B.TECH 1ST SEMESTER (COMMON TO ALL BRANCHES)
Physics –I (PHY111T)

L	T			
3	1	Credits	:	3.5
		Sessional	:	50
Duration of Exam.		End Sem. Exam.	:	50
		Total	:	100

UNIT – I CLASSICAL PHYSICS

PHYSICAL OPTICS:

Interference: Division of wave front – Fresnel biprism, Division of amplitude – Newton rings, Michelson interferometer and its applications. (5)

Diffraction: Difference between Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at a slit, Plane transmission diffraction grating, its dispersive and resolving powers. (4)

Polarization: Polarized and unpolarized light, double refraction, Nicol prism, quarter and half wave plates, Polarimetry, Biquartz and Laurent's half-shade polarimeters. Simple concepts of Photoelasticity. (4)

DIELECTRICS: Polarization, displacement, susceptibility, dielectric coefficient, permitivity & various relations between them, Energy stored in electric field, Behavior of dielectrics in ac fields-simple concepts, dielectric losses, Applications of dielectrics. (5)

UNIT-II: MODERN PHYSICS

QUANTUM PHYSICS : Drawbacks of Classical Physics, Introduction to quantum mechanics- simple concepts, discovery of Planck's Constant, Group velocity and phase velocity, Schrodinger wave equation, Postulates of quantum mechanics, Time dependent and time independent Schrodinger wave equation, Uncertainty principle, Eigen values, Elementary ideas of quantum statistics. (5)

X-RAYS: Production of X-rays, continuous and characteristics X-ray, Mosley Law, absorption and diffraction of X-ray, Bragg's law and its applications, Methods of X-ray diffraction, Compton scattering. (5)

SPECIAL THEORY OF RELATIVITY : The Michelson-Morley experiment, relativistic transformation, length contraction, time dilation, variation of mass with velocity, mass-energy equivalence. (5)

NUCLEAR ENERGY: Nuclear fission, moderators, nuclear reactors, reactor criticality & neutron cross-section, nuclear fusion; Interaction of radiation with matter (basic concepts), Radiation Detectors-ionization chamber, G.M.Counter, scintillation and solid state detectors, cloud chamber and bubble chamber. (7)

SUGGESTED BOOKS:

Optics	-	F.W.Sears
Physics of the Atom	-	Wehr, Richard & Adair
Perspectives of Modern Physics	-	Arthur Beiser
Physics-I, II	-	Halliday and Resnick
Engineering Physics	-	S.K.Srivastava and R.A.Yadav

NOTE: Eight questions will be set in the question paper, minimum four from each unit. Candidates will be required to attempt five questions selecting at least two questions from each unit.

B. TECH. 1ST SEMESTER PHYSICS PRACTICALS
(Common to all branches)

Time : 3 hrs.
P/D
2

Credits : 1.0
Sessional : 60
Practical (End Semester Exams.): 40
Total Marks : 100

PHYSICS-I (Practical): PHY112P

EXPERIMENTS

1. To determine the refractive index of the material of a lens.
2. To find the wavelength of light by Fresnel's biprism.
3. To find the wavelength of monochromatic light by using diffraction grating.
4. To verify Malus Law in polarization of light.
5. To find the wavelength of light by using Newton's rings.
6. To find the specific rotation of a solution by using a polarimeter.
7. To find a) the wavelength of sodium light b) the thickness of a thin transparent sheet by Michelson's interferometer.
8. To study the dielectric properties of a dielectric at different frequencies by resonance method.
9. To calibrate a voltmeter and an ammeter by using potentiometer.
10. To find high resistance by leakage method.
11. To find the temperature coefficient of resistance of platinum by using platinum resistance thermometer.
12. To study the variation of magnetic field along the axis of a circular coil carrying current and to estimate the radius of the coil.
13. To find the frequency of AC mains using sonometer.
14. To plot a graph between the difference of temperature of two junctions and thermo e.m.f. for a thermocouple using a potentiometer.
15. To study the shunting effect of a voltmeter on voltage measurement.
16. To verify Stefan's radiation law by using incandescent filament.
17. To find the value of Planck's constant by photo electric cell.

NOTE: Students are required to do any twelve experiments.

B.TECH 2ND SEMESTER (FOR ALL BRANCHES)

L	T			
3	1	Credits	:	3.5
		Sessional	:	50
Duration of Exam.	3	End Sem. Exam.	:	50
		Total	:	100

Physics-II (PHY112T)

UNIT-I : SOLID STATE PHYISCS

CRYSTAL STRUCTURE: Space Lattice, unit cell and translation vectors; Miller indices, Simple and closed packed crystal structures with examples, Defects in solids. (5)

FREE ELECTRON THEORY: Elements of classical free electron theory and its limitations, quantum theory of free electrons, Fermi level, Density of states, Fermi-Dirac distribution function, Thermionic emission, Richardson's equation. (5)

BAND THEORY OF SOLIDS: Origin of energy bands, Kronig Penney Model (qualitative), E-K diagram, Brilloun Zones, Concept of effective mass and holes, Classification into metals, Semiconcuctors and insulators, Fermi energy and its variation with temperature, Hall effect and its applications specific heat of solids, classical, Einstein and Debye Model. (8)

MAGNETIC PROPERTIES OF SOLIDS: Atomic magnetic moments, orbital diamagnetism, classical theory of paramagnetism, ferro magnetism, molecular field theory and domains. (3)

SUPERCONDUCTIVITY: Experimental facts, Type I and II superconductors, London equation, Applications of superconductivity. (3)

ELEMENTS OF NANOTECHNOLOGY: Introduction to nanoscience and technology, concept of quantum size effect, quantum dots, Nanomaterials: top down and bottom up techniques, Applications of nanotechnology. (4)

UNIT-II MODERN OPTICS

LASERS AND FIBRE OPTICS: Spontaneous and stimulated emission; Relation between Einestein coefficients of stimulated and spontaneous emission, Characteristics of laser beam, He-Ne, semiconductor and CO_2 lasers, Applications of lasers in industry and medicine.

Propagation of light in fibres; numerical aperture, single mode and multi mode fibres, applications of optical fibre in industry and communication. (7)

SUGGESTED BOOKS:

Introduction to Solid State Physics - Charles Kittel
Solid State Physics - S.O. Pillai
Lasers: Theory and Applications - Thyagarajan and Ghatak
Nanotechnology-Basic Science and Emerging Technologies- Mick Wilson, Kamali Kannangra Geoff Smith, Michelle Simons and Burkhard Raguse, Overseas Press

NOTE : EIGHT questions are to be set- SIX from Unit-I, TWO from Unit-II and the candidates will be required to attempt FIVE QUESTIONS selecting at least ONE from EACH unit.

B. TECH. 2nd SEMESTER PHYSICS PRACTICALS

Time : 3 hrs.
P/D
2/2

Credits: 0.5
Sessional : 60
Practical (End Semester Exams.): 40
Total Marks : 100

PHYSICS-II (Practical)
PHY122P

EXPERIMENTS

1. To calibrate an electromagnet using Guoy's balance.
2. To measure Hall's co-efficient of Germanium and calculation of charge carrier concentration.
3. To measure i) Saturation magnetization ii) coercivity and iii) retentivity in a given ferromagnetic material.
4. To measure the velocity of ultrasonic waves in organic liquids.
5. To verify Richardson's thermionic emission equation.
6. To study the decay of charge on a capacitor and to find its capacitance.
7. To determine e/m of an electron.
8. To study I/V characteristics and rectification properties of a semiconductor diode.
9. To study characteristics of a thermistor.
10. To determine the resistivity of a semiconductor by four probe method.
11. To determine the band gap of germanium from the variation of its resistivity with temperature.
12. To study the intensity response of a cadmium sulphide cell.
13. To study a G.M. counter.
14. To draw the I-V characteristics of a solar cell under constant illumination.

NOTE: Students are required to do any eight experiments.

B.TECH 7TH SEMESTER
(Open to all branches)

Time	:	3 hours	Credit Points	: 3.5
L T			Sessional	: 50
3 1			End Sem. Exams	: 50
			Total	: 100

PHY472T : ULTRASONICS

Unit I

Physics of ultrasonics-wave motion, velocity of propagation, characteristic impedance, reflection, attenuation and transmission through layers, Particle and radiation pressure.

Generation of Ultrasonics: Ultrasonic transducers-piezoelectric and magnetostrictive transducers, equivalent circuits, impedance matching, high and low power devices.

Unit II

Ultrasonic based bio-instrumentation:

Instrumentation and applications; Ultrasonic sensing using plus echo and Doppler techniques. Industrial processing units, Ultrasonic instrumentation in measurement and control; Flaw detection diagnostic, therapeutic and surgical ultrasonic instrumentation.

NOTE : EIGHT questions are to be set- four from Unit-I, four from Unit-II and the candidates will be required to attempt FIVE QUESTIONS selecting at least two from EACH unit.

