PHYSICS FOR CIVIL ENGINEERING STREAM

Course Code:	**22PHYC12/22**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:2:0	Exam Hours	03
Total Hours of Pedagogy	40 hours Theory + 12 Hours Lab	Credits	04

Prerequisite:
Basics of Oscillations, Elasticity, Stress & Strain,
Basics of Sound, Waves & light properties, Properties of light. Oscillations.

Course objectives.
■ To understand the types of oscillation, shock waves & its generation, and applications.
■ To Study the elastic properties of materials and failures of engineering materials
■ To Study the acoustics buildings and the essentials of radiometry and photometry.
■ To understand the principles photonic devices and their application relevant to civil engineering.
■ To understand the various natural disaster and safety

Modules	Teaching Hours
Module-1 **Module -I: Oscillations and Shock waves:** **Oscillations:** Simple Harmonic motion (SHM), Differential equation for SHM (No derivation), Sprigs: Stiffness Factor and its Physical Significance, Series and Parallel combination of springs (Derivation), Types of Springs and their applications. Theory of Damped oscillations (Qualitative), Types of Damping (Graphical Approach). Engineering applications of Damped oscillations, Theory of Forced oscillations (Qualitative), Resonance, Sharpness of resonance. Numerical Problems. **Shock waves:** Mach number and Mach Angle, Mach Regimes, Definition and Characteristics of Shock waves, Construction and working of Reddy Shock tube, Applications of Shock Waves, Numerical problems. **Pre-requisites: Basics of Oscillations** **Self-learning: Simple Harmonic motion, Differential equation for SHM**	**08 Hours**
Module-2 **Elasticity** Stress-Strain Curve, Stress hardening and softening. Elastic Moduli, Poisson's ratio, Relation between Y, n and $\acute{o}$ (with derivation), mention relation between K, Y and $\acute{o}$, limiting values of Poisson's ratio. Beams, Bending moment and derivation of expression, Cantilever and I section girder and their Engineering Applications, Elastic materials (qualitative). Failures of engineering materials - Ductile fracture, Brittle fracture, Stress concentration, Fatigue and factors affecting fatigue (only qualitative explanation), Numerical problems. **Pre requisites: Elasticity, Stress & Strain Self-learning: Stress-Strain Curve**	**08 Hours**

Module-3 **Acoustics, Radiometry and Photometry:** **Acoustics:** Introduction to Acoustics, Types of Acoustics, Reverberation and reverberation time, Absorption power and Absorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (derivation), Measurement of absorption coefficient, Factors affecting the acoustics and remedial measures, Sound Insulation and its measurements. Noise and its Measurements, Impact of Noise in Multi-storied buildings. **Radiometry and Photometry:** Radiation Quantities, Spectral Quantities, Relation between luminance and Radiant quantities, Reflectance and Transmittance, Photometry (cosine law and inverse square law). **Prerequisites: Basics of Sound, Waves & light properties. Self-learning: Introduction to acoustics.**	08 Hours
Module-4	
Photonics: **LASER** Properties of a LASER Beam, Interaction of Radiation with Matter, LASER action, Population Inversion, Metastable State, Requisites of a LASER System, Semiconductor LASER, LASER Range Finder, LIDAR, Road Profiling, Bridge Deflection, Speed Checker, Numerical Problems. **Optical Fiber** Principle and Construction of Optical Fibers, Acceptance angle and Numerical Aperture (NA), Expression for NA, Modes of Propagation, Attenuation and Fiber Losses, Fiber Optic Displacement Sensor, Fiber Optic Temperature Sensor, Numerical Problems **re requisite: Properties of light.** **Self-learning: Total Internal Reflection.**	08 Hours
Module-5 **Natural hazards and Safety** Introduction, Earthquake, (general characteristics, Physics of earthquake, Richter scale of measurement and earth quake resistant measures), Tsunami (causes for tsunami, characteristics, adverse effects, risk reduction measures, engineering structures to withstand tsunami), Landslide (causes such as excess rain fall, geological structure, human excavation etc., types of land slide, adverse effects, engineering solution for landslides). Forest Fires and detection using remote sensing. Fire hazards and fire protection, fire-proofing materials, fire safety regulations and firefighting equipment-Prevention and safety measures. Numerical Problems. **Pre requisite: Oscillations. Self-learning: Richter scale.**	08 Hours

Course outcome (Course Skill Set)
At the end of the course the student will be able to:
  CO1   **Elucidate** the concepts in oscillations, waves, elasticity and material failures
  CO2   **Summarize** concepts of acoustics in buildings and explain the concepts in radiation and photometry
  CO3   **Discuss** the principles photonic devices and their application relevant to civil engineering.
  CO4   **Describe** the various natural hazards and safety precautions.
  CO5 **Practice** working in groups to conduct experiments in physics and **perform** precise and honest measurements.	

Laboratory Component:

Any Ten Experiments have to be completed from the list of experiments

Note: The experiments have to be classified into

    (a) Exercise
    (b) Demonstration
    (c) Structured Inquiry
    (d) Open Ended

Based on the convenience classify the following experiments into above categories. Select at least one simulation/spreadsheet activity.

List of Experiments

1. Determination of Young's modulus of the material of the given bar Uniform Bending.
2. Determination of Rigidity modulus of the Material of the wire using Torsional Pendulum.
3. Study of Forced Mechanical Oscillations and Resonance.
4. Study of the frequency response of Series & Parallel LCR circuits.
5. Determination of Fermi Energy of the given Conductor.
6. Determination of Resistivity by Four Probe Method.
7. Determination of effective spring constant of the given springs in series and parallel combinations.
8. Determination of Young's modlus of the material of the given bar Single Cantilever.
9. Determination of the the Moment of Inertia of the given irregular body using torsional pendulum.
10. Determination of Wavelength of Laser using Diffraction Grating.
11. Determination of Acceptance angle and Numerical Aperture of the given Optical Fiber.
12. Determination of the Radius of Curvature of the given Plano Convex Lens by setting Newton's Rings.
13. Step Interactive Physical Simulations.
14. Study of motion using spread Sheets
15. Application of Statistics using Spread Sheets.
16. PHET Interactive Simulations :
17. Fly wheel
18. Interference of air wedge

(https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)