ALLIED COURSE I

GENERAL PHYSICS

SUBJECT CODE: 24UPH301

CONTACT HOURS/WEEK:4 **CREDIT: 4**

INTERNAL MARKS: 25 **EXTERNAL MARKS: 75**

COURSE OVERVIEW:

This course introduces the fundamental concepts of properties of matter, wave motion, heat and thermodynamics, electricity and magnetism, and basics of digital electronics. It covers classical experiments and modern applications including ultrasonics in medicine, smart electrical devices, and India's digital initiatives.

COURSE OBJECTIVE:

To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.

Pre requisite:

The students ought to have understanding of combination of foundational knowledge like basic high school chemistry, basic physics and basic mathematical skills.

Course Outcomes:

Unit	CO.NO	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	COGNITIVE LEVEL
I	**CO1**	Explain the properties of elasticity, viscosity, and surface tension and their measurements.	K1-K5
II	**CO2**	Describe SHM, wave motion, ultrasonics, and their applications.	K1-K5
III	**CO3**	Explain thermodynamic laws, heat engines, entropy, and liquefaction processes.	K1-K5
IV	**CO4**	Apply electrostatic principles to electric fields and capacitors.	K1-K5
V	**CO5**	Explain the working and applications of semiconductor devices and rectifiers.	K1-K5

SYLLABUS

UNIT I – PROPERTIES OF MATTER

Elasticity: Stress – Strain – Hooke’s law – Young’s modulus - Behaviour of wire under progressive tension – Bending of beams – Expression for the bending moment –

Measurement of Young's modulus by bending of beams – Non-uniform bending and Uniform bending.

Viscosity: Streamline flow and Turbulent flow – critical velocity - Poiseuille's formula – Determination of coefficient of viscosity of a liquid (Variable pressure head).

Surface Tension: Drop weight method of determining the surface tension of a Liquid – Experiment to determine the interfacial tension.

UNIT II – WAVES, OSCILLATIONS AND ULTRASONICS:

Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics

UNIT III – HEAT AND THERMODYNAMICS:

Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde's process of liquefaction of air– liquid Oxygen for medical purpose– importance of cryocoolers– thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.

UNIT IV ELECTROSTATICS

Coulomb's inverse square law – Gauss theorem and its applications - Intensity at a point due to a charged sphere and cylinder – Principle of a capacitor – Capacity of a spherical and cylindrical capacitors–Energy stored in a capacitor–Loss of energy due to sharing of charges – Capacitors in series and parallel–Types of capacitors.

UNIT V- SEMICONDUCTOR PHYSICS:

p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator –Half wave and full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations.

TEXT BOOKS

1. Murugesan, R. (2001). *Allied Physics*. S. Chand and Co., New Delhi.
2. Brijlal, & Subramanyam, N. (1994). *Waves and Oscillations*. Vikas Publishing House, New Delhi.

REFERENCE BOOKS

1. S. Sunramaniyan. *A Textbook of Sound*.
2. B. Brijlal and N. Subramaniam. *Heat and Thermodynamics*.

3. V. K. Mehta. (2004). *Principles of Electronics* (6th ed.). S. Chand and Company.
4. B. Brijlal and N. Subramaniam. (1994). *Properties of Matter*. S. Chand and Co., New Delhi.

WEB RESOURSES

1. https://youtu.be/gnD8Se92hfk?list=PL30D1917C52D9F9B9
2. https://youtu.be/pMmHdWvN_FI?list=PLyqSpQzTE6M_QOKxVxZ5nQ48gOkzg7zWP
3. https://youtu.be/h0Y9jDKqScQ?list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP

ALLIED COURSE II

APPLIED PHYSICS

CONTACT HOURS/WEEK:4 **CREDIT: 3**

INTERNAL MARKS: 25 **EXTERNAL MARKS: 75**

COURSE OVERVIEW:

Allied Physics introduces fundamental physics concepts tailored for students in health sciences and other non-physics disciplines. The focus is on understanding physical principles and their real-world applications, especially in biological and medical contexts.

COURSE OBJECTIVE:

To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics

PRE REQUISITE:

The students ought to have understanding of combination of foundational knowledge like basic high school chemistry, basic physics and basic mathematical skills.

Course Outcomes:

Unit	CO.NO	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	COGNITIVE LEVEL
I	**CO1**	Explain the principles of electricity, magnetism, AC circuits, and household electrical devices.	K1-K5
II	**CO2**	Describe atomic models, quantum numbers, photoelectric effect, and their applications.	K1-K5
III	**CO3**	Explain nuclear structure, radioactivity, nuclear fission, and fusion processes.	K1-K5
IV	**CO4**	Apply the principles of interference, diffraction, and polarization in optical systems.	K1-K5
V	**CO5**	Explain logic gates, Boolean algebra, digital electronics, and Digital India initiatives.	K1-K5

SYLLABUS

UNIT I – ELECTRICITY AND MAGNETISM:

Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law –Field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart wifi switches- fuses and circuit breakers in houses

UNIT II -ATOMIC PHYSICS:

Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect –Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation – application of photoelectric effect: solar cells.

UNIT III-NUCLEAR PHYSICS:

Nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses –controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – – nuclear fusion – thermonuclear reactions – differences between fission and fusion.

UNIT IV-OPTICS:

Interference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries.

UNIT V – DIGITAL ELECTRONICS AND DIGITAL INDIA:

Logic gates, OR, AND, NOT, NAND, NOR , EX OR logic gates – Universal building blocks – Boolean algebra – De Morgan's theorem – Verification – Overview of Government initiatives: software technological parks under MeitY, NIELIT- Semiconductor laboratories under Dept. of Space – an introduction to Digital India.

TEXT BOOKS

1. R. Murugesan. (2005). *Allied Physics*. S. Chand and Co., New Delhi.
2. R. Murugesan. (2005). *Modern Physics*. S. Chand and Co., New Delhi.
3. R. Murugesan. *Electricity and Magnetism*. S. Chand and Co., New Delhi.
4. B. Brijlal and N. Subramanyam. (2002). *Textbook of Optics*. S. Chand and Co., New Delhi.
5. V. K. Mehta. *Principles of Electronics*. S. Chand and Co., 2005.

REFERENCE BOOKS

1. A. Sundaravelusamy. (2011). *Allied Physics Paper-II*. Karur: Priya Publications.
2. B. L. Theraja. (2011). *Electronics Devices & Circuits*. Delhi: S. Chand & Co.

ALLIED PHYSICS LAB

Contact hours/week: 4 **Credit: 2**

Internal Marks: 40 **External Marks: 60**

Course Code: 24UPH51

Course Overview

This course provides practical experience in mechanics, properties of matter, optics, electronics, and electrical measurements.

Course Objectives

To impart practical skills for measuring physical quantities with precision. To verify fundamental physical laws through experimentation. To understand and apply electronic principles using semiconductor devices and logic circuits.

Pre requisites:

Basic knowledge of Mechanics, Properties of Matter, Optics and Semiconductor Physics.

Familiarity with basic concepts of Digital Electronics and Laboratory Measurements.

Course Outcomes:

CO.NO	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	COGNITIVE LEVEL
CO1	Perform experiments to determine elastic, viscous, and surface properties of materials and liquids.	**K3**
CO2	Verify the laws of oscillations, wave motion, and electrical measurements using standard instruments.	**K3**
CO3	Analyze optical phenomena and determine optical constants using interference, diffraction, and spectrometer techniques.	**K4**
CO4	Construct and characterize semiconductor devices and regulated power supply circuits.	**K3**
CO5	Design, verify, and analyze basic digital logic circuits using logic gate ICs.	**K4**

LIST OF EXPERIMENTS:

1. Young's modulus by non-uniform bending using pin and microscope.
2. Young's modulus by non-uniform bending using optic lever, scale and telescope.
3. Rigidity modulus by static torsion method.
4. Rigidity modulus by torsional oscillations without mass.
5. Surface tension and interfacial Surface tension – drop weight method.
6. Determination of viscosity by Poiseullie's flow method.

7. Comparison of viscosities of two liquids – burette method.
8. Verification of laws of transverse vibrations using sonometer.
9. Calibration of low range voltmeter using potentiometer.
10. Verification of truth tables of basic logic gates using ICs.
11. Verification of De Morgan's theorems using logic gate ICs.
12. Verify NAND as universal building block using IC's.
13. Characterisation of Zener diode.
14. Construction of Zerner as a regulated power supply.
15. Construction of AND, OR, NOT gates using diodes and transistor.
16. Verify NOR gate as a universal building block using IC's.
17. Radius of curvature of lens by forming Newton's rings.
18. Thickness of a wire using air wedge.
19. Wavelength of mercury lines using spectrometer and grating.
20. Refractive index of liquid containing Hollow prism using spectrometer.
21. Determination of AC frequency using sonometer.
22. Specific resistance of a wire using PO box.

TEXT BOOK:

1. S. Srinivasan. (2005). *A Text Book of Practical Physics*. S. Sultan Chand Publications.
2. Department of Physics. (2009). *Practical Physics (B.Sc Physics Main)*. St. Joseph's College, Tiruchirapalli.

REFERENCES:

1. Dr. S. Somasundaram. (2012). *Practical Physics*. Apsara Publications, Tiruchirapalli.
2. Gupta and Kumar. *Practical Physics*. Pragati Prakashan.
3. S. P. Singh. *Advanced Practical Physics*. Pragati Prakashan.

SEMICONDUCTOR DEVICES AND ITS APPLICATIONS

CONTACT HOURS/WEEK: 4 **CREDIT: 3**

INTERNAL MARK: **25** **EXTERNAL MARK: 75**

COURSE CODE: 24UPH303

Course Objective:

To provide a strong foundation in semiconductor materials, devices, and their operating principles, characteristics, and applications in electronic circuits. To develop skills in analyzing, designing, and applying semiconductor devices and modern technologies for real-world electronic, optoelectronic, communication, computing, and power systems.

Course Overview:

This course introduces the fundamental principles of semiconductor devices and their practical applications. It covers diodes, transistors, lasers, optoelectronic devices, and operational amplifiers in analog circuits.

Prerequisites

Basic knowledge of electricity, magnetism, and electronic circuit elements is required. Familiarity with modern physics concepts and mathematical tools like algebra and calculus is recommended.

Course Outcomes: At the end of the course, student will be able to

Unit	CO.NO	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	COGNITIVE LEVEL
I	**CO1**	Explain the energy band theory, semiconductor properties, Hall effect, and special semiconductor diodes.	K1-K5
II	**CO2**	Analyze the characteristics and applications of transistors and FETs as amplifiers and oscillators.	K1-K5
III	**CO3**	Describe the principles, construction, and applications of lasers and masers.	K1-K5
IV	**CO4**	Explain the working principles and applications of optoelectronic devices such as LEDs, photodetectors, laser diodes, solar cells, and LCDs.	K1-K5
V	**CO5**	Apply operational amplifier concepts to analyze and design basic analog electronic circuits.	K1-K5

SYLLABUS

UNIT – I SEMICONDUCTOR PHYSICS

Theory of energy bands in crystals- Distinction between conductors, Insulators and Semiconductors – Intrinsic and Extrinsic semiconductors – Hall effect in semiconductor– Zener diode –Tunnel diode - Backward diode - Breakdown voltage avalanche Breakdown.

UNIT – II TRANSISTORS

Transistors - PNP and NPN transistors - DC Characteristics of CE and CB configuration- Hybrid parameters - Functions of Transistor as an amplifier and oscillator – FET-N-channel FET - performance Characteristics - FET amplifier.

UNIT – III LASERS

Laser and Maser - Basic concepts of stimulated emission –Population inversion and Meta stable state-He-Ne laser-Ruby laser - Ammonia Maser - production – Advantages.

