Course Title:	**Applied Physics for Civil Engineering Stream**	Semester	I/II
Course Code:	**BPHYC102/202**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03
Total Hours of Pedagogy	40 hours Theory + 10 to12 Lab slots	Credits	04

Course Learning Objectives

CLO 1. To understand the principles of photonic devices and their application to civil engineering Practice
CLO 2. To understand the types of oscillation, shock waves & its generation, and applications.
CLO 3. To Analyse the elastic properties of materials and failures of engineering materials
CLO 4. To understand the various natural disaster and safety
CLO 5. To Evaluate the acoustics buildings and the essentials of radiometry and photometry.
CLO6. To conduct experiments in Physics and measure precise quantities.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Flipped Class

2. Chalk and Talk

3. Blended Mode of Teaching and Learning

4. Simulations, Interactive Simulations and Animations

5. NPTEL and Other Videos for theory topics

6. Smart Class Room

7. Lab Experiment Videos

8.Self-study motivation

9.Group Discussion

10.Seminars

Module-1: LASER AND OPTICAL FIBERS (8 hours)

Self-study: Interaction of Radiation with Matter

Lasers: Properties of a LASER Beam, Interaction of Radiation with Matter, LASER action, Population Inversion, Requisites of a LASER System, Homojunction and Heterojunction (Qualitative), Semiconductor laser, Applications of lasers in 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, Translucent concrete. Numerical Problems

Applications: Communication, LIDAR

(RBT Levels: L1, L2 and L3)

Module-2: Oscillations and Shock waves (8 hours)

Self-study: Basics of Oscillation,SHM

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) 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.

Applications: Design of spring in for Automatic door closure, Design of effective energy transfer system

(RBT Levels: L1, L2 and L3)

Module-3: Elasticity (8 hours)

Self-study: Elasticity, Stress & Strain

Stress-Strain Curve, Stress hardening and softening. Elastic Moduli, Poisson's ratio, Relation between Y (Young's Modulus), n (rigidity modulus) and σ (with derivation), mention relation between Bulk Modulus(K), Young's Modulus(Y) and Poisson's ratio *(σ),* limiting values of Poisson's ratio. Beams, Bending moment and Expression for Bending moment(derivation), 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.

Applications: Beams

(RBT Levels: L1, L2 and L3)

Module-4: Natural hazards and Safety (8 hours)

Self-study: Richter scale

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, fireproofing materials, fire safety regulations and firefighting Equipment-Prevention and safety measures. Numerical Problems

Applications: Engineering solution to natural hazards
(RBT Levels: L1, L2 and L3)

Module-5: Acoustics, Radiometry and Photometry (8hours)

Self-study: Introduction to Acoustics

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, Sound proofing building.
Radiometry and Photometry: Radiation Quantities, Spectral Quantities, Relation between luminance and Radiant quantities, Reflectance and Transmittance, Photometry (cosine law and inverse square law).

Applications: Architectural design, Canopy Mapping
(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1. Determination of Young's modulus of the material of the given bar Single Cantilever.
2. Determination of Rigidity modulus of the Material of the wire and Moment of Inertia of the given body 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 Wavelength of Laser using Diffraction Grating.
9. Determination of Acceptance angle and Numerical Aperture of the given Optical Fiber.
10. Study of motion using spread Sheets

Suggested software: Virtual Lab , PSPICE

Course outcome

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

1. For a given specifications of laser **determine** population ratio, wavelength, power and for a given specifications classify optical fibers, **determine** numerical aperture, V-number and attenuation coefficient.
2. **Set** equation of motion, **solve** and **analyze** solution for free, damped and forced oscillations, **Classify** Mach regime and determine Mach number.
3. **Determine** elastic moduli, Poisson's ratio, its limiting value and **discuss** beams, failures of engineering materials.
4. **Determine** energy released, seismic moment and intensity of earthquake, **discuss** engineering solutions to natural hazard- tsunami, landslide, fire hazards.
5. **Determine** reverberation time, absorption coefficient and discuss remedial for acoustic defects.
6. **Practice** working in groups to conduct experiments in physics and perform precise and honest measurements.

Course Assessment and Evaluation Details (both CIE and SEE)

Continuous Internal Evaluation: 50 marks		
Theory Assessment Tool	**Marks**	**Reduced marks**
IAT-1	25	15
IAT-2	25	
Assessment -1(activity based)	25	10
Assessment -2(activity based)	25	
Lab Assessment Tool	**Marks**	**Reduced marks**
Conducting Experiment and Laboratory Record(10 labs)	15(each lab)	15
Lab Test	10	10
Semester End Examination (SEE) : 50 marks		
SEE	**Marks**	**Reduced marks**
Course end examination (Answer any one question from each unit – Internal choice)	100	50

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning

1. Circuit design of LCR circuit using Pspice and study frequency response curve
2. Conduct Study of Forced Mechanical Oscillations and Resonance using virtual lab
3. Seminars on Natural hazards
4. Problem solving exercises
5. Quiz
6. Reports on Guest lectures/ industry visit

http://nptel.ac.in
https://swayam.gov.in
https://virtuallabs.merlot.org/vl_physics.html
https://phet.colorado.edu
https://www.myphysicslab.com

Suggested Learning Resources:

Text Books

1. A Textbook of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, 2020 edition, S Chand and Company Ltd. New Delhi-110055.
2. Engineering Physics by R. K. Gaur and S. L. Gupta, 2012 edition, Dhanpat Rai Publications Ltd., New Delhi-110002,
3. Building Science: Lighting and Acoustics, B. P. Singh and Devaraj Singh, Dhanpat Rai Publications (P) Ltc.,2013

Reference Books

1. Building Acoustics : Tor Eric Vigran, Taylor and Francis, 2008 Edition.
2. Photometry Radiometry and Measurements of Optical Losses, Micheal Bukshtab, Springer, 2nd edition. 2019
3. Materials Science for Engineers by James F. Shackelford and Madanapalli K Muralidhara, sixth edition, Pearson Education Asia Pvt. Ltd., New Delhi. 8TH edition 2015
4. Lasers and Non Linear Optics, B B Loud, New Age Internationals, 2011 edition
5. 9. Shock waves made simple by Chintoo S Kumar, K Takayama and K P J Reddy: Willey India Pvt. Ltd, Delhi 2014.
6. An Introduction to Disaster Management, Natural Disastr & Man Made Hazards, S. Vaidyanathan, IKON Books 2020
7. Natural Hazards, Edward Bryant, Cambridge University, Press, 2nd Edition 2004

8. Natural Hazards by Ramesh .P. Singh, CRC Press, Taylor and Francis group. 2018
9. Disaster Education and Management, Rajendra Kumar Bhandari, Springer, India 2014
10. Principles of Fire Safety Engineering Understanding Fire & Fire Protection, Akhil Kumar Das, PHI Learning , 2020 Edition.

Web links and Video Lectures (e-Resources):

- **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
- Virtual LAB :https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
- Virtual LAB : https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1

Cos and POs Mapping (CO-PO mapping are only Indicative)

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	3		3					2		2
CO2	3	3	3		3					2		2
CO3	3	3	3		3					2		2
CO4	3	3	3		3					2		2
CO5	3	3	3		3					2		2
CO6	3	3	3		3			2	2	2		2

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped