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

## DEPARTMENT OF PHYSICS

## SYLLABUS

## CHOICE BASED CREDIT SYSTEM
## OUTCOME BASED EDUCATION

## (OFFERED FROM THE ACADEMIC YEAR 2021-22)

## CONTENTS

## 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.

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**PO4**- Cultivate unparalled 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.

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**
**CHENNAI - 08**

**CURRICULUM TEMPLATE (2021-22 ONWARDS)**

**UNDERGRADUATE PROGRAMME PROFILE**
**DEPARTMENT OF PHYSICS**
**COURSE CODES AND CREDITS**

**TOTAL MINIMUM CREDITS: 140** **TOTAL TEACHING HOURS: 180**

| PART | CORE/ ALLIED/ ELECTIVE | TITLE OF THE PAPER | CODE | L | T | P | H | C | CA | SE | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | I SEMESTER | | | | | | | | | | |
| I | Language | Tamil/Hindi/French/ Sanskrit | | | | | | | 40 | 60 | 100 |
| II | English | Communicative English | | | | | | | 40 | 60 | 100 |
| III | Core 1 | Properties of Matter & Sound | PH21/1C/PMS | 4 | 3 | 0 | 105 | 5 | 40 | 60 | 100 |
| III | Core 2 | Major Practical I | PH21/2C/PR1 | 0 | 0 | 3 | 45 | End of 2nd Semester | | | |
| III | Allied | Allied Mathematics I | | | | | | | 40 | 60 | 100 |
| IV | EVS | Environmental Studies | | | | | | | - | 50 | 50 |
| IV | Soft Skill | English Department- Professional English for Arts/Commerce/Physical Sciences/Life Sciences | | | | | | | - | 50 | 50 |
| | II SEMESTER | | | | | | | | | | |
| I | Language | Tamil/Hindi/French/ Sanskrit | | | | | | | 40 | 60 | 100 |
| II | English | Communicative English | | | | | | | 40 | 60 | 100 |
| III | Core 3 | Heat &Thermodynamics | PH21/2C/HTD | 4 | 3 | 0 | 105 | 5 | 40 | 60 | 100 |
| III | Core 4 | Major Practical I | PH21/2C/PR1 | 0 | 0 | 3 | 45 | 4 | 40 | 60 | 100 |
| III | Allied | | | | | | | | 40 | 60 | 100 |
| IV | Val. Ed | Value Education | | | | | | | - | 50 | 50 |
| IV | Soft Skill | English Department- Professional English for Arts/Commerce/ Physical Sciences/Life Sciences | | | | | | | - | 50 | 50 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **III SEMESTER** | | | | | | | | | | |
| **I** | **Language** | **Tamil/Hindi/French/ Sanskrit** | | | | | | | **40** | **60** | **100** |
| **II** | **English** | **Communicative English** | | | | | | | **40** | **60** | **100** |
| **III** | **Core 5** | **Electricity and Magnetism** | **PH21/3C/ETM** | **4** | **3** | **0** | **105** | **5** | **40** | **60** | **100** |
| **III** | **Core 6** | **Major Practical II** | **PH21/4C/PR2** | **0** | **0** | **3** | **45** | **End of 4th semester** | | | |
| **III** | **Allied** | | | | | | | | **40** | **60** | **100** |
| **IV** | **NME (1c)** | | | | | | | | **-** | **50** | **50** |
| **IV** | **Soft Skill** | **English Department- Professional English for Arts/Commerce/ Physical Sciences/Life Sciences** | | | | | | | **-** | **50** | **50** |
| | **IV SEMESTER** | | | | | | | | | | |
| **I** | **Language** | **Tamil/Hindi/French/ Sanskrit** | | | | | | | **40** | **60** | **100** |
| **II** | **English** | **Communicative English** | | | | | | | **40** | **60** | **100** |
| **III** | **Core 7** | **Optics** | **PH21/4C/OPT** | **4** | **3** | **0** | **105** | **5** | **40** | **60** | **100** |
| **III** | **Core 8** | **Major Practical II** | **PH21/4C/PR2** | **0** | **0** | **3** | **45** | **4** | **40** | **60** | **100** |
| **III** | **Allied** | | | | | | | | **40** | **60** | **100** |
| **IV** | **NME (1c)** | | | | | | | | **-** | **50** | **50** |
| **IV** | **Soft Skill** | **English Department- Professional English for Arts/Commerce/ Physical Sciences/Life Sciences** | | | | | | | **-** | **50** | **50** |
| | **V SEMESTER** | | | | | | | | | | |
| **III** | **Core 9** | **Nuclear Physics** | **PH21/5C/NUP** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |
| **III** | **Core 10** | **Mechanics and Mathematical Physics** | **PH21/5C/MMP** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |
| **III** | **Core 11** | **Basic Electronics and Electronic Devices** | **PH21/5C/EED** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |
| **III** | **Elective I** | **Spectroscopy and Laser Physics / Solid State Physics** | **PH21/5E/SLP// PH21/5E/SSP** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |
| **III** | **Elective II** | **Astrophysics / Materials Science** | **PH21/5E/ASP // PH21/5E/MAS** | **3** | **1** | **0** | **60** | **4** | **40** | **60** | **100** |
| **III** | **Core** | **Major General Practical III** | **PH21/6C/PR3** | **0** | **0** | **3** | **45** | **End of 6th semester** | | | |
| **III** | **Core** | **Electronics Practical** | **PH21/6C/EPR** | **0** | **0** | **3** | **45** | **End of 6th semester** | | | |
| | **VI SEMESTER** | | | | | | | | | | |
| **III** | **Core 12** | **Electromagnetism** | **PH21/6C/EMG** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **III** | **Core 13** | **Quantum Mechanics and Relativity** | **PH21/6C/QMR** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |
| **III** | **Core 14** | **Atomic and Molecular Physics** | **PH21/6C/AMP** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |
| **III** | **Core 15** | **Digital electronics and Microprocessor** | **PH21/6C/DEM** | **4** | **1** | **0** | **75** | **4** | **40** | **60** | **100** |
| **III** | **Elective III** | **Nanoscience and Technology/ Advanced Electronics** | **PH21/6E/NST// PH21/6E/AEL** | **3** | **1** | **0** | **60** | **4** | **40** | **60** | **100** |
| **III** | **Core** | **Major General Practical III** | **PH21/6C/PR3** | **0** | **0** | **3** | **45** | **4** | **40** | **60** | **100** |
| **III** | **Core** | **Electronics Practical** | **PH21/6C/EPR** | **0** | **0** | **3** | **45** | **3** | **40** | **60** | **100** |
| **V** | | **Extension Activity (Sports/NCC/NSS/ CSS/ YRC/RRC/Retract/ Yoga)** | | **-** | **-** | **-** | **Min 60 hours** | **1** | **-** | **-** | **-** |
| | | **OPTIONAL EXTRA CREDITS** | | | | | | | | | |
| **IV** | **Extra Credits** | **Self-Study (Semester V)** | | **-** | **-** | **-** | **-** | **2** | **-** | **100** | **100** |
| | | **Internship (Summer Vacation after IV Semester)** | | **-** | **-** | **-** | **Min. 14 days** | **1** | **-** | **-** | **-** |
| | | **Project (Semester VI)** | | | | | **-** | **2** | **-** | **100** | **100** |

**L = Lecture Hours**

**T = Tutorial Hours**

**P=Practical Hours**

**H = Hours per week**

**C= Credits**

**CA=Continuous Assessment**

**SE= Semester Examinations**

**MM=Maximum Marks**

**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** | **CAMARK** |
|---|---|---|---|
| 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

| PART | CORE/ ALLIED/ ELECTIVE | TITLE OF THE PAPER | CODE | L | T | P | H | C | CA | SE | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | I SEMESTER | | | | | | | | | | |
| I | Language | Tamil/Hindi/French/Sanskrit | | | | | | | 40 | 60 | 100 |
| II | English | Communicative English | | | | | | | 40 | 60 | 100 |
| III | Core 1 | Properties of Matter & Sound | PH21/1C/PMS | 4 | 3 | 0 | 105 | 5 | 40 | 60 | 100 |
| III | Core 2 | Major Practical I | PH21/2C/PR1 | 0 | 0 | 3 | 45 | End of 2nd Semester | | | |
| III | Allied | Allied Mathematics I | | | | | | | 40 | 60 | 100 |
| IV | EVS | Environmental Studies | | | | | | | - | 50 | 50 |
| IV | Soft Skill | English Department- Professional English for Arts/Commerce/Physical Sciences/Life Sciences | | | | | | | - | 50 | 50 |

**SEMESTER – I**
**PROPERTIES OF MATTER AND SOUND**

**TEACHING HOURS: 105 HRS** **COURSE CODE: PH21/1C/PMS**
**CREDITS: 5** **L-T-P: 4 - 3 - 0**

**COURSE OBJECTIVES**
To enable the students to
1. Explore the basic laws governing the behaviour 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 behaviour of simple harmonic waves.
5. Access the importance of acoustic properties towards architectural development.

**UNIT I: Elasticity:**

Introduction- Hooke's law –Different moduli of elasticity – Work done in linear, Shearing and Volume strain - relation connecting elastic constants and Poisson's ratio – Torsion: twisting couple on a cylinder – work done in twisting – torsional oscillations of a body– Rigidity modulus and moment of inertia by torsion pendulum - Rigidity modulus by static torsion.
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 – non-uniform bending by Koenig's method**.**
25 hours

**UNIT II: Gravitation:**

Newton's law of gravitation–Mass and density of earth–Inertial mass –Gravitational mass–Kepler's laws of Planetary motion – Deduction of Newton's law from Kepler's laws – Gravitational field and Gravitational potential–Equipotential surface–Gravitational field and potential due to spherical shell– Gravitational field and potential due to solid sphere – variation of acceleration due to gravity with latitude, altitude and depth– Compound Pendulum – determination of g and period of oscillation of a compound pendulum**.** 20 hours

**UNIT III: Fluids**

Viscosity of liquids: Poiseuille'sFormula for the flow of a liquid through a capillary tube– correction to Poiseuille's formula –Poiseuille's method for determining coefficient of viscosity of a liquid( variable pressure head)– Friction and lubrication.
Surface tension: Molecular theory of surface tension – Explanation of surface tension on the basis of Kinetic theory–Pressure difference across a liquid surface –Excess pressure inside a liquid drop, soap bubble and a curved liquid surface – 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 - steel and brass wire - 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, DhanpatRai 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 CORELATED-3 MODERATELY CORELATED-2 WEAKLY CORELATED-1 NO CORELATION-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)**

**TEACHING HOURS: 60 HRS** **COURSE CODE: PH21/1A/AP1**

**CREDITS: 4** **L-T-P: 4 - 0 - 0**

**COURSE OBJECTIVES**

- To expose the interdisciplinary areas of Physics
- To give broader idea about various areas of Physics in a comprehensive manner.
- To prepare for various dimensions of problem solving.

**UNIT I**: **Wave and Oscillations:**

Sound: Simple harmonic motion - composition of two simple harmonic motions at right angles (periods in the ratio 1:1) –Lissajous figures- 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.

Ultrasonics – Piezoelectric effect- production of ultrasonic waves by piezoelectric method - application. 12 hours

**UNIT II**: **Properties of Matter**

Elasticity: Elasticity - Elastic constants –Energy stored in stretched wire- bending of beams –Expression for bending moment-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 – Newton's formula, Stoke's formula, molecular theory of surface tension, excess of pressure inside a liquid drop and bubble – determination of surface tension of a liquid by drop weight method. 14hours

**UNIT III**: **Heat and Thermodynamics**

Heat capacity - specific heat capacity- specific heat capacity of solids by the method of mixtures -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 - entropy- Definition- Change in entropy in reversible and irreversible process. 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**: **Optics and Fiber Optics**

Refraction – laws of refraction – image formation by refraction - dispersion through a prism rainbow expression for the dispersive power of the prism.
Introduction to optical fibers - critical angle - total internal reflection - principle of light propagation in optical fibers- acceptance angle- numerical aperture- applications. 10 hours

## RECOMMENDED TEXTBOOKS:

1. R.Murugeshan, Allied Physics, S.Chand& Co. Ltd., New Delhi, 1st edition, 2006.*
2. R. Murugeshan**,** KiruthigaSivaprasath**,** Properties of Matter and Acoustics, S. Chand & Co. Ltd. 3rd Edition, Reprint 2013.
3. R.Murugeshan, 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. BrijLal and N.Subrahmanyam, Properties of Matter, 3rd Edition, S.Chand& Co. Ltd., 2005.*
4. BrijLal&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, BrijLal, 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)
2. https://www.infoplease.com/encyclopedia/science/physics/concepts/centripetal-and-centrifugal-force (unit I)
3. http://hyperphysics.phy-astr.gsu.edu/hbase/surten.html (unit II)
4. https://www.livescience.com/50776-thermodynamics.html (unit III)
5. https://www.sciencebuddies.org/science-fair-projects/references/electricity-magnetism-electromagnetism-tutorial (unit IV)
6. 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: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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 II COURSE PROFILE - PROGRAMME OF STUDY

| PART | CORE/ ALLIED/ ELECTIVE | TITLE OF THE PAPER | CODE | L | T | P | H | C | CA | SE | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | II SEMESTER | | | | | | | | | | |
| I | Language | Tamil/Hindi/French/ Sanskrit | | | | | | | 40 | 60 | 100 |
| II | English | Communicative English | | | | | | | 40 | 60 | 100 |
| III | Core 3 | Heat &Thermodynamics | PH21/2C/HTD | 4 | 3 | 0 | 105 | 5 | 40 | 60 | 100 |
| III | Core 4 | Major Practical I | PH21/2C/PR1 | 0 | 0 | 3 | 45 | 4 | 40 | 60 | 100 |
| III | Allied | | | | | | | | 40 | 60 | 100 |
| IV | Val. Ed | Value Education | | | | | | | - | 50 | 50 |
| IV | Soft Skill | English Department- Professional English for Arts/Commerce/Physical Sciences/Life Sciences | | | | | | | - | 50 | 50 |

**SEMESTER – II**

**HEAT AND THERMODYNAMICS**

**TEACHING HOURS: 105 Hrs** **COURSE CODE: PH21/2C/HTD**

**CREDITS: 5** **L T P: 4 - 3 - 0**

**COURSE OBJECTIVE:**

To enable the students to

1. Demonstrate practical knowledge and skill in understanding the concepts of heatenergy.
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: Calorimetry**

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 -Newton's law of cooling (Definition) - Dulong and Petit's law – variation of specific heat and atomicheat with temperature –Einstein's theory of Specific heat of solid-Debye's theory of specific heat of solids. 25 hours

**UNIT II: Laws of Thermodynamics**

Thermodynamic systems –Three classes 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- Specific heat of a gas-Mayer's relation-Isochoric, isobaric, isothermal and adiabatic processes- PVdiagrams. Second law of thermodynamics -reversible and irreversible process- Heat Engines- Carnot's cycle- efficiency - Statement and proof of Carnot's theorem - internal combustion engine – petrol and diesel engines. 20 hours

**UNIT III: Entropy**

Concept of entropy- change in entropy– Physical concept of entropy - Entropy and second law of thermodynamics - principle of increase of entropy – 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- the size of a degree-zero of Absolute or Thermodynamic scale – Identity of perfect gas scale and absolute 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 - Application of Maxwell's thermodynamic equations – Specific heat relation - Mayer's

relation -thermodynamic potentials– Internal energy - Gibb's, Helmholtz and Enthalpy functions – Significance of thermodynamic potentials- relation of thermodynamic potentials with their variables-First and second T.dS equations - Clapeyron's latent heat equation using Maxwell's thermodynamic relations and Carnot's cycle – Joule Kelvin coefficient - Equilibrium between liquid and its vapour 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 – 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 & KiruthigaSivaprasath, Thermal Physics, S.Chand& Co., Revised Edition, 2015.
3. D.S. Mathur, Heat and Thermodyanamics, 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, McGraw 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.damtp.cam.ac.uk/user/tong/statphys.html (UnitV)

## 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 CORELATED-3 MODERATELY CORELATED-2
WEAKLY CORELATED-1 NO CORELATION-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

**TEACHING HOURS: 90 HOURS** **COURSE CODE: PH21/2C/PR1**
**CREDITS: 4** **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, verniercalipers& 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-0

## TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

**SEMESTER II**

**ALLIED PHYSICS -II**
**(for B. Sc Mathematics)**

**TOTAL HOURS: 60 Hours** **COURSE CODE: PH18/2A/AP2**
**CREDITS: 4** **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 – plane transmission diffraction grating - theory of transmission grating – determination of wavelength of light using transmission grating (normal incidence).

