PHYSICS

W.E.F. 2016-17

Paper II: Waves & Oscillations
(For Maths Combinations)
II SEMESTER

Work load: 60 hrs per semester   **4 hrs/week**

UNIT-I (12 hrs)

1. Simple Harmonic oscillations

Simple harmonic oscillator and solution of the differential equation - Physical characteristics of SHM, torsion pendulum - measurements of rigidity modulus, compound pendulum - measurement of 'g', Principle of superposition, beats, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

UNIT-II (12 hrs)

2. Damped and forced oscillations

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance and velocity resonance.

UNIT-III (10 hrs)

3. Complex vibrations

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions - square wave, triangular wave, saw tooth wave, simple problems on evaluation of Fourier coefficients.

UNIT-IV (17hrs)

4. Vibrating strings: 8 hrs

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Energy transport and transverse impedance.

5. Vibrations of bars: 9 hrs

Longitudinal vibrations in bars - wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

UNIT-V (9 hrs)

6. Ultrasonics: 9hrs

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, determination of wavelength of ultrasonic waves. Applications of ultrasonic waves.

REFERENCE BOOKS:

1. B.Sc. Physics Vol.1, Telugu Academy, Hyderabad.
2. Waves and Oscillations. N. Subramanyam and Brijlal, Vikas Pulications.

3. Unified Physics, Vol. 1, S.L. Gupata & S. Guptha, Jai Prakash Nath& Co, Meerut.
4. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
5. University Physics -FW Sears, MW Zemansky& HD Young,Narosa Publications, Delhi
6. Mechanics, S.G.Venkatachalapathy, Margham Publication, 2003.

Practical paper 1: Mechanics & Properties of Matter

Work load: 30 hrs per semester   **2 hrs/week**

Minimum of 6 experiments to be done and recorded

1. Viscosity of liquid by the flow method (Poiseuille's method).
2. Young's modulus of the material of a bar (scale) by uniform bending.
3. Young's modulus of the material a bar (scale) by non- uniform bending.
4. Surface tension of a liquid by capillary rise method.
5. Determination of radius of capillary tube by Hg thread method.
6. Viscosity of liquid by Searle's viscometer method.
7. Bifilar suspension – moment of inertia of a regular rectangular body.
8. Determination of moment of inertia using Fly-wheel.
9. Determination of the height of a building using a sextant.
10. Rigidity modulus of material of a wire-dynamic method (torsional pendulum)

Suggested student activities

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

Examples

Seminars	- A topic from any of the Units is given to the student and asked to give a brief seminar presentation.
Group discussion	- A topic from one of the units is given to a group of students and asked to discuss and debate on it.
Assignment	- Few problems may be given to the students from the different units and asked them to solve.
Field trip	- Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centers, any other such visit, etc.
Study project	- Web based study of different satellites and applications.

Domain skills:

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

*** Documental evidence is to be maintained for the above activities.

MODEL PAPER – W.E.F. 2016-17

THREE YEAR B.Sc DEGREE EXAMINATION

CHOICE BASED CREDIT SYSTEM

II SEMESTER: PART II: PHYSICS

Paper II: Waves & Oscillations
(For Mathematics Combinations)

Time: 3 Hours   Max. Marks: 75

Section-A (Essay type)

Answer All questions   **Marks :10x5 = 50**

1. a) What is simple harmonic motion ? Derive the equation of motion of simple harmonic
      oscillator.

OR

   b) What is compound pendulum. Derive an equation to determine the acceleration
   due to
      gravity using it.

2. a) Derive an expression for the motion of damped harmonic oscillator and find its
      solution.

OR

   b) What are forced oscillations? Derive and solve the differential equation of it

. 3.a) State and prove Fourier theorem and obtain Fourier constants.

OR

   b) Analyse a square wave using Fourier theorem.

4. a) Derive an expression for the velocity of transverse wave in stretched string.

OR

   b) Derive an expression for the velocity of longitudinal wave in a bar.

Signature of the Chairman / Chairperson (B.O.S.) :

Signature of the Members:

5. a) Describe the production of ultrasonics using Magnetostriction method.

OR

  b) Explain the experimental determination of the wavelength of ultrasonics using acoustic grating.

Section-B (Short answer type)

Answer any three questions   **Marks: 5 x3 = 15**

6. Write a note on Lissajous figures.
7. Explain the quality factor and sharpness of resonance.
8. Explain the energy transport in strings.
9. Write a short note on turning fork.
10. Write the applications of ultrasonics.

Section-C

Answer any two questions   **Marks: 5x2 = 10**

11. The spring is stretched by 8 cm by a force of 10N. Find the force constant of the spring. What will be the time period of a 4Kg mass suspended by it.

12. In what time will the amplitude of a damped harmonic oscillator be reduced to half its initial value, if the decay modulus is 1 sec?

13. Find the Fourier's series for the saw-tooth function given by $y = \dfrac{a}{T} t$ for 0<t<T.

14. A steel wire 100 cm long has mass of 10 gm. It is stretched by a tension of 400 N. Find the frequency of the wire in fundamental mode of vibration.

15. A piezo-electric crystal has a thickness 2mm has density 3200kg/m^3. If it is made of Material of Young's modulus 8 x 10^{10} N/m^3. What is its fundamental frequency.

Signature of the Chairman / Chairperson (B.O.S.) :

Signature of the Members: