Scheme Structure for Physics Courses

Academic Year: 2026-27

	I/II SEMESTER										
Sl.No	**Course Category**	**Course Code**	**Course Title**	**Teaching Hours per Semester**					**Weightage of Exam Marks**			**Credits**
				L	**T**	**P**	**TW + SL**	**Total**	**CIE**	**SEE**	**Total**	
1	BSC	**PHY6C12/22**	**Physics for Civil Engineering**	42	14	28	36	**120**	50	50	100	**4**
2	BSC	PHY6M12/22	**Physics for Mechanical Engineering Stream**	42	14	28	36	**120**	50	50	100	**4**
3	BSC	PHY6E12/22	**Physics for Electronics and Electrical Engineering Stream**	42	14	28	36	**120**	50	50	100	**4**
4	BSC	**PHY6S12/22**	**Physics for Computer Engineering Stream**	42	14	28	36	**120**	50	50	100	**4**

L: Lecture, T-Tutorial, P: Practical, TW:Term work (includes assignments, seminars, microprojects, industrial visits, any other student activities, etc.) SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.

Course Title	PHYSICS FOR CIVIL ENGINEERING		
Course Code	PHY6C12/22	(L-T-P) C	(3-1-2)4
Exam	3 hours	Hours/Week	06
SEE	100 marks	Total Hours (L+T+P+TW+SL)	120

Course Objective:

The objective of the course is to make students learn principles and theories of physics in civil engineering field and to develop effective solutions for civil engineering problems.

Course Outcomes:Upon completion of the course, students shall be able to

#	Course Outcomes	Mapping to PO's	Mappin PSO's
1	Interpret fundamental concepts of physics to analyze vibrations, rigid body dynamics, crystallography, photonics, Acoustics and shock waves.	1	
2	Apply theoretical principles to understand and solve problems related to rigid body dynamics, crystal structures, photonic systems, lasers, and Acoustics.	1	
3	Solve problems related to the applications of material science, crystallography, photonics, and Acoustics.	1	
4	Discuss collaboratively in groups to conduct experiments, analyze results, and effectively communicate findings through presentations	1, 8, 9	

MODULE-1	10Hrs.

Vibrations and Rigid Body Dynamics.

Pre-requisites:Fundamentals of Newtonian Mechanics.

Free vibrations. Damped vibrations-derivation of expressions for displacement of damped harmonic motion. Discussion of types of damped vibrations. Forced vibrations-derivation of expression for amplitude and phase-variation with frequency, Resonance. Condition for amplitude resonance. Consequences of resonance. Spring mass and its applications

Rigid body. Moment of inertia. Torsional pendulum-derivation of expression for time period of oscillation. Mention its uses. Bending of beams- derivation of expression for bending moment of a beam. Cantilever-derivation for depression of loaded end of a single cantilever. Applications of cantilevers.

Self-learning component: Simple Harmonic Vibrations.

Numerical problems *on amplitude and phase of forced vibrations, time-period of oscillation, bending moment and Young's Modulus/depression of a cantilever*.

MODULE-2	10Hrs.

Acoustics and Ultrasonics.

Pre-requisites:Fundamentals of Sound.

Acoustics; Introduction to acoustics, Types of Acoustics, reverberation and reverberation time, absorption power and absorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (No derivation), Eyring's formula (No derivation). Comparison of Eyring's and Sabine's formula, measurement of absorption coefficient, factors affecting the acoustics and remedial measures, Noise and its Insulation,

Ultrasonics. Non-destructive testing of materials using ultrasonics. Measurement of velocity of ultrasonic waves and elastic constants in solids and liquids. List of application of ultrasonics, detection of cracks in metal blocks, kill bacteria in liquid, medical field, Determining the depth of the sea.

Self-learning; Production of Ultrasonic waves.

Numerical Problems *on reverberation time, absorption power and absorption coefficient, Sabine's formula, Eyring's formula*.

MODULE-3	**10Hrs.**

Photonics.

Pre-requisites: Geometrical optics, physical science of light waves

Interaction of radiation with matter. Expression for energy density in terms of Einstein's coefficients. Requisites of a Laser system. Conditions for laser action. Types of laser sources. Ruby laser, CO2 laser, Semiconductor laser. Advantages and disadvantages of above laser sources. Holography. Qualitative discussion of measurement of pollutants (LIDAR),LASER Range Finder, Speed Checker, laser cutting, laserdrilling, laser welding,List of other applications: laser-guided missiles, Bridge Deflection ,Road Profiling.

Self-learning: Characteristics of Laser

Numerical problems *on Boltzmann factor, Energy density, number of photons*.

MODULE-4	**10Hrs**

Crystallography.

Pre-requisites: States of matter, Classifications of solids

Introduction to crystalline solids. Space lattice, Bravais lattice–unit cell, primitive cell. Lattice parameters. Directions and planes, Miller indices. Expression for interplanar spacing. Coordination number. Atomic packing factors (SC, FCC, BCC). Density of a unit cell. Production of X-ray, Bragg's law and Bragg's spectrometer. XRD-application in material characterization.

Shock waves: Mach number and Mach Angle, Definition and Characteristics of Shock waves, Construction and working of Reddy Shock tube, List of applications of Shock Waves,

Self-learning: 7 basic crystal systems.

Numerical problems *on Miller indices, Interplanar space. Bragg's law, Mach number*

List of experiments (to conduct any 10)

1. Measurement of electrical resistivity and energy gap of a semiconductor using four probe technique.
2. Determination of dielectric constant by charging and discharging of a capacitor.
3. Determination of wavelength of LASER by diffraction technique.
4. Verification of Stefan's law of radiation.
5. Determination of Planck's constant using Light Emitting Diodes.
6. Estimation of frequencies of vibrating string and AC using Sonometer.
7. Determination of resonance frequency and inductance using LCR circuits.
8. Determination of Young's modulus using single cantilever.
9. Determination of moment of inertia of rigid bodies and rigidity modulus of a string using torsion pendulum.
10. Determination of numerical aperture and modes of transmission of optical fiber.
11. Determination of Fermi energy of given material.
12. Determination of Mach number by using Reddy shock tube.

Prescribed Textbooks:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Engineering physics	R K Gaur and S L Gupta,ISBN: 9788189928223	Eleventh Edition,	Dhan pat Rai Publishing Company (P) Ltd.	2011
2	Solid state physics.	S.O.Pillai, ISBN-10: 9386070928,	Eighth edition,	New Age International Pvt. Ltd,	2018
3	Engineering physics Lab Manual	Faculty of Department of Physics	1	Department of Physics, Malnad College of Engineering, Hassan	2025

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Shock waves made simple.	Chin too S Kumar, K Takayama and K P J Reddy:	New	Willey India Pvt. Ltd, Delhi	2014

2	A Textbook of Engineering Physics	M.N. Avadhanulu and P.G. Kshirsagar,	10th revised Ed,	S. Chand. & Company Ltd, New Delhi	2018	
3	Lasers and Non Linear Optics	B.B Laud	3rd Ed	New Age International Pvt. Ltd,	2011	

Online Courses and Video Lectures:

1. **https://onlinecourses.nptel.ac.in/noc23_ee84/preview**
2. **https://onlinecourses.nptel.ac.in/noc23_cy37/preview**

Course Articulation Matrix

Course Outcomes	**Program Outcomes [POs]**										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**)1 1**
CO1	3										
CO2	3										
CO3	3										
CO4	3							1	1		

Course Title	PHYSICS FOR MECHANICAL ENGINEERING STREAM		
Course Code	PHY6M12/22	(L-T-P) C	(3-1-2)4
EXAM	3 Hours	Hours/Week	6
SEE	100 marks	Total Hours (L+T+P+TW+SL)	120

Course Objective:

The objective of the course is to make students learn principles and theories of physics in the Mechanical engineering field and to develop effective solutions for engineering problems.

