method - Hydrothermal growth (qualitative analysis). UV and IR spectroscopy: introduction and instrumental techniques.

18 hours

UNIT III: Ceramics and Polymers

Introduction to Ceramics – Classification – overview of the mechanical, thermal and electrical properties – Applications – Introduction to Polymers – Types of Polymers – Mechanism of polymerization – Classification of Polymers – qualitative analysis of mechanical, physical and chemical properties- Applications.

18hours

UNIT IV: Dielectric properties of materials

Introduction – Fundamental definitions – Different types of electric polarization: Electronic polarization – Ionic polarization – Orientational polarization – Space –charge polarization – Frequency and Temperature effects on polarization – Dielectric loss – Clausius- Mossotti relation – Determination of dielectric constant – Different types of dielectric materials – Active dielectrics – Passive dielectrics.

18hours

UNIT V: Nano materials

Introduction to Nanomaterials – Types of Nanomaterials: zero dimensional, one dimensional, two dimensional nanomaterials – fundamental principles of synthesis process of nanomaterials: Chemical vapour deposition (sol-gel method)- demonstration, Physical vapour deposition (high energy ball milling method) - Thermal evaporation – Properties of nanomaterials - Advantages of Nano materials - Application of nanomaterials in electronics, communication and medicine.

18 hours

RECOMMENDED TEXTBOOKS:

1. Dr. M. Arumugam, Material science, 3rd edition, Anuradha Publication, 2004*.
2. V. Raghavan, Material Science and Engineering, Prentice Hall India, New Delhi, 2011.
3. Santhana Raghavan and Dr. P. Ramaswamy, Crystal growth process and methods, 1st edition KRU publications, 2000*.
4. W. B. Fahrner (Ed.), Nanotechnology and Nanoelectronics, Springer, 2011.
5. W. M. Breck, Nanotechnology, C.B.S. Publishers and Distributors Pvt. Ltd., 2016.
6. K. G. Aswani, Material Science, 2nd edition, S. Chand & Company, New Delhi, 2001*.
7. William D. Callister & David G. Rethwisch, Materials Science and Engineering, 8th edition, Wiley Publications, 2009*.
8. J. C. Anderson, K. D. Leaver, P. Leever, R. D. Rawlings, Material science for engineers , 5th edition, Nelson Thornes Publications, 2003*.
9. G. K. Narula, K. S. Narula, V.K. Gupta, Materials Science, Tata McGraw Hill Publishing Company Limited, 27th reprint, 2007*.
10. W. David Kingery, H. K. Bowen, Donald R. Uhlmann, Introduction to Ceramics, 2nd Edition, Wiley-Interscience Publications, 1976*

REFERENCE BOOKS:

1. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, 6th edition, John Wiley and Sons., 2001*.
2. Charles Kittel, An Introduction to Solid State Physics, 7th Edition, John Wiley and Sons, 2003*.
3. C.M. Srivastava, C. Srinivasan, Science of Engineering Materials, 2nd Edition, New Age International, 2005*.

JOURNALS:

3. Journal of Materials Science and Nanomaterials (National)
4. Journal of Advanced Dielectrics (International)

E-LEARNING RESOURCES:

1. <https://www.khanacademy.org> > ... > Chemistry of life > Chemical bonds and reactions (Unit I)
2. <https://www.slideshare.net/krishslide/crystal-growth-39462667> (Unit II)
3. <https://me-mechanicalengineering.com/ceramics/>; <https://byjus.com> > JEE > IIT JEE Study Material (Unit III)
4. <https://physics.info/dielectrics> (Unit IV)
5. <https://www.slideshare.net/ParthaPMishra/properties-of-nanomaterials> (Unit V)

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Explain the concept of bonding of atoms and forces acting between them.
CO2	Apply the techniques of crystal growth in research.
CO3	Analyze the knowledge of production and properties of ceramics and polymers to synthesis of novel materials.
CO4	Evaluate the fundamentals of dielectric polarization mechanisms and apply it in problem solving.
CO5	Compute the various techniques for growing nanomaterials and apply to interdisciplinary research.

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	2
CO2	3	3	3	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	2	2
CO5	3	3	3	3	3	2
Average	3	2.8	2.8	2.8	2.8	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Power Point Presentation
Problem Solving
Assignment
Group Learning
E-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No.- is compulsory Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

Note: Elective Paper will be offered only when atleast 20% of the students opt for it.

SEMESTER -VI

ASTROPHYSICS

TOTAL HOURS: 90 HOURS
CREDITS: 5

COURSE CODE: PH18/6E/ASP
L-T-P: 4-2-0

COURSE OBJECTIVES:

To enable the students to

1. Study the mysteries of the universe using spatial and time co-ordinates.
2. Illustrate the use of different optical techniques for observational astronomy.
3. To analyze the evolution of stars and other planets with necessary theories.
4. Explore the origin and evolution of the physical universe through the study of Milky Way and cosmology.
5. Solar system and its activity.

UNIT I: General Astronomy

Systems of coordinates- horizon system – equatorial system – ecliptic system – galactic system- Time - solar time – sidereal time - universal time – ephemeris time- stellar parallaxes. 18 hours

UNIT II: Optical Techniques

Optical telescopes – magnifying power - brightness of image - f/a ratio - types of reflecting telescopes - refracting telescopes - radio telescopes - Hubble space telescope - detectors and image processing. 18 hours

UNIT III: Stellar Physics

Spectral classification of stars - Harvard classification system - Hertzsprung – Russel diagram – luminosity of stars (definition) – stellar evolution (qualitative analysis) – gravitational potential energy of a star- internal temperature and pressure of a star - stellar energy generation through p-p cycle and CNO cycle - white dwarfs (definition) – Chandrasekharan limit – neutron stars, binary stars, novae and supernovae (definition) – black holes. 18 hours

UNIT IV: Galactic Physics & Cosmology

Star clusters (definition) – features of star clusters – galactic and globular clusters (qualitative analysis) – O associations – types of galaxies: elliptical, spiral and irregular – Hubble's classification of galaxies - evolution of galaxies – dark matter, dark energy and accelerating universe – distribution of objects in the galaxy - our galaxy: size and shape- rotation of the galaxy: differential rotation and mass of the galaxy.

Cosmology – Cosmological principle - Redshift and expansion of Universe - Hubble's law
Big bang theory – cosmic showers and cosmic microwave background (qualitative analysis) -
Steady state universe. 18 hours

UNIT V: Sun & Solar System

Measurement of solar distances- size, mass and surface temperature of planets - Physics of planetary atmospheres – individual planets, comets, asteroids - Sun – surface temperature – composition – source of energy - sun spots and solar activity- solar cycle 18 hours

RECOMMENDED TEXTBOOKS:

1. V.B.Bhatia ,Textbook of Astronomy and Astrophysics with Elements of Cosmology, 1st edition, Narosa Publishing House, New Delhi, 2001.*
2. Brijlal and N.Subrahmanyam, Properties of Matter, 3rd Edition, S.Chand & Co., 2004.
3. R.Murugesan, Kiruthiga Sivaprasath, Modern Physics, S. Chand & Co. Ltd., 2016.
4. Baidyanath Basu, Tanuka Chattopadhyay , Sudhindra Nath Biswas, An Introduction to Astrophysics, 2nd edition, Prentice Hall India Learning Pvt.Ltd., 2010.
5. Hugh D. Young, Roger A. Freedman, Sears' & Zemansky's University Physics with Modern Physics, 14th edition, Pearson Education Ltd., 2016.
6. A. E. Roy and Clarke, Astronomy – Structure of the Universe, 3rd edition, Adam Hilger Ltd, 1989.*

REFERENCE BOOKS:

1. S. Chandrasekhar, An Introduction to the Study of Stellar Structure, 1st edition, S Dover Publications Inc., 2003.*
2. Donald D. Clayton, Principles of Stellar Evolution and Nucleosynthesis, 1st edition, University of Chicago Press, 1983.*
3. K.D.Abhyankar ,Astrophysics of the Solar system, 1st edition ,Universities Press (India) Pvt.Ltd., 1999, Reprint 2009.*
4. Kenneth Krane, Modern Physics, 3rd edition, Wiley India Pvt. Ltd., New Delhi, 2012.
5. K.D. Abhyankar, Astrophysics: Stars and Galaxies, Universities Press, Pvt.Ltd., 2001.*

JOURNALS:

1. Nature Astronomy (International)
2. The Astronomical Journal (International)
3. Journal of Astronomical Telescopes, Instruments and Systems (National)
4. Solar Physics (International)
5. Journal of Cosmology and Astroparticle Physics (International)
6. Solar System Research (International)
7. Bulletin of the Astronomical Society of India (National)

E-LEARNING RESOURCES:

1. <http://astronomy.nmsu.edu/holtz/a535/supplement/node1.html> (Unit I)
2. <https://dept.astro.lsa.umich.edu/resources/ugactivities/Labs/coords/> (Unit I)
3. <https://lco.global/spacebook/telescopes/refracting-telescopes/> (Unit II)
4. <https://www.handprint.com/ASTRO/specclass.html> (Unit II)
5. <https://www.pbs.org/wgbh/nova/article/the-chandrasekhar-limit-the-threshold-that-makes-life-possible/> (Unit III)
6. <http://hyperphysics.phy-astr.gsu.edu/hbase/Astro/galax.html> (Unit IV)
7. <https://www.britannica.com/science/cosmology-astronomy> (unit IV)
8. <https://www.britannica.com/science/solar-system> (Unit V)

COURSE OUTCOMES:

CO No	CO Statement
CO1	Assess the design of physical nature of celestial bodies through co-ordinates of space and time
CO2	Apply various optical instruments and explore the observable universe
CO3	To relate to the stellar observations, the properties, their environment and even the presence of planets with appropriate theories.
CO4	Evaluate the structure of milky way galaxy and all its contents with cosmology for the study of the character and evolution of the universe.
CO5	Explain the age and origin of the solar system and illustrate the differences between Earth and other planets in the Solar System.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2
CO2	3	2	3	2	2	2
CO3	3	3	3	3	2	2
CO4	3	3	3	3	2	2
CO5	3	3	2	3	2	2
Average	3	2.6	2.6	2.6	2	2

KEY:STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Lecture by Board and Chalk
Assignment
Seminar
Quiz
Group Learning
e-content

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1	A – 10 x 2 Marks	One or Two Sentences	20	100	Question No is compulsory. Section B must have 2 problems. Section C may have problems as a part of the question.
K1, K2	B – 5/8 x 8 Marks	250	40		
K2, K3	C – 2/4 x 20 Marks	500	40		

Note: Elective Paper will be offered only when atleast 20% of the students opt for it.

SEMESTER – VI

MAJOR GENERAL PRACTICAL – III

TOTAL HOURS: 90 HOURS
CREDITS: 4

COURSE CODE: PH18/6C/MPR3
L-T-P: 0 - 0- 3

COURSE OBJECTIVES

This Course Enables the Student to

1. Describe the concept of stress/strain and in its relation to force/displacement, to know the effect of forces during static conditions, to determine axial forces, shear forces and bending moments
2. Learns the different laws of thermodynamics, thermo-dynamical functions and there relations.
3. Relates physical observation and measurements to determine the Earth's magnetic field to theoretical principles
4. Apply circuit theory, including Ohm's Law and Kirchhoff's Laws to analysis of circuits with potential sources, capacitance, and resistance, including parallel and series capacitance and resistance.
5. Provide necessary foundation in optics and photonics which prepare the students for an intensive study of advanced topics at a later stage.

EXPERIMENTS

Elasticity moduli of the material

1. Young's Modulus of the material of a beam - By non- uniform bending - Koenig's Method. (Graphical method to determine q and mass of the unknown body).

Measurement of EMF of the thermocouple

2. E.M.F of a thermocouple - Potentiometer.
3. E.M.F of a thermocouple - B.G.

Electricity & Magnetism measurements

4. Temperature Co-efficient of a coil - Carey Foster's Bridge.
5. Calibration of high range voltmeter - Potentiometer.
6. M and B_H by Deflection Magnetometer and Vibration Magnetometer.
7. Conversion of a galvanometer into a voltmeter, ammeter and ohmmeter, and calibration of the converted voltmeter using potentiometer.
8. Self Inductance of a coil – Anderson Method.

Comparison of Inductance using BG

9. Absolute mutual inductance of a coil - B.G.
10. Absolute Capacitance of a capacitor – B.G.
11. Comparison of Capacitances – B.G.

Study of Optical properties

12. $i - i'$ curve – Spectrometer.
13. Dispersive power of a prism - Spectrometer.
14. Refractive index of the material of a narrow angled prism - Spectrometer.
15. Wavelength of prominent lines of mercury spectrum by Minimum Deviation Method using grating – Spectrometer.

