BPHC102C/ BPHC202C	APPLIED PHYSICS FOR CIVIL ENGINEERING STREAM (CV Branch) (Integrated)	Credits - 04
Hours/Week:(3:0:2)		CIE Marks: 50
Total Hours:60Hrs(40L+20P)		SEE Marks: 50

Course Objectives:

1. To study the types of oscillations and shockwaves
2. To study the elastic properties of materials and failures of materials
3. To study the acoustics of buildings and ultrasonics for engineering applications
4. To study the basics of laser, optical fiber and their applications
5. To study the various natural disaster and safety

MODULE – I — 8 Hrs

Oscillations and Shock waves :

Oscillations:

Introduction, Simple Harmonic Motion (SHM), the differential equation for SHM (no derivation). Springs: 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: Differential equation for SHM.

MODULE – II — 8 Hrs

Elasticity:

Introduction, stress-strain curve, stress hardening and softening, elastic moduli, Poisson's ratio, relation between Y, η and σ (with derivation), mention relation between K, Y and σ, 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: Basics of elasticity, stress and strain.

Self-learning: Hooke's law.

MODULE – III — 8 Hrs

Acoustics and Ultrasonics :

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, noise and its measurements, sound insulation and its measurements. Impact of noise in multi-storied buildings. Numerical problems.

Ultrasonics:

Introduction, generation of ultrasonic waves (inverse piezoelectric method) and properties. Measurement of velocity of ultrasonic waves in solids and liquids. Applications of ultrasonic waves- non destructive testing of materials and medical. Numerical problems.

Pre requisites: Basics of waves.

Self-learning: Introduction to acoustics.

MODULE – IV — 8 Hrs

Laser and Optical fibers:

Laser:

Introduction, absorption, spontaneous emission and stimulated emission, Einstein's coefficients (derivation for energy density), conditions for laser action, requisites of a laser system, working mechanism. Characteristics of a laser. Classification of lasers, construction and working of semiconductor diode laser. Applications- laser range finder, LIDAR, road profiling, bridge deflection, speed checker. Numerical problems.

Optical fibers:

Introduction, principle and construction of optical fibers, acceptance angle and numerical aperture (NA), derivation of NA, modes of propagation, types of optical fibers, attenuation and fiber losses, fiber optic displacement sensor, fiber optic temperature sensor. Numerical problems.

Pre requisite: Snell's law.

Self-learning: Optical fiber communication.

MODULE – V	**8 Hrs**

Natural hazards and Safety:

Introduction, Earthquake: general characteristics, physics of earthquake, Richter scale of measurement and earthquake resistant measures. Tsunami: causes for tsunami, characteristics, adverse effects, risk reduction measures, engineering structures to withstand tsunami. Landslide: causes such as excess rainfall, geological structure, human excavation etc, types of landslide, adverse effects, and engineering solution for landslides. Forest Fires and detection using remote sensing. Fire hazards and fire protection, fire-proofing materials, fire safety regulations and fire fighting equipment - Prevention and safety measures.

Pre requisite: Basics of natural hazards and fire safety.

Self-learning: Richter scale.

Reference Books :

1. R. Balasubramaniam, 2020, "Materials Science and Engineering", 9th edition, Wiley India Pvt. Ltd. Ansari Road, Daryaganj, New Delhi
2. M. N. Avadhanulu, P. G. Kshirsagar and T. V. S. Arun Murthy, 2019, "A Textbook of Engineering Physics" 11th edition, S Chand and Company Ltd. NewDelhi-110055.
3. R. K. Gaur and S. L. Gupta, 2010, "Engineering Physics", 8thedition, Dhanpat Rai publications Ltd., New Delhi
4. B. B. Laud, 2002, "Lasers and Non-Linear Optics", 2ndedition, New age international
5. K.R. Nambiar, 2006, "Lasers principles, types and applications", New age international publishers
6. Tor Eric Vigran, Taylor and Francis, 2019, "Building Acoustics", 1st edition CRC press
7. Akhil Kumar Das "Principles of fire safety engineering understanding fire and fire Protection", II edition, PHI Learning
8. Chintoo S Kumar, K Takayama and K. P. J Reddy, 2014, "Shock waves made simple", Willey India pvt. Ltd, Delhi
9. Edward Bryant, 2001 "Natural Hazards", 2ndEdition. Cambridge university press
10. Ramesh P. Singh and Darius Bartlett, 2018, "Natural hazards, Earthquakes, Volcanoes, and landslides", 1st edition, CRC press, Taylor and Francis group

Web links and Video Lectures (e-Resources):

Web links:

Simple harmonic motion:https://www.youtube.com/watch?v=k2FvSzWeVxQ
Shock waves:https://physics.info/shock/
Shock waves and its applications:https://www.youtube.com/watch?v=tz_3M3v3kxk
Stress-strain curves:https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
Stress curves:https://www.youtube.com/watch?v=f08Y39UiC-o
Oscillations and waves :https://openstax.org › books › college-physics-2e
Earthquakes:www.asc-india.org
Earthquakes and hazards:http://quake.usgs.gov/tsunami
Landslide hazards:http://landslides.usgs.gov

Acoustics:https://www.youtube.com/watch?v=fHBPvMDFyO8
Activity based learning (suggested activities in class)/ practical based learning
http://nptel.ac.inhttps://swayam.govin
https://virtuallabs.merlot.org/vl_physics.htmlhttps://phet.colorado.eduhttps://www.myphysicslab.com

Laboratory Component:
Any Ten experiments have to be completed from the list of experiments

LIST OF EXPERIMENTS

1. Determination of effective spring constant of the given springs in series and parallel combination
2. Study of forced mechanical oscillations and resonance
3. The study of frequency response in series and parallel LCR circuits
4. Identification of passive components and estimation of their values in a given black box
5. Determination of rigidity modulus of a wire by torsional pendulum method
6. Determination of Young's modulus of a metal strip by single cantilever method
7. Determination of Young's modulus of a material of the given bar by uniform bending
8. Measurement of velocity of ultrasonic waves in a liquid using ultrasonic interferometer
9. Determination of wavelength of laser using diffraction grating.
10. Determination of acceptance angle and numerical aperture of the given optical fiber
11. Determination of resistivity by four probe method.
12. Determination of Fermi energy for a copper.
13. Determination of dielectric constant of a material in a capacitor by charging and discharging method.
14. Determination of radius of curvature of the given plano convex lens by setting Newton's rings.
15. Step interactive physics simulations
16. Study of motion using spread sheets
17. Application of statistics using spread sheet
18. PHET interactive simulations (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

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

1. Apply the concepts of oscillations and shockwaves for engineering applications
2. Apply the concepts of elasticity for engineering applications
3. Apply the concepts of acoustics and select appropriate property of ultrasonic waves for engineering applications
4. Select the appropriate properties of laser and type of optical fiber for engineering applications
5. Apply the concepts of natural hazards and safety precautions for engineering applications

Course Outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2			1				1			1
CO2	3	2			1				1			1
CO3	3	2			1				1			1
CO4	3	2			1				1			1
CO5	3	2			1	2	2		1			1