UNIT – IV OPTO-ELECTRONIC DEVICES

Basics of Optoelectronics and its Importance- Light Emitting Diodes (LEDs): Working Principle and Applications- Photodetectors: Photodiodes, Phototransistors, and Photomultipliers- Laser Diodes: Construction, Working, and Applications- Solar Cells: Working Principle and Types- LCD (Liquid Crystal Display): Working and Applications

UNIT - V OPERATIONAL AMPLIFIER

The basic operational amplifier– Inverting and Non inverting operational Amplifier – Differential operational amplifier- CMRR-Basic uses of operational amplifier as sign and scale changer and phase shifter - Adder – Subtractor – comparator - Differentiator - ADC Successive approximation.

TEXT BOOKS

1. V. K. Mehta. (2005). *Principles of Electronics*. S. Chand & Co.
2. William T. Silfvast. (2012). *Laser Fundamentals* (2nd ed.). Cambridge University Press, University of Central Florida.
3. K. Thyagarajan and Ajoy Ghatak. (2019). *Lasers – Fundamentals and Applications* (2nd ed.). Laxmi Publications Pvt Ltd.

REFERENCE BOOKS

1. Jacob Millman. (1985). *Microelectronics*. McGraw Hill Publications, New Delhi.
2. G. K. Mithal and Vanvasi. (2006). *Pulse and Digital Electronics*. Khanna Publications, New Delhi.
3. A. Sundaravelusamy. (2011). *Applied Physics Paper-II (B.Sc Computer Science)*. Priya Publications, Karur.
4. B. L. Theraja. (2011). *Electronics Devices & Circuits*. S. Chand & Co., Delhi.

WEB-RESOURCES

1. https://nptel.ac.in/courses/115102025 17.
2. https://youtu.be/hOT72IdQBbw
3. https://youtu.be/FNp81kkxj5c
4. https://youtu.be/WxiOQvq2P-k
5. https://youtu.be/WYKsYvLJ7HE

DIGITAL CIRCUITS AND MEMORIES

CONTACT HOURS/WEEK: **4** **CREDITS: 3**

INTERNAL MARK: **25** **EXTERNAL MARK: 75**

SUB CODE: 24UPH304

COURSE OVERVIEW

This course introduces fundamental concepts of binary operations, digital and analog converters, feedback amplifiers, digital circuit design using HDL, and memory organization essential for understanding computer architecture.

COURSE OBJECTIVE

To impart knowledge on binary operations, data converters, feedback amplifiers, digital circuit design, and memory organization, enabling students to design and analyze electronic and digital systems.

PREREQUISITE:

Basic knowledge of electronics, digital logic circuits, and introductory programming.

Course Outcomes: At the end of the course, student will be able to

Unit	CO.NO	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	COGNITIVE LEVEL
I	**CO1**	Apply binary arithmetic and coding techniques used in digital systems.	K1-K5
II	**CO2**	Analyze the operation and performance of D/A and A/D converters.	K1-K5
III	**CO3**	Explain feedback amplifier concepts and evaluate the effects of feedback on amplifier performance.	K1-K5
IV	**CO4**	Design and analyze register transfer level circuits and digital system operations using HDL concepts.	K1-K5
V	**CO5**	Explain memory organization, memory hierarchy, interfacing, and memory management techniques in computer systems.	K1-K5

Syllabus

UNIT-I BINARY OPERATIONS

Binary Arithmetic – addition, subtraction, multiplication and division, Binary codes: Weighted and non-weighted codes, Sequential codes, Self complementing codes, Excess-3 code, Gray code, Error-detecting codes, Error-correcting codes, Hamming code, Alphanumeric codes

UNIT-II D/A AND A/D CONVERTERS

Digital to Analog Converters: Resistive Divider Type - Ladder Type – Accuracy and Resolution - Analog to Digital Converters: Counter – Ramp Type – simultaneous Conversion – Dual Slope Type – Accuracy and Resolution.

UNIT-III FEED BACK AMPLIFIERS

Basic concepts of feedback – Positive Feedback – Negative Feedback – Effects of Negative Feedback on Gain, Bandwidth and Distortion – Noise – Voltage Series Feedback - Voltage Shunt Feedback – Current Series Feedback – Current Shunt Feedback.

UNIT-IV DIGITAL CIRCUITS

Register Transfer levels: Register transfer level notion, Register transfer level in HDL, Algorithm, State machine, Design Example, HDL Description of Design, Examples, Binary Multiplier.

