P.R. Government College (A), Kakinada.

I B.Sc., Physics-Semester – II Paper – II

WAVES AND OSCILLATION

Course Code : PH2202 **No. of credits : 03**

w.e.f. 2019-20 ADMITTED BATCH

Hours/Week 4 **Total hours : 60**

Module – 1: Fundamentals of Vibrations(12)

Simple harmonic oscillator and solution of the differential equation(T)– Physical characteristics of SHM(P) - combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies(T), Lissajous figures – applications(L).

Module – 2: Damped and Forced Oscillations(12)

Damped harmonic oscillator(L), solution of the differential equation of damped oscillator(T). Logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution(P).

Module – 3: Complex vibrations and coupled oscillations (6)

Fourier theorem and evaluation of the Fourier coefficients(T), analysis of periodic wave functions-square wave(T), saw-tooth wave(P).

Module – 4: Vibrations of bars (12)

Longitudinal vibrations in bars- wave equation and its general solution(T). Special cases (i) bar fixed at both ends ii) bar fixed at the midpoint iii) bar free at both ends iv) bar fixed at one end(T). Tuning fork(P). Comparison between Longitudinal and Teraservers Vibrations in a bar.

Module – 5: Vibrating Strings (12)

Transverse wave propagation along a stretched string, general solution of wave equation and its significance (T), modes of vibration of stretched string clamped at both ends(L), overtones.

Module – 6: Ultrasonics (6)

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods(L), detection of ultrasonics. Applications of ultrasonic waves – ultra sound scan(S).

Textbooks

1. **Berkeley Physics** Course. Vol.1,
2. **Mechanics** by C. Kittel, W. Knight, M.A. Ruderman - *Tata-McGraw hill Company Edition 2008*.
3. **Fundamentals of Physics**. Halliday/Resnick/Walker *Wiley India Edition 2007*.
4. **Waves and Oscillations**. S. Badami, V. Balasubramanian and K. Rama Reddy *Orient Longman*.
5. **First Year Physics** - *Telugu Academy*.
6. **Mechanics of Particles, Waves and Oscillations**. Anwar Kamal, *New Age International*.
7. **College Physics-I**. T. Bhimasankaram and G. Prasad. *Himalaya Publishing House*.
8. **Introduction to Physics for Scientists and Engineers**. F.J. Ruche. *McGraw Hill.*
9. **Waves and Oscillations**. N. Subramaniyam and Brijlal *Vikas Publishing House Private Limited*.
10. Mechanics, waves and oscillations S.L. Gupta and Sanjeev Gupta

Reference Books

1. **Fundamentals of Physics** by Alan Giambattista et al *Tata-McGraw Hill Company* Edition, 2008.
2. **University Physics** by Young and Freeman, *Pearson Education, Edition 2005*.
3. **Sears and Zemansky's University Physics** by Hugh D. Young, Roger A. Freedman *Pearson Education Eleventh Edition*.
4. **An introduction to Mechanics** by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies*.
5. **Mechanics**. Hans & Puri. *TMH Publications*.
6. **Engineering Physics**. R.K. Gaur & S.L. Gupta. *Dhanpat Rai Publications*.
7. Waves and oscillations Brijlal and Subrahmanyam.
8. Mechanics and waves Berkley series

I B.Sc., Semester – II (Model paper)
PHYSICS PAPER – II
w.e.f. 2019-20 ADMITTED BATCH

(Waves and oscillations)

Course Code : PH2202 **No. of credits : 03**

Note:- Set the question paper as per the blue print given at the end of this model paper.

Time : $2\frac{1}{2}$ Hours Max Marks : 60

Section	Questions to be given	Questions to be answered	Marks
A	5	3	3 x 10M = 30M
B	9	6	6 x 5 M = 30M
Total	14	9	60M

Blue Print

Module	Essay Questions 10 marks	Short Questions 5 marks	Problems 5 marks	Marks allotted
I	1	1	1	20
II	1	1	1	20
III	1	1	-	15
IV	1	1	-	15
V	--	1	1	10
VI	1	1	-	15
Total Marks				95

Note: At least ONE problem should be answered.

QUESTION BANK

SUBJECT: PHYSICS PAPER: II SEMESTER: II

WAVES & OSCILLATIONS

UNIT – I (Fundamentals of vibrations)

Essay Questions - 10M

1. Obtain the differential equation for the motion of a simple harmonic oscillator.Find its solution?
2. Discuss the linear combination of two mutually perpendicular simple harmonic vibrations having different frequencies?
3. Discuss the linear combination of two mutually perpendicular simple harmonic vibrations having same frequencies?

Short Questions – 5 M

4. What are Lissajous Figures? What are its uses?
5. What is simple harmonic motion? What are its characteristics?

Problems - 5M

6. A particle executes S.H.M. with a period of 0.02 sec and amplitude 10 cm. Find its acceleration when it is 4 cm away from its mean position.
7. The displacement of the particle executing S.H.M. is given by $x= 10 \cos(4\pi t+\pi/3)$ metre. Find the frequency and displacement after time 1 second.

UNIT – II (Damped and Forced oscillations)

Essay Questions - 10M

8. Explain Damped oscillations. Obtain equation for damped oscillator and find its solution?
9. What are Forced oscillations? Obtain differential equation for forced oscillations and find its solution.

Short Questions – 5 M

10. Explain Logarithmic decrement of an oscillator?
11. Define Relaxation time? Derive the formula for it?
12. Explain Quality factor?

Problems - 5M

13. The amplitude of a second pendulum falls to half initial value in 150 sec. calculate the Q factor.
14. The amplitude of an oscillator of frequency 200Hz falls to 1/10 of its initial value after 2000 cycles. Calculate its relaxation time.

UNIT – III (Complex vibrations and coupled oscillations)

Essay Questions - 10M

15. State and prove Fourier theorem?what are its limitations?
16. Analyse a square wave using fourier theorem?
17. Analyse a saw-tooth wave using Fourier theorem?

Short Questions – 5 M

18. State Fourier theorem?
21. What are limitations of Fourier theorem?
22. Evalute the values of A_0, A_r, B_r?

UNIT- IV(Vibrations of bars)

Essay Questions - 10M

23. What are longitudinal waves?.Obtain wave equation and its solution for longitudinal vibrations in a bar.
24. Derive the general solution for a longitudinal wave in a bar. Discuss the mode of vibrations for (a) Bar free at both ends (b) Bar fixed at one and.
25. Derive the general solution for a longitudinal wave in a bar. Discuss the mode of vibrations for (a) Bar fixed at both ends (b) Bar fixed at middle.

Short Questions – 5 M

26. Compare the longitudinal and transverse vibrations in a bar.
27. Describe the construction and working of tuning fork.

UNIT- V(Vibrating strings)

Essay Questions - 10M

Short Questions – 5 M

28. Obtain the equation for velocity of transverse wave in a stretched string and discuss the solution of a wave equation.
29. Explain modes of vibration of stretched string clamped at both ends.
30. Write a note on overtones.

Problems - 5M

31. The diameter of iron wire is 1.2 mm .If the speed of transverse waves in the wire is 50m/sec then what is the tension in the wire. The density of iron is $7.7x10^2$ kg/m^3.
32. A wire of mass 0.001kg and length 2.5 mm is under tension of 1N.Find the fundamental frequency of the wire.
33. A travelling wave propagates according to the expression Y=0.003sin (3x-2t).Determine the amplitude, wave length ,frequency and period of the wave.
34. A steel wire 50cm long has mass of 5gms. It is stretched with a tension of 400N. Find the frequency of the wire in fundamental mode of vibration?

UNIT- VI(Ultrasonics)

Essay Questions - 10M

35. What are Ultrasonic waves? Describe the magnetostriction method of producing ultrasonics?
36. Explain how ultrasonic waves can be produced and detected using Piezo-electric method?

Short Questions – 5 M

37. What are the applications of ultrasonic sounds.
38. Explain various methods used in detection of ultrasonics?