Polarization –Polarisation by reflection- Double refraction – Huygen's Theory of Double Refraction - Nicol prism. 12 hours

## UNIT II: Atomic and Laser 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.

Characteristics of laser- Spontaneous and stimulated emission – population inversion – working of semiconductor laser and its applications. 12 hours

## UNIT III: Nuclear Physics

Nuclear model - liquid drop model – semi-empirical mass formula - mass defect - binding energy – nuclear fission –Bohr and Wheelers theory of nuclear fission- chain reaction –Atom bomb- 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 – variation of mass with velocity - 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 – characteristics - 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.Murugeshan, Allied Physics,1st edition, S. Chand & Co. Ltd., New Delhi, 2006.*
2. M. N Avadhanulu, N.Subrahmanyam,BrijLal, Text Book of Optics, S.Chand& Co. Ltd., 2012.
3. G. Senthil Kumar, Engineering Physics – I, VRB Publishers Pvt. Ltd., 2013.
4. R.Murugeshan, KiruthigaSivaprasath**,** 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 textbooks,7th revised edition, edition 2006.*
2. Donald P Leach, Albert Paul Malvino, GoutamSaha, 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: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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)

**TEACHING HOURS: 60 Hours** **COURSE CODE: PH21/2A/PPR**
**CREDITS: 2** **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, Verniercalipers, 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: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-0

**TEACHING METHODOLOGY:**

Hands on Learning – Practical Sessions

# SEMESTER III COURSE PROFILE - PROGRAMME OF STUDY

| PART | CORE/ ALLIED/ ELECTIVE | TITLE OF THE PAPER | CODE | L | T | P | H | C | CA | SE | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | III SEMESTER | | | | | | | | | | |
| I | Language | Tamil/Hindi/French/ Sanskrit | | | | | | | 40 | 60 | 100 |
| II | English | Communicative English | | | | | | | 40 | 60 | 100 |
| III | Core 5 | Electricity and Magnetism | PH21/3C/ETM | 4 | 3 | 0 | 105 | 5 | 40 | 60 | 100 |
| III | Core 6 | Major Practical II | PH21/4C/PR2 | 0 | 0 | 3 | 45 | End of 4th semester | | | |
| III | Allied | | | | | | | | 40 | 60 | 100 |
| IV | NME (1c) | | | | | | | | - | 50 | 50 |
| IV | Soft Skill | English Department- Professional English for Arts/Commerce/Physical Sciences/Life Sciences | | | | | | | - | 50 | 50 |

## SEMESTER III

## ELECTRICITY AND MAGNETISM

**TEACHING HOURS: 105 HOURS** **COURSE CODE: PH21/3C/ETM**

**CREDITS: 5** **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 the charge on a capacitor to its potential leading to the comprehension of dielectrics, dielectric breakdown, effect of dielectrics on capacitors.
3. Solve electrical circuits using network theorems.
4. Evaluate the physical accuracy of electrical measurements and thermoelectricity.
5. Express the behavior of different magnetic materials and produce examples where its effects are observed.

### UNIT I: Electric charges

Coulomb's law - Permittivity of free space – relative permittivity – superposition principle - electric intensity – continuous charge distributions (line, surface and volume charges) - intensity due to a point charge – normal electric induction – electric dipole: torque and potential energy of a dipole in a uniform electric field – lines of force - 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 & Capacitor

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 – basic concepts of electrical circuits: definitions of node, passive and active networks, voltage and current sources, linear and non-linear networks) - 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 application in the determination of temperature coefficient of resistance – potentiometer: principle – calibration of low range and high range voltmeter and low range ammeter – Thermoelectricity: Seebeck effect – laws of thermo E.M.F - experiment to measure thermo e.m.f. using potentiometer – Peltier and Thomson effects – application of thermodynamics to a thermocouple – Peltier and Thomson coefficients – thermoelectric power - thermo electric diagrams and its applications. 20 hours

**UNIT V: Magnetism**

Introduction: Definition of magnetic induction, magnetization, magnetic susceptibility and permeability – relation between the magnetic properties - different types of magnetic materials: dia, para, ferro, antiferro and ferri magnetic materials (properties) - Langevin's theory of dia and paramagnetism - domain theory of ferromagnetism – 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. Murugeshan, Electricity and Magnetism, S.Chand & Co. Ltd, 10th edition, 2019.
2. Brij Lal & N. Subrahmanyam, Electricity and Magnetism, 8th edition, S. Chand & CoLtd., 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 GrawHill Publishing Company, 2008*.
4. John Bird, Electrical Circuit Theory and Technology, Newnes, 4th edition, 2010.


**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-spof.gsfc.nasa.gov/Education/Imagnet.html (Unit V)

## COURSE OUTCOMES

| CO No. | CO Statement |
|---|---|
| CO1 | Apply Gauss law and analyze its effects between electric charge and underlying physical principles to solve problems in everyday life. |
| CO2 | Acquire knowledge on the fundamentals of capacitors, evaluate the characteristic effects of a dielectric material in a capacitor. Develop,design and experiment with various dielectric circuits. |
| CO3 | Use the basic laws that underlie in the properties of electric circuit elements and apply various network theorems to solve problems in circuitry. |
| CO4 | Experiment various methods to evaluate electrical properties and thermoelectric energy harvesting techniques. |
| CO5 | Classify magnetic materials on the basis of properties and identify its application in relevant fields by appropriate study of the behavior of hysteresis loops. |

**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 – 2

WEAKLY CORRELATED - 1 NO CORRELATION - 0

**TEACHING METHODOLOGY:**

Lecture (Chalk and Talk-LCD)
E Content,
Videos
Problem SolvingSeminar

**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)**

**TEACHING HOURS: 60 HRS** **COURSE CODE: PH21/3A/AP1**

**CREDITS: 4** **LTP: 4 – 0 - 0**

**COURSE OBJECTIVES:**

- To expose the interdisciplinary areas of Physics
- To give broader idea about various areas of physics in a comprehensive manner.
- To prepare for various dimensions of problem solving.

**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 - Elastic constants –Energy stored in stretched wire- bending of beams – Expression for bending moment- Young's modulus by non-uniform bending - I girders **–** torsion of a wire - determination of rigidity modulus by torsion pendulum - Static torsion.

Surface Tension: Definition, unit and dimension of surface tension – Newton's formula, Stoke's formula, molecular theory of surface tension, excess of pressure inside a liquid drop and bubble – determination of surface tension of a liquid by drop weight method.

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- Statement and proof of Carnot's theorem- Entropy-Definition- Change in entropy in reversible and irreversible process.

12hours

**UNIT IV**: **Electricity and Magnetism**

Current, current density, Ohm's law – resistance in series & 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**: **Optics and Fiber Optics**

Refraction – laws of refraction - image formation by refraction - dispersion through a prism – expression for the dispersive power of the prism.

Introduction to optical fibers - critical angle - total internal reflection - principle of light propagation in optical fibers-acceptance angle- numerical aperture- applications. 10 hours

## RECOMMENDED TEXTBOOKS:


1. R.Murugeshan, Allied Physics, S.Chand& Co. Ltd., New Delhi, 1st edition, 2006.*
2. KiruthigaSivaprasath, R. Murugeshan**,** Properties of Matter and Acoustics, S.Chand& Co. Ltd. 3rd Edition, Reprint 2013.
3. R.Murugeshan, 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. BrijLal and N.Subrahmanyam, Properties of Matter, 3rd Edition, S.Chand& Co. Ltd.,2003.*
4. BrijLal&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, BrijLal, 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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

## BASICS OF ASTRONOMY

**TEACHING HOURS: 30 HOURS** **COURSE CODE: PH21/3N/ BOA**
**CREDITS: 2** **L-T-P: 1 -1- 0**

## COURSE OBJECTIVES:

1. A data from distant sources is obtained through modern telescopes and detectors.
2. Survey of modern astronomy basics.
3. To analyze the evolution of stars and other planets with necessary theories.

**UNIT- I: Astronomical Instruments**

Optical telescope - reflecting telescope - types of reflecting telescope - advantages of reflecting telescope - Radio telescopes - astronomical spectrographs. 10 hours

**UNIT- II: Sun**

Sun – A typical star - Photosphere - Chromosphere - corona –Theory of sunspots- solar flare – Radio emission from the Sun - solar wind. 10 hours

**UNIT- III: Stellar Physics**

Spectral classification of stars – stellar evolution –white dwarfs – Black holes- galaxies- classification and distribution of galaxies- luminosity distribution of galaxy. 10 hours

**RECOMMENDED TEXTBOOKS:**

1. BaidyanathBasu, 'An introduction to Astro physics', second printing, prentice - Hall of India Private limited, New Delhi,2001
2. R. Murugesan, ' Modern Physics', Eleventh revised edition, S. Chand & Company Ltd, New Delhi, 2003.
3 K.S. Krishnasamy, 'Astro Physics a modern perspective,' Reprint, New Age International (p) Ltd, New Delhi,2002.

**BOOKS FOR REFERENCE:**

1. Baker and Fredrick, 'Astronomy, ninth edition, Van No strand Rein hold, Co, New York - 1964.
2. Hugh D. Young, Roger A. Freedman, Sears' &Zemansky's University Physics with Modern Physics, 14th edition, Pearson Education Ltd., 2016.

## E-LEARNING RESOURCES:

1. https://lco.global/spacebook/telescopes/refracting-telescopes/ (Unit I)
2. https://www.britannica.com/science/solar-system (Unit II)
3. https://www.britannica.com/science/cosmology-astronomy (Unit III)

## COURSE OUTCOMES:

| CO No | CO Statement |
|---|---|
| CO1 | Apply various optical instruments and explore the observable universe |
| CO2 | Explain the age and origin of the solar system and illustrate the differences between Earth and other planets in the Solar System. |
| CO3 | Evaluate the structure of milky way galaxy and all its contents with cosmology for the study of the character and evolution of the universe. |

**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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-0

# SEMESTER IV COURSE PROFILE - PROGRAMME OF STUDY

| PART | CORE/ALLIED /ELECTIVE | TITLE OF THE PAPER | CODE | L | T | P | H | C | CA | SE | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | IV SEMESTER | | | | | | | | | | |
| I | Language | Tamil/Hindi/French/ Sanskrit | | | | | | | 40 | 60 | 100 |
| II | English | Communicative English | | | | | | | 40 | 60 | 100 |
| III | Core 7 | Optics | PH21/4C/OPT | 4 | 3 | 0 | 105 | 5 | 40 | 60 | 100 |
| III | Core 8 | Major Practical II | PH21/4C/PR2 | 0 | 0 | 3 | 45 | 4 | 40 | 60 | 100 |
| III | Allied | | | | | | | | 40 | 60 | 100 |
| IV | NME (1c) | | | | | | | | - | 50 | 50 |
| IV | Soft Skill | English Department- Professional English for Arts/Commerce/Physical Sciences/Life Sciences | | | | | | | - | 50 | 50 |

**SEMESTER IV**

**OPTICS**

**TEACHING HOURS: 105 Hours** **COURSE CODE: PH21/4C/OPT**
**CREDITS: 5** **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 with suitable mathematical approach for its application in various fields.
4. Gain knowledge on various instrumentation techniques in optical instruments for precise measurements.
5. Identify the fundamentals of polarization, nicol prism, optical activity and specific rotatory power and its relevance in specific domains of recent developments.

**UNIT I: Geometrical Optics and Fibre Optics**

Refraction – laws of 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 – distortion - 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 – Fresnel's biprism – determination of the wavelength of monochromatic light - displacement of fringes - interference by reflected light - wedge shaped film – testing the planeness of a surface - 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 - Fraunhoffer diffraction at a single slit - double slit – missing orders - plane transmission diffraction grating (grating at normal incidence and oblique incidence) – absent spectra – overlapping of spectral lines - 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 – plane of polarization - polarization by reflection: Brewster's law - 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 – Fresnel's theory of optical rotation - specific rotation – Laurent's half shade polarimeter – Faraday effect.

23 hours

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**RECOMMENDED TEXTBOOKS:**


1. R. Murugeshan, Optics and Spectroscopy, 6th edition, S.Chand & Co., Pvt Ltd, NewDelhi, Reprint 2010.
2. N. Subrahmanyan & Brij Lal, A text book of Optics, 22nd edition, S. Chand & Co., Pvt.Ltd., New Delhi, 2012.
3. Senthil Kumar, Engineering Physics, Revised edition, VRB Publishers Pvt. Ltd., 2018.


**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 concepts of dispersion, aberration in prisms and light propagation in fiber optic communication systems. |
| CO2 | Explore the theoretical and practical ideas of interference. |
| CO3 | Analyze and apply the principles of diffraction in laboratory experiments. |
| CO4 | Comprehend the resolution of optical instruments and compare their resolving power and magnifying power. |
| CO5 | Illustrate the concepts of polarization and nicol prism and to understand the laws of optical activity. |

**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 - MODERATELY CORRELATED - 2

WEAKLYCORRELATED - 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<br>Section B must have 2 problems.<br>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**

**TEACHING HOURS: 90 Hours** **COURSE CODE: PH21/4C/PR2**
**CREDITS: 4** **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 modulii 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-0

## TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

**SEMESTER -IV**

**ALLIED PHYSICS -II**
**(for B. Sc Chemistry)**

**TEACHING HOURS: 60 Hours** **COURSE CODE: PH21/4A/AP2**
**CREDITS: 4** **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.
Diffraction: Fresnel's explanation of rectilinear propagation of light – plane transmission diffraction grating– determination of wavelength of light using transmission grating (normal incidence).
Polarization – Double refraction –Huygen's Theory of Double Refraction- Nicol prism.
15 hours

### UNIT II: Atomic and Laser 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.

Characteristics of laser- Spontaneous and stimulated emission –population inversion – working of semiconductor laser and its applications. 12 hours

### UNIT III: Nuclear Physics

Nuclear model - liquid drop model – semi-empirical mass formula - mass defect - binding energy – nuclear fission – Bohr and Wheelers theory of nuclear fission- chain reaction - Atom bomb- nuclear reactor - nuclear fusion - thermonuclear reactions – nuclear radiation hazards. 11 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 – variation of mass with velocity-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 - characteristics -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. Murugeshan, Allied Physics, 1st edition, S. Chand & Co. Ltd., New Delhi, 2005.*
2. M. N. Avadhanulu, N. Subrahmanyam, BrijLal, Text Book of Optics, S.Chand& Co. Ltd., 2012.
3. G. Senthil Kumar, Engineering Physics – I, VRB Publishers Pvt. Ltd., 2013.
4. R. Murugeshan, KiruthigaSivaprasath,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, GoutamSaha, 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 **N**O CORELATION-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 -IV**

**ALLIED PHYSICS PRACTICAL**

**(for B. Sc Chemistry)**

**TEACHING HOURS: 60 HOURS** **COURSE CODE: PH21/4A/PPR**
**CREDITS: 2** **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: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-0

## TEACHING METHODOLOGY:

Hands on Learning – Practical Sessions

**SEMESTER – IV**

**PHYSICS IN EVERYDAY LIFE**

**TEACHING HOURS: 30 HRS** **COURSE CODE: PH21/4N/PEL**
**CREDITS: 2** **L – T - P: 1 - 1 - 0**

**COURSE OBJECTIVE:**

The course creates concern among the students on applications of physics in daily life.

**UNIT I: Heat and Light**

Transfer of heat energy- conduction, convection and radiation- practical applications of conduction, convection and radiation of heat – Heat radiation – applications of heat radiation - change of state-latent heat of fusion – Heat absorbed in solution- vaporization and condensation - effect of pressure on boiling point and melting point - Solar energy- uses.

Light: reflection of light – spherical mirrors – concave and convex – image formation by spherical mirrors – uses. 10 hours

**UNIT II: Sound and Electricity**

Sound wave- propagation of sound waves -frequency, amplitude, and time period of vibration- musical sound and noise- Decibel scale - characteristics of musical sound – - ultrasonics -application of ultrasonic waves - medicine- Industry – noise pollution – measures to limit noise pollution.
Fundamentals of electricity – electric charge –voltage -current - resistance- conductors – insulators – semiconductors - Ohm's law – series and parallel circuits -battery- explanation of A.C and D.C. 10 hours

**UNIT III: Physics in Technology, Energy Generation and Natural Phenomena**

Technology: Lasers – DVD player – Electric motors – Projector – Telescope – Microwave oven – Hybrid car – Optical recording.
Energy Generation: Solar Energy – Wind Energy – Nuclear Energy.
Natural Phenomena: Lightening –Cyclone – Earthquake – Solar eclipse - Volcanic eruption –Tsunami - Nuclear disaster. 10 hours

**Books for Reference**:

1. Robert F.Kingsbury, Elements of Physics, 1st edition, Van Nostrand Company, Inc Londomn, 1966.
2. M. Nelkon and P. Parker, Advanced Level Physics (Heinemann International, London, U.K.)2012.
3. H. C. Verma, Concepts of Physics (Bharati Bhawan publishers and distributors, New Delhi, India, 2011).

**COURSE OUTCOMES**

| CO No. | CO Statement |
|---|---|
| CO1 | Define the utilization of heat and light energy in everyday Physics. |
| CO2 | Explore the applications of electrical connections and safety precautions. |
| CO3 | Identify the applications of Physics in different areas. |

**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** |
| **Average** | **3** | **2.4** | **3** | **2.8** | **2.4** | **2.4** |

KEY: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2 WEAKLY CORELATED-1 NO CORELATION-0

# SEMESTER V COURSE PROFILE - PROGRAMME OF STUDY

| PART | CORE/ ALLIED/ ELECTIVE | TITLE OF THE PAPER | CODE | L | T | P | H | C | CA | SE | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | V SEMESTER | | | | | | | | | | |
| III | Core 9 | Nuclear Physics | PH21/5C/NUP | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Core 10 | Mechanics and Mathematical Physics | PH21/5C/MMP | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Core 11 | Basic Electronics and Electronic Devices | PH21/5C/EED | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Elective I | Spectroscopy and Laser Physics / Solid State Physics | PH21/5E/SLP// PH21/5E/SSP | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Elective II | Astrophysics / Materials Science | PH21/5E/ASP// PH21/5E/MAS | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |
| III | Core | Major General Practical III | PH21/6C/MPR | 0 | 0 | 3 | 45 | End of 6th semester | | | |
| III | Core | Electronics Practical | PH21/6C/EPR | 0 | 0 | 3 | 45 | End of 6th semester | | | |

## SEMESTER V

## NUCLEAR PHYSICS

**TEACHING HOURS: 75 HOURS** **COURSE CODE: PH21/5C/NUP**
**CREDITS: 4** **L-T-P: 4-1-0**

### 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. Acquire the basic knowledge of cosmic rays and elementary particles.

### 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: Detector and Particle Accelerators

Interaction between the energetic particles and matter – Heavy charged particles – Electrons – Gamma ray-Ionization chamber – Solid State detector – GM counter – Wilson Cloud chamber – Nuclear emission – Linear accelerators – Cyclotron – Betaron. 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 – lnternal 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 and Cosmic Rays

Elementary particles – Introduction – particles and antiparticles – Antimatter – The fundamental interactions – The Quark model - Cosmic rays – Origin of cosmic rays – Latitude effect – Azimuthal effect – Attitude effect – Seasonal, Diagonal changes – Primary and Secondary Cosmic rays – cascade theory of shower – Pair production and Annihilation – Van Allen Belts – 20 hours

**RECOMMENDED TEXTBOOKS:**

1. R. Murugeshan, KiruthigaSivaprasath**,** 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)
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 | Device instruments utilizing the behaviour of nuclear particles. |

**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: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 **N**O CORELATION-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-2/4x20 marks | 500 | 40 | | |

## SEMESTER- V

## MECHANICS AND MATHEMATICAL PHYSICS

**TOTAL HOURS: 75 HOURS** **COURSE CODE: PH21/5C/MMP**
**CREDITS: 4** **L-T-P: 4 - 1 - 0**

### COURSE OBJECTIVES

To enable the students to

1. Apply the underlying forces in the motion of rigid bodies.
2. Apply the equations for the situation of different physical problems.
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: 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 – diagonalization of 2 x 2 matrices. 15 hours

### UNIT II: 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 (statement and proof). 15 hours

### UNIT III: Special Functions

Definition – The Beta function – Gamma function – Evaluation of Beta function – Other forms of Beta function – Evaluation of Gamma function – Other forms of Gamma function – Relation between Beta and Gamma functions – Bessel's function (Properties not included; mention of four series). 15 hours

### UNIT IV: 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- Moment of inertia of a solid sphere about an axis through its CG- kinetic energy of a body rolling in a horizontal plane – acceleration of a body rolling down an inclined plane. 15 hours

**UNIT V: Classical Mechanics**

Classical Mechanics- Mechanics of a system of Particles - Degrees of freedom- Constraints- Generalised Coordinates- Generalised displacement, velocity, momentum, force, potential - Transformation Equations - Configuration Space - Principle of Virtual work - D'Alembert'sPrinciple - 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. 15 hours

**RECOMMENDED TEXTBOOKS:**


1. R. Murugeshan, 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. BrijLal 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 | Analyze special functions and their applications. |
| 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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

## BASIC ELECTRONICS AND ELECTRONIC DEVICES

**TEACHING HOURS: 75 Hours** **COURSE CODE: PH21/5C/EED**
**CREDITS: 4** **L-T-P: 4 – 1 - 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

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- 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: Semiconducting and Switching 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. Introduction - switching circuit- electronic switches - important terms - switching action of a transistor – multivibrators – types of multi vibrators– transistor mono stable multivibrator - Clipping circuits – Clamping Circuits - basic idea of a clamper- Positive clamper – negative clamper. 15hours

### 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. 15 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. 15hours

**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, PragatiPrakashan, 2012.


**REFERENCE BOOKS:**


1. Dennis Le Croissette, Transistors, 5th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1998*.
2. Millman and Halkias, Integrated Electronics, McGraw 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 (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 andanalyze 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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<br>Section B must have 2 problems.<br>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

## SPECTROSCOPY AND LASER PHYSICS

**TEACHING HOURS: 75 Hours** **COURSE CODE: PH21/6E/SLP**
**CREDITS: 4** **L-T-P: 4 - 1 - 0**

### COURSE OBJECTIVES

To enable the students to

1. Elucidate the rotation of molecules.
2. Analyse the fundamentals of infrared and raman spectroscopy.
3. Build up their knowledge on laser theory.
4. Explain the types of the solid state and semiconductor lasers.
5. Introduce the applications of laser in industries, communication and medicine.