RECOMMENDED TEXTBOOKS:

1. Practical Physics, M.N.Srivastava, Srinivasan, A Text Book of Practical Physics, Sultan Chand & Sons, 2011.

COURSE OUTCOMES

CO No.	CO Statement
CO1	Formulate the type of force, type of supports and the reactions on beams and plane frames.
CO2	Utilize the fundamental concepts of thermodynamics, develop analytical skills, team work and technical communication .
CO3	Analyze earth's magnetic field and magnetisation using vibration magnetometer
CO4	Demonstrate knowledge of the fundamental concepts of electricity and electromagnetism acquire hands on experience about measuring device
CO5	Assess the principles of reflection, refraction, diffraction, interference and superposition of waves. Substantiate the results to various physical phenomena leading to update in field of geometrical optics.

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2
CO2	3	3	3	3	2	2
CO3	3	2	2	2	2	2
CO4	3	2	3	2	2	2
CO5	3	2	3	2	2	2
Average	3	2.2	2.6	2.2	2	2

KEY: STRONGLY CORRELATED-3 MODERATELY CORRELATED-2 WEAKLY CORRELATED-1 NO CORRELATION-0

TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

SEMESTER – VI

ELECTRONICS PRACTICAL

TOTAL HOURS: 90 HRS
CREDITS: 4

COURSE CODE: PH18/6E/EPR
L-T-P: 0 - 0 – 3

COURSE OBJECTIVES

This Course Enables the Student to

1. Understand operation of semiconductor devices, DC analysis and AC models of semiconductor devices.
2. Apply concepts for the design of Regulators and Amplifiers.
3. Verify the theoretical concepts through laboratory and simulation experiments.
4. Introduce students with binary math operation using operational amplifier.
5. Familiarize the students with the architecture and programming of microprocessor 8085.

EXPERIMENTS

Electronic devices study of diodes and transistors

1. Characteristics of Junction diode and Zener diode.
2. Construction of Basic Logic Gates – AND, OR and NOT using Diodes and Transistors.
3. Characteristics of a transistor in CE mode and determination of parameters.

Regulators and Oscillators

4. Regulated power supply - 2 diodes. (Using Zener diode and IC).
5. UJT - Characteristics and Relaxation oscillator.
6. Sine wave oscillator -Wein's Bridge Oscillator and Phase shift Oscillator- using IC 741.
7. Hartley Oscillator using transistor.

Design of Amplifiers

8. Single stage amplifier-Frequency response curve to study the variation of gain with load.
9. OP-Amp Amplifier as an a) adder and subtractor b) differentiator & an integrator.
10. Inverting, non-inverting amplifier, current follower and voltage follower - OP-AMP.

Universal Gates and Counters

11. NAND and NOR gate - Universal building block and verification of De Morgan's theorems using IC.
12. Counters & serial shift right register - JK Flip Flops

Programming of Microprocessor 8085

13. Microprocessor 8085- Addition and subtraction, Multiplication and division (8 bit numbers).
14. Microprocessor 8085 - Sort the numbers in ascending and descending order.
15. Microprocessor 8085 – Data Conversion – Binary to ASCII and ASCII to Binary, BCD to ASCII and ASCII to BCD.
16. Microprocessor 8085 – Largest and Smallest number in an array.

RECOMMENDED TEXTBOOKS:

- 1.C. C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics, 1st Edition, Viswanathan. S Printers and Publishers, Pvt. Ltd., 2015

COURSE OUTCOMES

CO No.	CO Statement
CO1	Assess the knowledge circuit connection, Understanding the current voltage characteristics of semiconductor devices.
CO2	Analyze DC circuits and relate AC models of semiconductor devices with their physical Operation,
CO3	Design and analyze of electronic circuits, evaluate frequency response to understand behavior of analog electronics circuits
CO4	Assess and solve basic binary math operations using the operational amplifier. Develop design competence in linear and nonlinear opamp circuit analysis.
CO5	Apply the knowledge acquired and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor

MAPPING - COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2
CO2	3	2	3	2	2	2
CO3	3	2	2	2	2	2
CO4	3	2	3	2	2	2
CO5	3	2	3	2	2	2
Average	3	2	2.6	2	2	2

KEY: **STRONGLY CORRELATED-3 MODERATELY CORRELATED-2WEAKLY CORRELATED-1 NO CORRELATION-0**

TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

COURSE OUTLINES

Department of Physics is revising syllabi with effect from the academic year 2015-2016, under CBCS, Part – IV and Part – V components as specified by the Government of Tamil Nadu. Part – IV and Part –V components will seek to build the capacity of the students and provide inputs for their social service and social analysis capabilities.

Every academic year is divided into two semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.