Course Outcomes:

Upon completion of the course, students shall be able to

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Interpret fundamental concepts of physics to analyze vibrations, rigid body dynamics, crystallography, photonics, and thermoelectric phenomena.	1	-
2	Apply theoretical principles to understand and solve problems related to rigid body dynamics, crystal structures, photonic systems, lasers, and thermoelectric materials.	1	-
3	Solve problems related to the applications of material science, crystallography, photonics, and thermoelectric devices in engineering	1	-
4	Work collaboratively in groups to conduct experiments, analyze results, and effectively communicate findings through presentations	1, 8, 9	-

MODULE-1	10 hours

Vibrations and Rigid Body Dynamics

Prerequisites: Basics of Mechanics, Oscillations, and Differential equations.

Simple harmonic vibrations. Free vibrations. Damped vibrations-derivation of expressions for displacement of damped harmonic motion. Discussion of types of damped vibrations. Forced vibrations-derivation of expression for amplitude and phase-variation with frequency. Resonance. Condition for amplitude resonance. Applications of resonance,spring mass and its applications.

Rigid body. Moment of inertia. Torsional pendulum-derivation of expression for time of oscillation. Applications in automotive engineering and robotics (moment of inertia of rotating parts like wheels, axles and design of rotating machinery and structural elements). Bending of beams- derivation of expression for bending moment of a beam. Cantilever-derivation for depression of loaded end of a

single cantilever. Application: Cantilever beams in cranes and wings of airplanes.

Self-learning topics: Fundamentals of Elasticity.

Numerical problems *on Amplitude and phase of forced vibrations, time-period of oscillation, bending moment and Young's Modulus/depression of a cantilever.*

MODULE-2	**10 hours**

Crystallography

Pre-requisites: Basic understanding of Atomic structure, Wave-particle duality, and Geometry

Space lattice, Bravais lattice–unit cell, primitive cell. Lattice parameters. Directions and planes, Miller indices. Expression for interplanar spacing. Coordination number. Atomic packing factors (SC, FCC, BCC). Density of a unit cell. X-rays and their types. Bragg's law. Bragg's X-ray spectrometer for identification of crystal structure. Importance of X-ray diffraction in material characterisation. de Broglie's concept of matter waves. Diffraction of matter waves-Davisson-Germer experiment, application of diffraction of X-rays and electrons inadvent of nanotechnology and material characterization-Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM).

Self-learning topics: 7 basic crystal systems

Numerical problems on de Broglie's equation Miller indices, Interplanar space, Bragg's law.

MODULE-3	**10 hours**

Photonics

Pre-requisites: Fundamentals of electromagnetic waves and geometrical optics.

Interaction of radiation with matter. Expression for energy density in terms of Einstein's coefficients. Requisites of a Laser system. Conditions for laser action. Types of laser sources (to list out Solid, Gas and Semiconductor lasers and to list the contrast between them). CO_2 laser –construction and working. Industrial applications of laser: laser cutting, laser drilling, laser welding and laser assisted ultrasonics of finding defects in materials

Optical fibres. Construction and principle. Ray propagation mechanism. Angle of acceptance and numerical aperture - their relationship with refractive indices of core and clad and condition for ray propagation. Modes of transmission: V-number and number of modes, Types of optical fibres, Merits and demerits of optical fibres. Applications: Optical fiber sensors and industrial endoscopy.

Self-learning topics: Identification of other applications: Bar Code scanner, Laser Printer, Laser Cooling, laser fencing, laser-guided missiles, LASER Range Finder, Road Profiling, Bridge Deflection, Speed Checker.

Numerical problems *on Boltzmann factor, Numerical aperture, V-number and number of modes*.

MODULE-4	**10 hours**

Thermoelectric materials and devices

Pre-requisites: Fundamentals of thermodynamics.

Thermoelectric phenomena. Thermo emf and thermo current, Seebeck effect. Variation of thermo emf with temperature, Peltier effect, Seebeck, Peltier and Thomson coefficients (Mention Expression), laws of thermoelectricity. Experimental demonstration of Peltier effect. Explanation of thermo emf based on Peltier effect. Thermo-electric power. Construction and Working of Thermoelectric generators (General). Construction and working of Thermoelectric coolers (Refrigerators), Construction and working of Exhaust (Automobiles). Applications: Temperature sensors: Resistance Temperature Detector (RTD), Thermistor, Thermocouple, waste heat recovery.

Self-learning topics: Renewable energy sources from heat

Numerical Problems *on thermoelectric coefficients*.

List of experiments (to conduct any 10)

1. .Measurement of electrical resistivity and energy gap of a semiconductor using four probe technique.
2. Determination of dielectric constant by charging and discharging of a capacitor.
3. Determination of wavelength of LASER by diffraction technique.
4. Verification of Stefan's law of radiation.
5. Determination of Planck's constant using Light Emitting Diodes.
6. Estimation of frequencies of vibrating string and AC using Sonometer.
7. Determination of resonance frequency and inductance using LCR circuits.
8. Determination of Young's modulus using single cantilever.
9. Determination of moment of inertia of rigid bodies and rigidity modulus of a string using torsion pendulum.
10. Determination of numerical aperture and modes of transmission of optical fiber.
11. Spring constant
12. Fermi energy of copper
13. Measurement of Mach number using Reddy Shock tube

Prescribed Text Books:

Sl.No	BookTitle	Authors	Edition	Publisher	Year
1	Engineering physics	R K Gaur and S L Gupta, ISBN: 9788189928223, Dhanpat Rai	second	(P) Ltd. Edition	2011
2	Solid state physics	S O Pillai, physicsISBN-10: 9386070928	Eighth edition	New Age Internation	9 January 2018.

				al Pvt. Ltd,	
3	Engineering physics Lab Manual	Faculty of Department of Physics	1	Department of Physics, Malnad College of Engineering, Hassan	2025

Reference Books:

Sl.No	BookTitle	Authors	Edition	Publisher	Year
1	Fiber Optics	A K Ghatak and K Thyagarajan ISBN-13: 978-0521577854	2	Cambridge University Press India Pvt. Limited	1998
2	NPTEL courses on Engineering physics	E-resources			
3	Heat, Thermodynamics and Statistical Physics	Singal, Agarwal and Prakash ISBN-13-9789350065235	New	Pragati Prakashan, India	2017
4	Heat and thermodynamics	Brijlal N Subramanyam ISBN: 81-219-2813-3 S.	new	Chand and Co. Ltd. New Delhi,	2007

E Books and online course materials:

https://onlinecourses.nptel.ac.in/noc23_ee84/preview

https://onlinecourses.nptel.ac.in/noc23_cy37/preview

Online Courses and Video Lectures:

https://youtu.be/ASOcMmPCLhU

https://youtu.be/pJm1B-||_OE

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**
CO1	3										
CO2	3										
CO3	3										
CO4	3							1	1		

Course Title	PHYSICS FOR ELECTRONICS AND ELECTRICAL ENGINEERING STREAM		
Course Code	PHY6E12/22	**(L-T-P) C**	(3-1-2)4
Exam	3hour	**Hours/Week**	06
SEE	**100 marks**	**Total Hours (L+T+P+TW+SL)**	**120**

Course Objective:

Objective of the course is to make students learn principles and theories of physics in electronics and electrical engineering fields and to develop effective solutions for engineering problems.

Course Outcomes: Upon completion of the course students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Interpret theories of materials science, photonics and quantum mechanics	1	-
2	Identify applications of materials science, photonics and quantum mechanics.	1	-
3	Solve problems on materials science, lasers, optical fibers and quantum mechanics.	1	-
4	Realise the concepts, laws and properties of materials, photonics and quantum behaviour of matter through experiments.	1,8,9	

MODULE-1	10Hrs.

Electrical Properties of Solids

Pre-requisites: States of Matter and their properties

Free electron theories: Free electrons in metals. Drift velocity, Mean free path, Mean collision time, Relaxation time. Classical free electron theory-assumptions. Expression for electrical conductivity in metals. Failures of classical free electron theory. Quantum free electron theory–assumptions. Fermi energy. Fermi-Dirac distribution function (Fermi factor). Merits of quantum free electron theory. Effects of impurity and temperature on electrical resistivity of metals. Applications(Qualitative discussion); Designing electrical interconnects, PCBs, conductor materials, optoelectronic components-photodetectors, thermal solutions for electronics-heat sinks.

Semiconductors:Effects of impurity and temperature on electrical resistivity of semiconductors. Electrical conductivity of a semiconductor (derivation). List of Applications: Diodes, Transistors,

Integrated Circuits (ICs), Sensors, and in Electric Motor Control, Smart Grids and Power Monitoring, Electric Vehicles (EVs).

Self-learning topics: Band theory of solids and classification of semiconductors.

Numerical problems *on electron concentration, electrical conductivity, resistivity, Fermi factor, Fermi energy.*

MODULE-2	**10Hrs.**

Dielectrics and Superconductors

Pre-requisites: Distinction between different types of materials.

Dielectric materials:Classification: polar and nonpolar dielectrics. Relative permittivity (dielectric constant), Polarization and its types. Frequency dependence of polarizability and permittivity. Expression for internal field. Clausius-Mossotti equation. Dielectric loss and loss tangent, Dielectric strength and breakdown. Ferroelectric and Piezoelectric Materials. Applications(Qualitative); Energy storage devices, transformers, PCBs, RF and Microwave Components.

Superconductors: Temperature dependence of electrical resistivity in superconductors. Meissner effect. Critical magnetic field.Critical current. Type I and Type II superconductors. BCS Theory. High temperature superconductors. Applications; Discussion of superconducting magnets, MRI and SQUID, Identification of other applications; LosslessPower Transmission and Distribution, Superconducting Filters and Amplifiers, Quantum Technology, Generators and Maglev Vehicle.

Self-learning topics: Types of Dielectric Materials-Solid, Liquid, and Gaseous Dielectrics.

Numerical problems *on dielectric constant, internal field, Clausius-Mossotti equation, critical currentand critical magnetic field*.

MODULE-3	**10Hrs.**

Photonics

Pre-requisites: Fundamentals of Geometrical optics

LASER: Interaction of radiation with matter. Expression for energy density in terms of Einstein's coefficients. Requisites of a Laser system. Conditions for laser action. Types of laser sources (to list out Solid, Gas and Semiconductor lasers and to list the contrast between them). CO_2 laser –construction and working, Applications:LIDAR-Measurement of pollutants (qualitative), Identification of other applications: laser cutting, laser drilling, laser welding, Mention of Communication Systems, Measurements and Instrumentation, Testing and Inspection, Power Systems, Consumer Electronics Devices, Remote Sensing.

Optical fibers: Construction and principle. Ray propagation mechanism. Angle of acceptance and numerical aperture - their relationship with refractive indices of core and clad and condition for ray

propagation. Modes of transmission: V-number and number of modes, Types of optical fibres, Attenuation. Applications: Discussion of Fiber Optic Communication, identification of other applications-Electrical Power Systems, Measurement and Instrumentation. Lighting and Displays, Embedded Sensing in Smart Systems, Electromagnetic Isolation. Merits and demerits of optical fibers.

Self-learning topics:Analog vs Digital Transmission.

