S.S.D. Girls' College, Bathinda
Multidisciplinary course Based on NEP-2020
B.Sc./B.Sc. (Honours)
Session 2025-2026
B.Sc. (Non-Medical) Part-2, Sem-III
Waves and Vibrations
Paper Code: BNM301
(Major Theory)

Max. Marks: 70 **Total Teaching Hrs.: 3 Hrs Per Week**
Theory Paper:50 **Credits: 03**
Internal Evaluation: 20 marks **Pass Marks: 35%**

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective sections of the syllabus out of which the student will be required to attempt two questions from each Section. Each question will carry 8 marks. Section C will be compulsory with 9 short-answer type questions of 02 marks each which will cover the entire Syllabus.

Instructions for Students

Students have to attempt four questions in all from Section A and B by selecting 2 questions from each Section. Section C will be compulsory. Use of scientific calculator is allowed.

SECTION - A

Simple Harmonic motion: Differential equation of motion, Energy of Simple Harmonic Oscillations (SHO), Compound pendulum, Electrical oscillations, Plasma vibrations, Lattice vibrations, Transverse vibrations of a mass on a string, Superposition of two perpendicular SHM of same period and of period ratio 1:2, Anharmonic oscillations.

Damped Simple harmonic Motion: Decay of free vibrations due to damping, Differential equation of damped motion, Types of Damping, Determination of damping Coefficient-logarithmic decrement, Relaxation time and Quality-Factor, Electromagnetic damping (Electrical oscillator).

Forced Oscillators: Differential equation for forced mechanical and electrical oscillators, Transient and steady state oscillation, Displacement and velocity variation with driving force frequency, variation of phase with frequency, resonance, Power supplied to an oscillator and its variation with frequency, Q value of a forced oscillator.

SECTION - B

Coupled oscillators: Stiffness coupled oscillators, Normal co-ordinates and normal modes of vibration, Inductance coupling of electrical oscillators.

Waves: Types of waves, Wave equation (transverse) and its solution, The string as a forced oscillator, Characteristic impedance of a string, Impedance matching, Energy transport in transverse waves, Reflection and transmission of waves on the string, Reflection and transmission of energy, Reflection and Transmission of Energy coefficients, Standing waves on a string of fixed length, Energy of vibrating string, Wave and group velocity.

Electromagnetic waves: Physical interpretation of Maxwell's equations, Electromagnetic waves and wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma=0$. Pointing Theorem. Impedance of a dielectric to EM waves, EM waves in a conducting medium and skin depth, EM waves velocity in a conductor an anomalous dispersion, Response of a conducting medium of EM waves.

Course Outcomes

1. understanding of various types of motion like simple harmonic, damped and forced Oscillators.
2. To impart knowledge about various terms like quality factor, resonance and their calculation methods.
3. Understanding various types of modes and their frequency calculations for coupled oscillators.
4. Students will study the maxwell equations which helps in understanding fundamental principles of electromagnetism.

Text Books:

I. Physics of Vibrations and Waves by H.J. Pain, Wiley & Sons, New Delhi, 6™ Edition, 2005.
2. Fundamentals of Vibrations and Waves by S.P. Puri, Tata McGraw Hill, New Delhi.
3. Waves and Oscillations, by E Crawford, Berkeley Physics Course, McGraw-Hill Publications.
4. EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain, Prentice Hall of India. New Delhi.

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Multidisciplinary course Based on NEP-2020
B.Sc. / B.Sc. (Honours)
Session 2025-2026
B.Sc. (Non-Medical) Part-2, Sem-III
Physics Laboratory
Paper Code: BNM301P
(Major Practical)

Max. Marks: 30 **Total Teaching hours: 2 hours/week**
End-Semester exam: 20 marks **Total time Allowed:03 hours**
Internal Evaluation: 10 marks **Pass Marks: 35 %**
Credits: 01

General Guidelines for End-Semester Practical Examination:

1. The student will be allotted one experiment out of the experiments mentioned in syllabus and asked to perform.

Instructions for Students

Students have to perform at least nine experiments from the List of the experiments:

1. To set up CRO for Sine/Triangular/Square wave and find their frequencies and amplitudes.
2. To compare the frequencies of oscillations produced by two audio oscillators using Lissajous figures.
3. To measure the phase difference between current and voltage for CR and LR ac circuit using CRO.
4. To determine the frequency of an electrically maintained tuning fork using a CRO.
5. To determine the frequency of AC mains using a sonometer and an electro magnet.
6. To verify laws of transverse vibrations of stretched strings using a sonometer.
7. To determine the frequency of an electrically maintained tuning fork by Melde's experiment.
8. To verify the laws of vibrating strings by Melde's experiment that is to show that λ^2/T = constant.
9. To compare mass per unit length of two strings by Melde's experiment.
10. To determine the velocity of ultrasonic waves in a given liquid.
11. To determine the frequency of a tuning fork using a sonometer.

Text Books:

1. B.Sc. Practical Physics, C.L. Arora, S. Chand & Company Ltd. 2020.