Course Type	Course Code	Name of Course	L	T	P	Credit
DSC1	NPHC101	WAVES AND ACOUSTICS	3	0	0	3

Course Objective

The objective of the course is to present an introduction to different types of oscillations and propagation of waves in different media and its effect. Much emphasis will be given on sound waves and its effect, application etc.

Learning Outcomes

Upon successful completion of this course, students will:

- have a broad understanding of propagation of waves and its effects in different media.
- have a high-level understanding of modes of vibrations of coupled pendulum and also acoustics of buildings.
- be able to understand about the shock and seismic waves and its types.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction:** Critical review on Oscillations: Lissajous figures; Small oscillations, Damped and forced oscillations, Amplitude resonances, Quality factor, linear and transverse oscillations of a mass between two springs; Two dimensional oscillator, Normal modes, Longitudinal and transverse oscillations of coupled masses, Energy transfer between modes, Coupled pendulum	13	Understanding of different types of oscillations: its superposition along and perpendicular direction, normal modes of vibration of coupled pendulum having longitudinal or transverse oscillation and energy transfer during oscillation
2	**Waves**: Wave motion; Wave velocity, Boundary conditions and normal modes, Dispersion relations, Dispersive waves, Acoustic and optical modes. Waves in continuous media, Waves in absorptive media; Energy density and energy transmission in waves, Normal and anomalous dispersions in waves, Group velocity and phase velocity; Bandwidth theorem. Superposition of waves: Linear homogeneous equations and the superposition principle, Interference in space and energy distribution; beats, Fog-signaling and Zones of silence	13	Understanding of propagation of waves and also motion of medium particles during the propagation, difference between normal and anomalous dispersion and finally about the propagation of matter waves. Understanding the difference between interference between two sound waves with time or space and its energy distribution.
3	**Acoustics:** Reflection and transmission of sound wave at a boundary between two media; Acoustic filters	3	This will help in understanding propagation of sound wave in two media and its effect at the interface. Idea of audio filter
4	**Ultrasonics:** Production, detection, properties and applications of ultrasonic waves; Acoustic grating.	3	Understanding of ultrasonic, infrasonic, supersonic waves and Uses of ultrasound
5	**Architectural acoustics**: Reverberation, Sabine's and Eyring's formula, Absorption of sound, Acoustical designs of rooms and auditorium, Presence of echoes, Focussing of sound, Echelon effect, Noise reduction and sound insulations; Acoustical measurements	7	Understanding of acoustics of room and auditorium. Concept of design of building for better audio system.
6	Shock waves, propagation of explosive sound, seismic waves	3	Understanding about earth quake and its source
	Total	**42**	

Textbooks:

1. Waves (Berkeley Physics Course, Vol. 3) by Frank S. Crawford Jr., McGraw-Hill, 1968.
2. Vibrations and Waves, A.P. French, CBS Publishers & Distributors, 2003.
3. Vibrations, Waves, and Acoustics, 8th Edition by D. Chattopadhyay and P. C. Rakshit, Books & Allied Ltd; 2010.

Reference Books:

1. Oscillations, Waves and Acoustics: by Mittal; I. K. International, 2010
2. Waves and Oscillations; N Subrahmanyam; Vikas Publication House Pvt Ltd; 1994
3. Waves and Oscillations; B K Mukherjee; Campus Books International; 2009
4. Oscillations and Waves; Satya Prakash; Pragati Prakashan; 2010
5. Waves and Oscillations: By R. N. Chaudhuri; New Age International, 2010
6. The Physics of Waves and Oscillations; Bajaj N K; Tata Mcgraw Hill; 2000.