SUGGESTED BOOKS:

1. Ultrasonic Engineering : J.R.Fredrick
2. Physical Principles of Ultrasonic Diagnosis : P.N.T.Wells

B.TECH 7TH SEMESTER
(Open to all Except C)
PHY471T: LASER

Time : 3 hours
L T P
3 1 -

Credit : 3.5
Sessional : 50
Theory : 50
Total : 100

Unit-I

Quantum behavior of light, concept of spontaneous and stimulated emission, Derivation of Einstein relations, Population Inversion, Pumping methods, condition for light amplification, Two, three and four level laser systems, quantum efficiency, laser rate equations and Threshold condition. Components of laser devices, Laser action, Temporal and spatial coherence. Optical cavities: gain and losses in optical cavities, Laser resonators, their characteristics, design and construction.

Unit-II

Design and operating characteristics of solid state (Nd: YAG and glass laser), Tunable dye lasers, gaseous (CO_2 and Argon laser), semiconductor lasers and Free-Electron Laser (FEL). Mode locking, Types of mode Locking, Q- Switching.

Applications of Lasers in Mechanical, Electronics, Nuclear energy, Medical, Optical data storage devices, Holography, Environmental studies, Communications.

Note: EIGHT questions are to be set – **Four** from unit-I, **Four** from Unit-II and the candidates will be required to attempt **FIVE QUESTIONS** selecting at least TWO from each unit.

Books Suggested:

1. Ajay Ghatak: Optics, McMillan India.
2. W.T. Silfvast : Laser Fundamentals, Foundation Books.
3. B.B. Laud: Lasers and Non-linear Optics, Wiley Eastern Limited.
4. Svelto Lasers, Pergmon.
5. Thyagarajan & Ghatak: Laser Theory and applications.
6. Yariv : Quantum Electronics

B.TECH 8TH SEMESTER
(For Mechanical Engg. Students)

Time	:	3 hours	Credit Points	:	3.5
L T			Sessional	:	50
3 1			End Sem. Exams:		50
			Total	:	100

PHY481T: NON-DESTRUCTIVE TESTING

Non-Destructive Testing (NDT): Introduction, Comparison between Destructive and Non-Destructive tests; Various NDT methods; Comparison and selection of NDT methods.

Non-Destructive Techniques:

a) **Visual Examination**- Basic principle, Optical aids for visual inspection, Applications.
b) **Liquid Penetrant Testing** (LPT): Physical principles, Procedure, Penetrant Testing materials, LPT methods, Applications.
c) **Magnetic Particle Testing (MPT):** Principle, Magnetizing techniques, MPT procedure and equipment, Applications.
d) **Eddy Current Testing (ECT) :** Principle, Instrumentation for ECT, ECT Techniques, Applications and limitations.
e) **Radiography:** Principle, E.M. radiation sources-X-rays and Gamma rays, the sources and properties, Radiographic films and imaging, Radiographic inspection techniques, Applications and standards.
f) **Ultrasonic Testing (UT):** Basic properties of sound beam, Ultrasonic transducers, Inspection methods-Normal incident pulse-echo, Normal beam and angle beam inspection methods, Flaw Non-Destructive Testing codes and Standards; Brief introduction.

SUGGESTED BOOKS:

1. Practical Non-Destructive Testing: Baldev Raj, T.Jayakumar and M.Thavasimuthu
2. Principles and Practice of NDT : L.H. Lamble
3. Techniques of NDT : C.A. Hogarth and J.Blitz
4. Non-Destructive Testing Techniques: Poter Fordham

B.TECH. 8TH SEMESTER
(For students of ECE)

Time	:	3 hours	Credit Points	:	3.5
L T			Sessional	:	50
3 1			End Sem. Exams	:	50
			Total	:	100

PHY482T: TRANSDUCERS & THEIR APPLICATIONS

1. **TRANSDUCERS AND SENSOR** : Introduction, Classification and characteristics.
2. **APPLICATIONS OF TRANSDUCERS IN THE MEASUREMENT OF**:
   - i) Displacement: Electrical transducer systems only.
   - ii) Strain: Strain gauges (Bonded and unbonded type)
   - iii) **Pressure:** Force summing devices and electrical transducers

     Temperature: RTD, Thermistors, Quartz crystal and Fibre-optic thermometers, thermocouples, total radiation type and optical pyrometers.

     Flow: Flow meters (Electromagnetic, ultrasonic, anemometer).

SUGGESTED BOOKS:

1. Electronic Instrumentation and Measurement: W.D.Cooper and A.D. Helfrick Techniques
2. Instrumentation : Devices and Systems : C.S. Rangan, G.R. Sharma and V.S.V. Mani (Tata McGraw-Hill)
3. Principles of Industrial Instrumentation : D. Patranabis (Tata McGraw-Hill)