### UNIT I: Rotation of Molecules

Rotational Spectra of rigid diatomic molecules – Isotopic effect in rotational spectra- Intensities of rotational spectral lines – Linear polyatomic molecules- symmetric and asymmetric top molecule – Microwave spectrometer – Microwave oven. 15 hours

### UNIT II: UV-Visible Spectroscopy

Electronic Spectra of Diatomic Molecules: Born – Oppenheimer Approximation – Franck Condon Principle – Dissociation Energy and Dissociation Products – Fortrat Diagram – Techniques and Instrumentation – Ultra-violet Photoelectron Spectroscopy – X-Ray Photoelectron Spectroscopy. 15 hours

### UNIT III: Infrared and Raman Spectroscopy

Infrared Spectroscopy - Energy of a diatomic molecule – Simple harmonic oscillator – Diatomic vibrating rotator – Vibration – Rotation spectrum of Carbon Monoxide – Breakdown of the Born Oppenheimer – Approximation : Interaction of rotations and vibrations – Techniques and instrumentation – Double and Single – beam operation
Raman Spectroscopy – Raman effect – Classical and quantum theory – Molecular polarizability– Pure rotational Raman spectra of linear molecules – Vibrational Raman spectra – structure determination - Techniques and instrumentation. 15 hours

### UNIT IV: Laser Theory

Basic principles of laser – Absorption - Spontaneous and stimulated emission - Einstein Coefficients – Condition for light amplification – Pumping configurations - Population inversion - Threshold condition – Optical resonators (Qualitative only). 15 hours

**UNIT V: Types of Lasers**

Ruby laser – Nd: YAG laser - He-Ne – Carbon dioxide - Argon Ion – Excimer laser - Tunable Dye lasers - Semiconductor lasers- features and principles of laser action (Qualitative analysis) Applications of Lasers in Astronomy – Medicine – Industry (Overview).
15 hours

**RECOMMENDED TEXTBOOKS:**


1. Banwell, Fundamentals of molecular spectroscopy, Tata Mc Graw Hill, New Delhi, 2016
2. B.B.Laud, Lasers and Non- linear Optics, New Age International publishers, 2008*
3. G. Aruldhas, Molecular Structure and Spectroscopy, Prentice Hall of India Pvt. Ltd., 2004.
4. N. Avadhanulu, An Introduction to LASERS, S. Chand & Company, 2001.
5. K. Thyagarajan and A.K. Ghatak, LASER Theory and Applications, Cambridge University Press, 1999.


**BOOKS FOR REFERENCE:**


1. William T. Silfvast, Laser fundamentals, Cambridge University Press, 1999.
2. Oshea, Callen and Rhcdes, "An Introduction to Lasers and their Applications", Addison Wesley, 1985.
3. A.Yariv, "Quantum Electronics", Third Edn., Addison-Wesley 1990.
4. Hariharan, "Optical Holography", Academic Press, New York, 1983.
5. Erf.R.K."Speckle Metrology", Academic Press, New York, 1978.


**JOURNALS:**

1. Journal of Spectroscopy (International)
2. Journal of Molecular Spectroscopy (International)
3. Journal of Ramam Spectroscopy (International)
4. Journal of Optics and Spectroscopy (International)
5. Journal of Physical Review A: Atomic, Molecular and Laser Physics (International)
6. Journal of Laser Applications (International)
7. Journal of Optics (National)

**E-LEARNING RESOURCES:**

1. https://en.wikipedia.org/wiki/Rotational_spectroscopy (Unit I)
2. https://www.spectroscopyonline.com/view/analytical-vibrational-spectroscopy-nir-ir-and-raman (Unit II)
3. http://physics.oregonstate.edu/~leeys/COURSES/ph485/ph485ch6s07.pdf (Unit III)
4. http://www.physics-and-radio-electronics.com/physics/laser/differenttypesoflasers.html(Unit IV)
5. https://www.rp-photonics.com/lasers.html (UnitV)

**COURSE OUTCOMES**

| CO No. | CO Statement |
|---|---|
| CO1 | Define the fundamentals of rotation of molecules. |
| CO2 | Explore the infrared and raman spectroscopy |
| CO3 | Analyze the laser principles and laser behaviour. |
| CO4 | Categorize the various types of lasers |
| CO5 | Illustrate the applications of lasers in industry, medicine and communication. |

**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: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2 WEAKLY CORELATED-1 NO CORELATION-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 | | |

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

## SEMESTER V

## SOLID STATE PHYSICS

**TEACHING HOURS: 75 HOURS** **COURSE CODE: PH21/5E/SSP**
**CREDITS: 4** **L-T-P: 4 - 1 - 0**

### COURSE OBJECTIVES

To enable the students to

1. Learn about the crystal structure and properties of solid
2. Acquire knowledge on lattice dynamics of the solids.
3. Comprehend the concepts of electronic theory of solids.
4. Gain insight on magnetic properties and their theory.
5. Understand the concepts of superconductivity and their applications.

**UNIT I: Basics of Crystallography**

Solids :– Amorphous and Crystalline Materials- Lattice - Unit cell - Translation Vectors- Basis and Crystal Structure, Primitive lattice cell- Bravais Lattices in two dimension, three dimension- Reciprocal Lattice – Lattice planes - Rational features of a Crystal and Miller Indices – Interplanar spacing – Density of atoms in a crystal plane- BCC, FCC, HCP & Diamond - Crystal defects- Point, Line, Surface and Volume - Laue equations. 15 hours

**Unit II: Elementary Lattice Dynamics**

Lattice Vibrations and Phonons: – Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Einstein and Debye Theories of Specific Heat of Solids.T3Law– phonon– photon interaction. 15 hours

**Unit III: Electron Theory of Solids**

Drude Lorentz Classical theory- Sommerfield quantum theory-free electron gas in one dimensional box - application free electron gas model- electron specific heat – energy bands in solids – brillouin zones- distinction between metals, insulators and semiconductors –effective mass of electron and hole - Hall effect and its applications. 15 hours

**Unit IV: Magnetic Properties**

Dia, Para, Ferro and Ferri magnetic Materials. Classical Langevin Theory of dia and Paramagnetism – magnetic domains – Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism. Discussion of B–H Curve. Hysteresis and Energy Loss. 15 hours

**Unit V: Superconductivity:**

Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors - HTS - London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation): Cooper Pair and Coherence length -Variation of Superconducting Energy Gap with Temperature. Experimental Evidence of Phonons. AC/DC Josephson Effect (No derivation). 15 hours

**RECOMMENDED TEXTBOOKS:**

1. Charles Kittel,Introduction to Solid State Physics JohnWiley and Sons, Inc 2007 7th Edition
2. A J Dekkar,Solid State Physics Macmillan India Limited 2000 New 1st edition
3. J. S. Blackmore,Solid State Physics Cambridge University Press 1985 2nd edition
4. Pillai S.O., Soild State Physics, 6th Edition, New Age Science, 2013.
5. M.A.Wahab, Solid State Physics, Alpha Science International Ltd, 2nd edition, 1999.

**REFERENCE BOOKS:**

1. Ashcroft W. and Mermin N.D., Solid State Physics, Holt–Rinehart–Winston, 1976.
2. M. Ali Omar,elementary Solid State Physics, Pearson Education, 4th edition 2008.
3. Giuseppe Grosso, Giuseppe PastoriParravicini, Solid State Physics, Academic Press, Second Edition, 2014.

