

Semester I

PH25C01	Applied Physics – I	L	T	P	C
		2	0	2	3
Course Objective(s): <ul style="list-style-type: none"> To impart knowledge and expose the essentials of physics in various engineering applications. 					
<p>Properties of Matter: Elasticity, Cantilever, Young's modulus (non-uniform bending), Girders: Bridges and buildings, Viscosity: Stokes method, Surface tension: drop weight method, Thermal expansion, Thermal stress, Bimetallic strips, Expansion joints</p> <p>Practical: Non-Uniform bending, Young's modulus of the material, Torsional pendulum, Rigidity modulus of the wire and moment of inertia of the disc.</p> <p>Activities: Virtual demonstration of thermal stress.</p>					
<p>Oscillations: Simple Harmonic motion, Torsional pendulum, Couple per unit twist, Damped and Forced Oscillation</p> <p>Waves: Waves on a stretched string, Energy and Power, standing waves, Ultrasonics, piezo, electric method, Acoustic grating, Electromagnetic waves: Maxwell equation, Production of EM waves by dipole antenna, Propagation of EM waves in free space, wave equation, Cell phone reception</p> <p>Practical: Melde's string experiment – Frequency of an electrically vibrating metal tip.</p> <p>Activities: Virtual demonstration of propagation of EM waves</p>					
<p>Quantum Mechanics: Black body radiation, Photoelectric effect, de Broglie hypothesis, Schrodinger Wave equation, Particle in a box (infinite potential well - three-dimensional box), Barrier penetration and quantum tunnelling.</p> <p>Practical: Photo-electric effect, Determination of Planck's constant.</p> <p>Activities: Virtual demonstration of Scanning Transmission Electron Microscope</p>					
<p>Applied Optics: Interference: Air wedge, Michelson's Interferometer, Fiber optics: Structure of a fiber, Fiber Optic Communication System, Fiber Sensors (Virtual demo), Displacement, pressure sensor and Temperature sensor, Einstein Co-efficient, Nd:YAG laser, CO₂ laser (construction, functioning and applications), dye laser</p> <p>Practical: Ruling width of Compact disc using Laser, Thickness of a thin sheet/wire using Air wedge Method.</p> <p>Activities: Demonstration of sensors and applications of Lasers</p>					
<p>Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%</p>					
<p>Assessment Methodology: Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)</p>					

References:

1. Young, H. D., & Freedman, R. A. (2020). University physics with modern physics. Pearson.
2. Gaur, R. K., & Gupta, S. L. (2022). Engineering physics. Dhanpat Rai Publications.
3. Mathur, D. S. (2010). Elements of properties of matter. S. Chand Publishing.
4. Griffiths, D. J. (2018). Introduction to quantum mechanics. Cambridge University Press.
5. Silfvast, W. T. (2008). Laser fundamentals. Cambridge University Press.

E-Resources:

1. Barrier penetration problem and Quantum tunnelling:
<https://archive.nptel.ac.in/courses/115/104/115104096/>
2. EM waves and wireless channelling:
https://onlinecourses.nptel.ac.in/noc24_ee31/preview
3. CO2 Laser: https://onlinecourses.nptel.ac.in/noc25_ph03/preview
4. Bimetallic Strips _ <https://www.youtube.com/watch?v=WZQ8lvxdzDk>
5. Cell phone Reception_ https://www.youtube.com/watch?v=1JZG9x_VOwA
6. Dipole Antenna_ <https://www.youtube.com/watch?v=4xF1Fq2wB1I>
7. Optical Sensors_ <https://auece.digimat.in/nptel/courses/video/108106173/L02.html>
8. Scanning Tunnelling Electron Microscope_
<https://www.youtube.com/watch?v=XNYZYbXNWQA>

	Description of CO	PO	PSO1	PSO2	PSO3
CO1	Explain the physics concepts in various applications.	---			
CO2	Apply the principles of wave optics and laser physics in practical systems.	PO1(3)			
CO3	Analyse the behaviour of materials under different conditions.	PO2(2)			
CO4	Conduct experiments in groups and interpret the data.	PO4(3) PO8(1)			

Semester II

PH25C03	Applied Physics (CSIE) – II	L	T	P	C
		2	1	0	3
Course Objectives: <ul style="list-style-type: none"> To provide a comprehensive understanding of physics concepts in computer science and engineering applications. 					
Magnetic Materials: Parameters, Ferromagnetic materials, Ferrites - Soft and Hard magnetic materials – GMR sensors - magnetic disk memories – Principle of magnetic recording – Magnetic data storage. Activities: Determination of Hysteresis loop for ferromagnetic materials.					
Logic Gates: Conversion of Binary to decimal - decimal to binary – binary coded decimal code-logic gates (OR, AND, NOT, NAND and NOR)–Exclusive OR gate-simplification based on basic Boolean theorems (sum of products, product of sums expression)- simplification by Karnaugh Map method (don't care conditions). Activities: Virtual demonstration of Logic Gates.					
Nano-Devices: Introduction – electron density in bulk material – size dependence of Fermi energy-quantum confinement – quantum structures: quantum wells, wires and dots – band gap of nanomaterials. Tunneling- Coulomb blockade - single electron transistor - resonant-tunneling diode- Carbon nanotubes: Properties and applications. Activities: Virtual demonstration of single electron transistor					
Quantum Computing: Quantum system for information processing - quantum states – classical bits – quantum bits or qubits – Bloch sphere -CNOT gate – Single and multiple qubits – quantum gates (Pauli – X, Y and Z Gates, Hadamard Gate, Phase gate - T gate .CNOT Gate) – advantage of quantum computing over classical computing. Activities: Virtual demonstration of quantum computing					
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%					
Assessment Methodology: Quiz (10%), Assignments (30%), Flipped Class (10%), Internal Examinations (50%)					
References: <ol style="list-style-type: none"> Kasap, S. O. (2007). Principles of electronic materials and devices. McGraw-Hill Education. Bernhardt, C. (2019). Quantum computing for everyone. MIT Press. Hanson, G. W. (2009). Fundamentals of nanoelectronics. Pearson Education. 					
E-Resources: <ol style="list-style-type: none"> Single electron Transistor: https://youtu.be/MTT729LtB-o?si=RGaEhGgmyWJWcZib Basics of quantum computing- https://lab.quantumflytrap.com 					

3. Single electron transistor - <http://vlabs.iitkgp.ac.in/tcad>
4. Quantum Computing:
<http://www.digimat.in/nptel/courses/video/106106232/L01.html>
5. Review article: Claude Chappert, Albert Fert and Frédéric Nguyen Van Dau, "The emergence of spin electronics in data storage" Nature Publishing 2007

	Description of CO	PO	PSO1	PSO2	PSO3
CO1	Explain the concepts of physics in computer science stream.	---			
CO2	Apply appropriate techniques in physics to solve engineering problems.	PO1(3)			
CO3	Analyse physical systems and interpret data from the virtual studies in the core branches in computer science and engineering.	PO2(2)			

PH25C05	Applied Physics (ME) – II	L	T	P	C
		2	1	0	3
Course Objective(s): <ul style="list-style-type: none"> To impart fundamental knowledge of rigid body dynamics, thermal physics, phase transitions, and functional materials. To provide analytical abilities for evaluating physical phenomena in mechanical engineering applications. 					
Rigid Body Dynamics: Centre of mass – Moment of inertia (circular disc, solid cylinder, hollow cylinder, solid sphere, hollow sphere), Gear, shaft, gyroscope Activities: Demonstration of moment of inertia of Gear, shafts and Gyroscopes.					
Thermal Physics: Thermal conductivity –Transient plane source method, Transient Line Source method- Forbe’s method - conduction through compound media, Laws of Thermodynamics . Activities: Demonstration of thermal conductivity of insulators					
Phase Transitions: Solid solutions - single component system, binary phase diagrams - iron-carbon equilibrium diagram, T-T-T-diagram - heat treatment of steels – hardening techniques Activities: Demonstration of Hardening of steels					
Functional Materials: Ceramics – Composites, Fiber Reinforced Plastics, Metallic Glasses, LED Characteristics Activities: Demonstration of LED working and its characteristics.					
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%					
Assessment Methodology: Quiz (10%), Assignments (30%), Flipped Class (10%), Internal Examinations (50%)					
References: <ol style="list-style-type: none"> Mathur, D. S. (2008). <i>Elements of properties of matter</i>. S. Chand. Brij Lal, & Subramaniam, N. (2018). <i>Heat, thermodynamics and statistical physics</i>. S. Chand. Raghavan, V. (2009). <i>Physical metallurgy: Principles and practice</i>. PHI Learning. Askeland, D. (2010). <i>Materials science and engineering</i>. Brooks/Cole. 					
E-resources: <ol style="list-style-type: none"> Moment of Inertia: https://youtu.be/fDJevR0o__w Conduction: http://kcl.digimat.in/nptel/courses/video/112106155/L32.html Iron –Carbon phase diagram - https://archive.nptel.ac.in/courses/113/104/113104068/ Gyroscope_ https://www.youtube.com/watch?v=FydJu1A1oeM gyroscope-131127011945-phpapp02.pdf Hardening Techniques_ https://www.youtube.com/watch?v=ckCN9jGsdUY LED Characteristics - https://youtu.be/lgapvczVyXs_ 					