Numerical problem*s on energy, Boltzmann factor, V-number, Numerical aperture, and attenuation.*

MODULE-4	**10Hrs**

Quantum Communication

Pre-requisites: Modes of transfer of thermal energy

Black body. Black body radiation spectrum, Wien's law and Rayleigh Jeans law. Planck's law. Dual nature of matter-Louis de Broglie hypothesis of matter waves. Group velocity, phase velocity, particle velocityand their relation with velocity of light (no derivations). Expression for de Broglie wavelength of electron. Characteristics of matter waves. Schrodinger wave equation. Max Born's interpretation of wave function. Application of Schrodinger wave equation to find eigen values and eigen functions for a trapped particle. Discussion of probability density for different quantum states and advent to quantum computing and communication.

Classical bits and Qubits; Definitions of their types; SQUID, Photonic, NMR, Ion trap. Heisenberg's uncertainty principle. Quantum tunneling, Quantum superposition, Quantum entanglement. Quantum Communication- Quantum Teleportation. Features, Challenges, and Future Prospects of quantum communication: Quantum key distribution. Quantum repeater. Quantum internet. Quantum Satellite Communication (Qualitative).

Self-learning Topics:Application of Schrodinger wave equation to find eigen values and eigen functions for a free particle.

Numerical problems *on Louis de Broglie equations, group velocity, phase velocity and Eigenvalue equation.*

SN	**Experiments (to conduct any 10)**
1	Measurement of electrical resistivity and energy gap of a semiconductor using four prob technique
2	To determine the **resistivity (ρ)** and **conductivity (σ)** of a given metallic wire using i resistance, length, and cross-sectional area.
3	Determination of dielectric constant by charging and discharging of a capacitor.

4	Determination of wavelength of LASER by diffraction technique
5	Verification of Stefan's law of radiation
6	Determination of Planck's constant using Light Emitting Diodes
7	Estimation of frequencies of vibrating string and AC using Sonometer
8	Determination of resonance frequency and inductance using LCR circuits.
9	Determination of Young's modulus using single cantilever
10	Determination of moment of inertia of rigid bodies and rigidity modulus of a string using torsion pendulum.
11	Determination of numerical aperture and modes of transmission of optical fiber
12	Determination of quantum circuit under black box using the output (only 5 circuits).
13	I-V Characteristics of zener diode

Prescribed Textbooks:

Sl.No	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**
1	Engineering physics	R K Gaur and S L Gupta ISBN: 9788189928223	2022	Dhanpat Rai Publishing Company	2022
2	Solid state physics	S O Pillai ISBN-10: 9386070928	Eighth edition	New Age International Pvt. Ltd	2018
3	Quantum Computation and Quantum Information	Michael A. Nielsen & Isaac L. Chuang	10thAnniversary Edition	Cambridge University Press	2012
4	Engineering physics Lab Manual	Faculty of Department of Physics	1	Department of Physics, Malnad College of Engineering, Hassan	2025

Reference Books:

Sl. No	BookTitle	Authors	Edition	Publisher	Year
1	Modern Physics	Kenneth S. Krane, ISBN-13: 9781118061145,	3	John Wiley & Sons	2012
2	Lasers and non-linear optics	B.B. Laud, ISBN: 9788122430561	3	New Age International Private Limited	2015
3	Fiber Optics	A K Ghatak and K Thyagarajan, *ISBN-13: 978-1-4039-3011-8, ISBN: 1-4039-3011-2*	2	Macmillan/Laxmi Publications (P) Ltd., New Delhi	2006

E Books and online course materials:

1. https://onlinecourses.nptel.ac.in/noc23_ee84/preview
2. https://onlinecourses.nptel.ac.in/noc23_ph36/preview

Online Courses and Video Lectures:

https://www.coursera.org/search?query=engineering%20physics&topic=Physical%20Science%

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1
CO1	3										
CO2	3										
CO3	3										
CO4	3							1	1		

Course Title	PHYSICS FOR COMPUTER ENGINEERING STREAM		
Course Code	PHY6S12/22	(L-T-P) C	(3-1-2) 4
Exam	3 hour	Hours/Week	06
SEE	100 marks	Total Hours (L+T+P+TW+SL)	120

Course Objective: The objective of the course is to enable students to learn the principles and theories of physics relevant to computer science and allied engineering fields, forming a foundation towards developing effective engineering solutions.