UNIT-V MEMORY ORGANIZATION

Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map. Memory Architecture, Memory hierarchy, Types of Memories, Data Read/ Write process, Vertical and Horizontal Memory Expansion, Role of Cache memory, Virtual Memory.

TEXT BOOKS

1. Malvino and Leach. (2002). *Digital Principles and Applications* (5th ed.). Tata McGraw-Hill.
2. M. Morris Mano. (2000). *Digital Logic and Computer Design*. PHI Learning.

REFERENCE BOOKS

1. T. M. Floyd and R. P. Jain. *Digital Fundamentals*. Pearson Education.
2. John F. Wakerley. (3rd ed.). *Digital Design: Principles and Practice*. Pearson Education.
3. R. P. Jain. *Digital Electronics*. Tata McGraw-Hill.
4. William Stallings. (10th ed.). *Computer Organization and Architecture*. Pearson Education.

WEB RESOURSES

1. **https://youtu.be/m4sjTt7rhow**
2. **https://youtu.be/as1lc9u96jI**
3. **https://youtu.be/jKezEWNcut0**
4. **https://youtu.be/as1lc9u96jI**

APPLIED PRACTICAL

DIGITAL ELECTRONICS LAB

CONTACT HOURS/WEEK: 4 **CREDIT: 2**

INTERNAL MARKS: 40 **EXTERNAL MARKS: 60**

COURSE CODE: 24UPH352

COURSE OVERVIEW:

To provide hands-on experience with digital electronic circuits, enabling students to understand the practical implementation of theoretical digital concepts such as logic gates, combinational and sequential circuits, and digital system design.

COURSE OBJECTIVES:

To perform basic experiments on characteristics of electronic devices and then get into the applications such as amplifiers, oscillators.

Pre requisite:

The students ought to have understanding of Basic knowledge of digital electronics theory (gates, Boolean algebra, number systems)

Course Outcomes:

CO.NO	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	COGNITIVE LEVEL
CO1	Perform and analyze the characteristics of semiconductor devices such as diodes, transistors, FETs, LEDs, photodiodes, LDRs, and solar cells.	**K4**
CO2	Analyze the resonance behavior of AC circuits containing R, L, and C components.	**K4**
CO3	Construct and test operational amplifier circuits for various applications.	**K3**
CO4	Verify the operation of logic gates and universal gates using ICs and discrete components.	**K3**
CO5	Design and verify combinational logic circuits and Boolean theorems using digital ICs.	**K4**

EXPERIMENTS:

1. Semi-Conductor diode - Characteristics.
2. Zener diode – Characteristics.
3. FET- Characteristics.
4. Transistor Characteristics - CE configuration.
5. Transistor Characteristics-CB Configuration.

6. AC circuits with L,C,R -Series resonance
7. AC circuits with L,C,R -Parallel resonance
8. Operational amplifier - inverting amplifier and summing.
9. Operational amplifier – non-inverting amplifier and summing
10. Characteristics of LED.
11. Characteristics of Photo Diode.
12. Characteristics of LDR.
13. Characteristics of Solar Cell.
14. Logic Gates (AND, OR, NOT, NAND, NOR) Using IC's. -Verification of truth tables.
15. Verify NAND as Universal Gates using IC's.
16. Verification of De-Morgan's Theorems.
17. Half Adder and Half Subtractor using IC's.
18. Full Adder and Full Subtractor using logic IC's.
19. Verify NOR as Universal Gates using IC's.
20. Logic Gates (AND, OR, NOT) Using Discrete's. Components–Verification of truth tables.

REFERENCES:

1. Department of Physics. (2009). *Practical Physics (B.Sc. Physics Main)*. St. Joseph's College, Tiruchirappalli.
2. Dr. S. Somasundaram. (2012). *Practical Physics*. Apsara Publications, Tiruchirappalli.
3. M. N. Srinivasan, S. Balasubramanian, and R. Renganathan. (2000). *A Textbook of Practical Physics*. Sultan Chand & Sons, New Delhi.