	Description of CO	PO	PSO1	PSO2	PSO3
CO1	Explain the concepts of physics in mechanical engineering stream.	---			
CO2	Apply appropriate techniques in physics to solve engineering problems.	PO1(3)			
CO3	Analyse physical systems and interpret data from the virtual studies in the core branches in mechanical engineering.	PO2(2)			

PH25C04	Applied Physics (EE) – II	L	T	P	C
		2	1	0	3
Course Objectives: <ul style="list-style-type: none"> To impart knowledge on physics concepts and explore the potential applications in the field of electrical engineering. 					
Semiconductor Materials: Intrinsic and Extrinsic Semiconductors, Carrier Concentration- Fermi level, Dependence on carrier-concentration and temperature, Carrier generation and recombination, Carrier transport: diffusion and drift, Hall Effect, Applications, Metal-semiconductor junction (Ohmic and Schottky) <p>Activities: Determination of Hall coefficient</p>					
Dielectrics Materials: Dielectric polarization under static fields - electronic, ionic and dipolar polarizations-internal fields in solid-Clausius-Mossotti equation, Behavior of dielectrics in alternating fields- Application of dielectrics in transformers-Capacitor materials, Ferro and piezo materials- Complex dielectric permittivity-dipolar relaxation- dielectric loss, Applications. <p>Activities: Measurement of Dielectric Constant of different materials</p>					
Magnetic Materials: Magnetic material parameters, Ferromagnetic materials, Ferrites - Soft and Hard magnetic materials, GMR sensors, magnetic disk memories, Principle of magnetic recording, Materials for magnetic data storage. <p>Activities: Determination of Hysteresis loop for a ferromagnetic material (B-H curve)</p>					
Advanced Materials: Thermocouple, bimetals, leads soldering and fuses Materials – their applications <p>Activities: Virtual demonstration of working of various types of thermocouples.</p>					
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%					
Assessment Methodology: Quiz (10%), Assignments (30%), Flipped Class (10%), Internal Examinations (50%)					
References: <ol style="list-style-type: none"> Kasap, S. O. (2007). Principles of electronic materials and devices. McGraw-Hill Education. Callister, W. D., & Rethwisch, D. G. (2014). Materials science and engineering. John Wiley & Sons. Indulkar, C. S., & Thiruvengadam, S. (n.d.). An introduction to electrical engineering materials. S. Chand. 					
E-Resources: <ol style="list-style-type: none"> The emergence of spin electronics in data storage -Claude Chappert, Albert Fert and Frédéric Nguyen Van Dau, Nature Publishing Group 2007 					

2. Hall Effect - <https://ssp-amrt.vlabs.ac.in/exp/hall-effect-charge-carrier/simulation.html>
3. Magnetic Susceptibility – <https://em-amrt.vlabs.ac.in/exp/quinckes-method>
4. NPTEL : NOC:Nanophotonics, Plasmonics, and Metamaterials.

	Description of CO	PO	PSO1	PSO2	PSO3
CO1	Explain the concepts of physics in electrical engineering stream.	---			
CO2	Apply appropriate techniques in physics to solve engineering problems.	PO1(3)			
CO3	Analyse physical systems and interpret data from the virtual studies in the core branches in electrical engineering.	PO2(2)			