**JOURNALS:**

1. Journal Physicsof Solid State (International)
2. Journal of Advances in Chemical Sciences (National)

**E-LEARNING RESOURCES:**

1. https://youtu.be/RImqF8z91fU
2. https://nptel.ac.in/courses/115/105/115105099/

**COURSE OUTCOMES:**

| CO No. | CO Statement |
|---|---|
| CO1 | Examine the symmetries in 3D solids and the experimental methods to unfold the same. |
| CO2 | Employing simple theoretical models to understand the different physical properties like lattice heat capacity and electrical property. |
| CO3 | Validating the microscopic view point of the different physical properties of solids |
| CO4 | Analyze and classify magnetic materials based on their field and temperature response. |
| CO5 | An idea of the properties and usefulness of the superconducting materials and the existing theories to explain the experimental facts. |

**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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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<br>Section B must have 2 problems.<br>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**

**ASTROPHYSICS**

**TOTAL HOURS: 60 HOURS** **COURSE CODE: PH21/5E/ASP**
**CREDITS: 4** **L-T-P: 3 – 1 - 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. 12 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. 12 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. 12 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. 12 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. 12 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.Murugeshan, KiruthigaSivaprasath**,** Modern Physics, S. Chand & Co. Ltd., 2016.
4. BaidyanathBasu, TanukaChattopadhyay , SudhindraNath Biswas, An Introduction to Astrophysics, 2ndedition, Prentice Hall India LearningPvt.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 though co-ordinates of space and time |
| CO2 | Apply various optical instruments and explore the observable universe |
| CO3 | To relate to the **s**tellar 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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 V**

**MATERIALS SCIENCE**

**TEACHING HOURS: 60 Hours** **COURSE CODE: PH21/5E/MAS**
**CREDITS: 4** **L-T-P: 3 – 1 - 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.

12 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. 12 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. 12 hours

**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. 12hours

**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 nanomateials in electronics, communication and medicine. 12 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. SanthanaRaghavan 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. Leevers, 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 Kittle, An Introduction to Solid State Physics, 7th Edition, John Wiley and Sons,2003*.
3. C.M. Srivastava, C. Srinivasan, Science of Engineering Materials, 2ndEdition, New Age International, 2005*.


**JOURNALS:**

1. Journal of Materials Science and Nanomaterials (National)
2. 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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 V**

**SELF STUDY COURSE / ADVANCED LEARNER COURSE**

# ACOUSTICAL PHYSICS

**CREDITS: 2**

**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

**Unit II: Underwater Acoustics**

Speed of sound in sea water – transmission loss – refraction- the mixed layer – surface interference – SONAR equations (Active and Passive SONAR) – under water acoustic imaging – acoustic telemetry 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

**Unit IV: Damping Attenuation and Absorption**

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

**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.

**RECOMMENDED TEXTBOOKS:**

1. Introduction to acoustics, Robert D Finch,Prentice Hall of India, 2008*.
2. Fundamentals of Acoustics, LawerenceE.Kinsler, Austin, R.Frey, Alan B.Coppens, James V.Sanders, 4ht 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.pdfhttps://www.thoughtco.com/the-compton-effect-in-physics-2699350 (Unit I)
2. http://ultrasound.ee.ntu.edu.tw/classnotes/us1/Chapter 2.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. |

**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 – V**

**SELF STUDY COURSE / ADVANCED LEARNER COURSE**

**MEDICAL PHYSICS**

**CREDITS: 2**

**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 Electrodcardiography (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 - Ventillators.

**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 Instumentation, 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)
2. https://sourceforge.net/projects/biosig/(unit II)
3. http://eeedrmcet.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)
5. 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 VI COURSE PROFILE - PROGRAMME OF STUDY

| PART | CORE/ ALLIED/ ELECTIVE | TITLE OF THE PAPER | CODE | L | T | P | H | C | CA | SE | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | VI SEMESTER | | | | | | | | | | |
| III | Core 12 | Electromagnetism | PH21/6C/EMG | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Core 13 | Quantum Mechanics and Relativity | PH21/6C/QMR | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Core 14 | Atomic and Molecular Physics | PH21/6C/AMP | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Core 15 | Digital electronics and Microprocessor | PH21/6C/DEM | 4 | 1 | 0 | 75 | 4 | 40 | 60 | 100 |
| III | Elective III | Nanoscience and Technology/ Advanced Electronics | PH21/6E/NST// PH21/6E/AEL | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |
| III | Core | Major General Practical III | PH21/6C/PR3 | 0 | 0 | 3 | 45 | 4 | 40 | 60 | 100 |
| III | Core | Electronics Practical | PH21/6C/EPR | 0 | 0 | 3 | 45 | 3 | 40 | 60 | 100 |
| V | | Extension Activity (Sports/NCC/NSS/CSS/ YRC/RRC/Retract/Yoga) | | - | - | - | Min 60 hours | 1 | - | - | - |
| | | OPTIONAL EXTRA CREDITS | | | | | | | | | |
| IV | Extra Credits | Self-Study (Semester V) | | - | - | - | - | 2 | - | 100 | 100 |
| | | Internship (Summer Vacation after IV Semester) | | - | - | - | Min. 14 days | 1 | - | - | - |
| | | Project (Semester VI) | | | | | - | 2 | - | 100 | 100 |

**SEMESTER – VI**

# ELECTROMAGNETISM

**TEACHING HOURS: 75 HOURS** **COURSE CODE: PH21/6C/EMG**
**CREDITS: 4** **L-T-P: 4 - 1 - 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.- Comparision 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. Murugeshan, 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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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

**TEACHING HOURS: 75 Hours** **COURSE CODE: PH21/6C/DEM**
**CREDITS: 4** **L-T-P: 4 – 1 - 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 resister 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, McGraw 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://tiiciiitm.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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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

## QUANTUM MECHANICS AND RELATIVITY

**TEACHING HOURS: 75 Hours** **COURSE CODE: PH21/6C/QMR**
**CREDITS: 4** **L-T-P: 4 – 1 - 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-Derivation-Deduction of Wiens displacement law and Rayleigh jeans law- Photo electric effect-Einstein's explanation of the photoelectric effect- Compton effect-Derivation- the Ritz combination principle in spectra- stability of an atom- Bohr's Quantization of angular momentum and its application to the hydrogen atom. 15 hours

### UNIT II: Wave Mechanics I

Inadequacy of classical mechanics –Matter waves – de Broglie wavelength – characteristics of waves (amplitude– frequency– angular frequency– time period– wave number– phase)– wave packet– phase velocity– group velocity– Davisson and Germer Experiment – G.P. Thomson's experiment. 15 hours

### UNIT III: Wave Mechanics II

Heisenberg's Uncertainty Principle– Elementary proof between Displacement and Momentum, Energy and Time– Illustration– Diffraction of electrons through a slit– Gamma ray microscope through experiment– Application– Non–existence of free electrons in the nucleus– Size and Energy in the ground state of Hydrogen atom Basic postulates of wave mechanics –eigen value and eigen function–operator formalism – linear operators –self–adjoint operators – expectation values (position and momentum). 15 hours

### UNIT IV: Schrodinger's Wave Equation and its Applications

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 probabilityIntroduction – Wave function for a free particle - Schrodinger's one dimensional time-dependent, time -independent wave equation.Limitations of a wave function- Normalization of a wave function- Operators for Momentum, Kinetic Energy and

Total Energy - Eigen function- Eigen value and Eigen value equation- Postulates of Quantum Mechanics

Application of Schrodinger equation: Particle in one dimensional box- Simple harmonic oscillator. 15 hours

**UNIT V: Relativity**

Frame of reference –Galilean transformation – Michelson & Morley experiment – postulates of special theory of relativity – Lorentz transformation – length contraction – time dilation – relativity of simultaneity – addition of velocities – variation of mass with velocity – mass – energy relation – Minkowski's four dimensional space – time continuum – four vectors – elementary ideas of general theory of relativity- Principle of equivalence – gravitational red shift – fundamental ideas of general relativity. 15 hours

**RECOMMENDED TEXTBOOKS:**


1. Robert Resnick, Introduction to special theory of relativity, John Wiley Eastern Ltd., Reprint 2003*.
2. Kamalsingh, S.P.Singh ,Elements of Quantum Mechanics , First Edition, S.Chand & Co. Ltd, New Delhi-110055, 2005*.
3. R.Murugeshan, Kiruthiga Sivaprasath**,** 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.
6. V.K. Thangappan, Quantum mechanics, New Age International, 1993.
7. G. Aruldass, Quantum Mechanics, Prentice–Hall Of India Pvt. Limited, 2002.


**REFERENCE BOOKS:**


1. Ghatak and Loganathan, Quantum Mechanics, Macmillan India Pvt Ltd, 2004*.
2. Beiser, Concepts of modern Physics, 6thedition A,Tata MC Graw Hill, New Delhi,1997*.
3. V. Devanathan, Quantum Mechanics, Narosa Publications, New Delhi, 2011.
4. Max Born, Atomic physics, Dover Publications Inc, 8 edition, 1990
5. Ajoy Ghatak& S. Loganathan, Quantum Mechanics, Springer, 2004
6. Linus pauling, E. Bright wilson, Introduction to Quantum mechanics, Dover Publications Inc., United States, 1985
7. Arthur Beiser, Concepts of modern Physics, McGraw Hill Education; 6th edition, 2009.


**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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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.<br>Section B must have two problems.<br>Section C may have problems as a part of the question. |
| K1, K2 | B-5/8x8 marks | 200 | 40 | | |
| K2, K3 | C-2/4x20 marks | 500 | 40 | | |

## SEMESTER VI

## ATOMIC AND MOLECULAR PHYSICS

**TEACHING HOURS: 75 Hours** **COURSE CODE: PH21/6C/AMP**
**CREDITS: 4** **L-T-P: 4 - 1 - 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. Study the concept of Photoelectric effect 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. 15 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. 15 hours

### UNIT III: Magneto Optical Properties of Spectrum

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. 15 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.

15 hours

**UNIT V: Photoelectric Effect**

Introduction – Richardson and Compton experiment – Relation between Photoelectric current and retarding potentials – Relation between velocity of Photo electrons and the frequency of light – Laws of Photoelectric emission – Failure of electromagnetic theory – Einstein's Photo electric equation – Experimental verification – Millikan's Experiments – Photo electric cells – Photo emissive cell – Photo Voltaic cell – Photo conductive cell – Applications of Photo electric cells. 15 hours

**RECOMMENDED TEXTBOOKS:**


1. C. Kittel, An Introduction to Solid State Physics, 8th Edition, John Wiley and Sons, 2008.*
2. R. Murugeshan, KiruthigaSivaprasath**,** 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, McGraw 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 | Find applications of photo electrical cells and X Rays |

**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 CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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 – VI

## NANOSCIENCE AND TECHNOLOGY

**TEACHING HOURS: 60 HOURS** **COURSE CODE: PH21/6E/NST**
**CREDITS: 4** **L-T-P: 3 - 1 - 0**

### 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

NanotechnologyBasics- 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. 12 hours

### UNIT II: Synthesis - Physical and Chemical Methods

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. 12 hours

### UNIT III: Microscopic and Surface Analysis

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. 12 hours

### UNIT IV: Thermal and Optical Characteriztion

X-ray photoelectron spectromter (XPS) – EDAX and WDA - Mass Spectrometer – Secondary Ion Mass Spectrometer (SIMS) –ICPMS - Nuclear magnetic resonance (NMR) – Electron spin resonance (ESR).Differential scanning calorimeter (DSC) – Thermogravimetric/Diffferentialthermalanalyzer (TG/DTA) – UV – Visible spectrophotometer – Spectroflourometer – Contact angle measurement. Dynamic Light Scattering (DLS). 12 hours

**UNIT- V Applications of Nanotechnology**

Information storage- nano computer, molecular switch - nano probes in medical diagnostics – nanomedicines –targetted drug delivery – nanosensors – gas sensors nanoparticles for solar cell – battery. 12 hours

**RECOMMENDED TEXTBOOKS:**


1. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, John Wiley & Sons Ltd, (2005).
2. NANO: The Essentials- Understanding Nanoscience and Nanotecchnology, T. Pradeep, McGraw Hill Education (India) Private Limited, (2018).
3. Encyclopedia of Materials Characterization, C. Richard Brundle, Charles A. Evans Jr., Shaun Wilson, Butterworth-Heinemann Publishers, (1992).
4. Handbook of Microscopy for Nanotechnology, Ed. By Nan Yao and Zhong Lin Wang, Kluwer Academic Press, (2005).


**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 |
|---|---|
| CO1 | Apply engineering and physics concepts to the nano-scale and non-continuum domain. |
| CO2 | Identify and compare state-of-the-art nanofabrication methods |
| CO3 | Formulate appropriate tools for measurements of relevant physical properties |
| CO4 | Discuss and evaluate state-of-the-art characterization methods for nanomaterials |
| CO5 | Acquire the knowledge in applications of nanotechnology in various fields |

**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: **S**TRONGLY CORELATED-3 MODERATELY CORELATED-2WEAKLY CORELATED-1 NO CORELATION-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 | | |

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

## SEMESTER -VI

## ADVANCED ELECTRONICS

**TEACHING HOURS: 60 HOURS** **COURSE CODE: PH21/6E/AEL**
**CREDITS: 4** **L-T-P: 3 -1 - 0**

### COURSE OBJECTIVES:

To enable the students to

1. Assess the operation of 555 timer and generation of wave forms using it.
2. Explain the different types of amplifiers and their efficiency for various applications.
3. Apply the knowledge of the working of multivibrators using transistors.
4. Analyse the different wave shaping circuits and its applications.
5. 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.

12 hours

### 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. 12 hours

### UNIT III: Multivibrators Using Transistors

Types of Multivibrators :Astablemultivibrator – circuit operation- switching time and frequency of Oscillation -Monostablemultivibrator– circuit operation - Bistable – Circuit operation — Applications of multivibrators. 12 hours

### 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. 12 hours

### 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. 12 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. Kennedy. Davis. Electronic Communication Systems,TataMcGraw 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, PragatiPrakashan, 2012.
3. Millman and Halkias, Integrated Electronics, McGraw 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

**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 |

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 – VI

## MAJOR GENERAL PRACTICAL – III

**TEACHING HOURS: 90 HOURS** **COURSE CODE: PH21/6C/PR3**
**CREDITS: 4** **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. Temperature Co-efficient of a coil - Carey Foster's Bridge.
3. Calibration of high range voltmeter - Potentiometer.
4. E.M.F of a thermocouple - Potentiometer.
5. Conversion of a galvanometer into a voltmeter, ammeter and ohmmeter, and calibration of the converted voltmeter using potentiometer.
6. Self Inductance of a coil – Anderson Method.

**Magnetic measurements**

7. M and $B_H$ by Deflection Magnetometer and Vibration Magnetometer.

**Comparison of Inductance using BG**

8. E.M.F of a thermocouple - B.G.
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.Srivasava, 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 CORELATED-3 MODERATELY CORELATED-2
WEAKLY CORELATED-1 NO CORELATION-0

**TEACHING METHODOLOGY:**

Hands on Learning – Practical Sessions

**SEMESTER – VI**

**ELECTRONICS PRACTICAL**

**TEACHING HOURS: 90 HRS** **COURSE CODE: PH21/6C/EPR**
**CREDITS: 3** **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.

**Design of Regulators and Amplifiers**

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.

**Electronic Circuits Evaluation of Frequency Response Curves**

7. Single stage amplifier-Frequency response curve to study the variation of gain with load.
8. Hartley Oscillator using transistor.

**Binary Math Operations Using Operational Amplifier**

9. Inverting, non-inverting amplifier, current follower and voltage follower – OP- AMP.
10. OP-Amp Amplifier as an a) adder and subtractor b) differentiator & an integrator.
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 CORELATED-3 MODERATELY CORELATED-2
WEAKLY CORELATED-1 NO CORELATION-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.