Course Outcomes: Upon completion of the course the students will be able to

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Discuss the working principles of quantum and classical physics, LASERs, optical fibers, and their applications in photonic systems.	1	-
2	Apply principles of photonics, classical and quantum mechanics in deriving relations between physical quantities and properties.	1	-
3	Solve the problems pertaining to photonics, classical and quantum properties of materials.	1	-
4	Analyze principles of classical and quantum physics through experiments.	1,8,9	-

MODULE-1	10 Hrs.

Photonics

Pre-requisites: Fundamentals of geometrical optics.

LASER: Characteristic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients and Expression for Energy Density (Derivation), Laser Action, Population Inversion, Metastable State, Requisites of a laser system, Semiconductor Diode Laser, Applications: LIDAR, Bar code scanner, Laser Printer (Qualitative).

Optical Fiber: Principle and Structure, Propagation of Light, Acceptance angle and Numerical Aperture (NA), Derivation of Expression for NA, V-number, Modes of Propagation, fractional refractive index, Classification of Optical Fibers, Attenuation and their types, Applications: Fiber Optic Communication and networking, broadband communication and speed of internet.

Self-learning: Acceptance angle and Total Internal Reflection.

Numerical problems *on Boltzmann factor, V-number, Numerical aperture, and attenuation.*

MODULE-2	10 Hrs.

Free Electron Theory and Superconductivity

Pre-requisites: Basics of current electricity.

Free Electron Theory

Free electron concept in metals. Classical free electron theory-assumptions. Drift velocity, mean free path, Mean collision time, Relaxation time. Expression for electrical conductivity in metals, Failures of Classical Free Electron Theory, Assumptions of Quantum Free Electron Theory, Fermi Energy, Fermi Factor, Variation of Fermi Factor with Temperature and Energy. Merits of Quantum Free Electron Theory. Matthiessen's rule and temperature dependent electrical conductivity.

Superconductivity

Introduction to Superconductors, Temperature dependence of resistivity, Meissner's Effect and its experimental demonstration, Critical Field, Temperature dependence of Critical field, Critical Current, Types of Superconductors. BCS theory, High Temperature superconductivity, Josephson Junctions, superconducting magnets, SQUID(Qualitative), Applications in Quantum Computing and magnetic sensors for brain computer interface.

Self-learning: Resistivity and Mobility

Numerical problems *on electrical conductivity, Fermi energy, and critical magnetic field.*

MODULE-3	10 Hrs.

Quantum mechanics for computation

Pre-requisites: Wave–Particle dualism

Black body radiation spectrum, Wien's law and Rayleigh Jeans law, assumptions of quantum theory of radiation, Planck's law. Explanation of dual nature of matter. de Broglie Hypothesis of Matter Waves, de Broglie wavelength and derivation of its expression for electrons, Phase Velocity and Group Velocity, and their relationship with speed of light (no derivation). Wave Function, Time independent Schrödinger wave equation, Physical Significance of a wave function and Born Interpretation, Expectation value, Eigen functions and Eigen Values, Particle inside one dimensional infinite potential well, Quantization of Energy States, Waveforms and Probabilities. The application of quantum mechanics in quantum technology - quantum computation, quantum communication, quantum sensors, quantum materials and devices.

Self-learning: Photoelectric Effect and Compton Effect (qualitative)

Numerical problems *on de Broglie equations, group velocity, phase velocity and Eigenvalue equation***.**

MODULE-4	10 Hrs.

Elements of Quantum Computing

Pre-requisites: Fundamentals of binary systems, thermodynamics and statistics.

Introduction to quantum computers, difference between classical and quantum computers, features of quantum computers; exponential speedup, parallel computation, reversible computation. Principles of quantum computation; Heisenberg's uncertainty principle, Quantum tunnelling, Quantum entanglement, quantum superposition. Qubits and working principle of their different types; SQUID, Photonic, NMR, Ion trap. Notations of representing states and operations of quantum computation; Dirac bracket notation, Bloch sphere and matrix. Basics of quantum logic gates; single qubit logic gates (X, Y, Z and Hadamard) and multi-qubit logic gates (Controlled X).

Physics-Inspired Machine Learning Systems

Energy minimization principle in physical systems and its application to neural networks; Hopfield network structure, energy function, attractor states, and Hebbian learning rule. Boltzmann distribution and its role in determining state probabilities in neural systems; influence of temperature on energy-based learning. Simulated annealing technique for global optimization, temperature scheduling and acceptance probability. Ising model analogy for binary neurons; local interactions and global stability.

SN	Experiments (to conduct any 10)
1	Measurement of electrical resistivity and energy gap of a semiconductor using four probe technique
2	Determination of quantum circuit under black box using the output (only 5 circuits).
3	Determination of dielectric constant by charging and discharging of a capacitor.
4	Determination of wavelength of LASER by diffraction technique
5	Verification of Stefan's law of radiation
6	Determination of Planck's constant using Light Emitting Diodes
7	Estimation of frequencies of vibrating string and AC using Sonometer
8	Determination of resonance frequency and inductance using LCR circuits.
9	Determination of Young's modulus using single cantilever
10	Determination of moment of inertia of rigid bodies and rigidity modulus of a string using torsion pendulum.

11	Determination of numerical aperture and modes of transmission of optical fiber
12	I-V Characteristics of zener diode

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	Engineering physics	R K Gaur and S L Gupta	1	*Dhanpat Rai Publishing* Company (P) Ltd.	2011
2	Solid state physics	S O Pillai	1	New Age International Pvt. Ltd	2018
3	Engineering physics Lab Manual	Faculty of Department of Physics	1	Department of Physics, Malnad College of Engineering, Hassan	2025

Reference Books:

Sl.No	BookTitle	Authors	Edition	Publisher	Year
1	Modern Physics: Kenneth S. Krane	Kenneth S. Krane	3	John Wiley & Sons, Inc.,	2012
2	Fiber Optics	A K Ghatak and K Thyagarajan	1	Cambridge University Press India Pvt. Limited	1998
3	Quantum Computation and Quantum Information	Michael A. Nielsen & Isaac L. Chuang	10thAnniversary Edition	Cambridge University Press	2012
4	Engineering physics Lab Manual	Faculty of Department of Physics	1	Department of Physics, Malnad College of Engineering, Hassan	2025

E Books and online course materials:

https://onlinecourses.nptel.ac.in/noc23_ph29/preview

Online Courses and Video Lectures:

https://youtu.be/lZ3bPUKo5zc?si=xH1W4tBalCExwzEw

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO1 1**
CO1	3										
CO2	3										
CO3	3										
CO4	3							1	1		

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No.of Weeks	Hours/ Semester
1	Class Room Teaching (Lecture)	3	14	42
2	Tutorials	1	14	14
3	Integrated Lab Component	2	14	28
3	Student Study Hours–Self Learning	1	14	14
4	Term work	-	-	12
5	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**120**

Assessment Plan

Continuous Evaluation (for 50marks):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50 marks each and scaled down to 15 marks	30
Lab conduction and CIE	Conduction and record: Evaluated for10 marks and scaled down to 5 CIE: 15 marks	20
Total		**50**

Semester end examination (SEE) (for 50 marks):

Examination to be conducted for 100 marks and scaled down to 50 marks.