Total No. of printed pages = 7

3 (Sem 1) PHY M2

2015

PHYSICS

(Major)

Paper : 1.2

Full Marks – 60

Time – Three hours

The figures in the margin indicate full marks for the questions.

SECTION – I

Marks – 40

1. (a) What do you mean by sharpness of resonance ? 1

   (b) If a parameter whose unit is *meter* is Fourier Transformed what will be the unit in the Fourier plane ? 1

[Turn over

(c) Plot the first two cycle of the wave starting from t = 0 represented by the wave equation

$$x = a \sin\left(\omega t + \frac{\pi}{4}\right).$$ 1

(d) What is the mean free path of sound wave in a room if the dimension of the room is $6 \times 4 \times 5$ m^3? Velocity of sound in the room is 350 m/s. 1

2. Answer any *two* questions : $6 \times 2 = 12$

(a) What are the characteristics of wave motion? A simple harmonic wave is represented by $y = 100 \sin\left(\frac{2\pi t}{T} + \alpha\right)$ and the time period is 30 sec. At time $t = 0$, the displacement is 50 cm.

(i) Calculate the phase angle at 7.5 sec.

(ii) Phase difference between two positions at an interval of 6 sec. $2+4=6$

(b) Write the properties of wave.

Two transverse sine wa 4 mm wavelength 2m in phase at x = 0, t = x-axis in opposite d equation of the resulta maximum displacemer positions of the node

(c) Show that in forced v R is inversely propor force.

3. Answer any *three* questio

(a) Show that composit harmonic vibrations with phase difference forms an ellipse. If the between the two wav angle between the ma with the x-axis when

Explain how the frequ can be determined us

(b) Show that for a series LCR circuit, the discharging is of simple harmonic type when $\frac{R^2}{4L^2} < \frac{1}{LC}$ with natural frequency

$$f = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$

A condenser of capacity 1μF, and inductance of 0.2 H and a resistance of 800Ω are connected in series. Check whether the circuit is oscillatory. 7+1=8

(c) Why the Laplace correction is required in the formulation of velocity of sound. Derive the formula for the velocity of sound in air by incorporating the Laplace correction.

Calculate the increase in velocity of sound in air per degree Celsius rise in temperature. 1+4+3=8

(d) Consider a periodic function of the form with time period T and amplitude a

$$f(t) = a\left(1 - \frac{t}{T}\right) \text{ for } 0 < t < T$$

express the above function in Fourier series. Plot first three terms of the Fourier series. 5+3=8

(e) The displacement y(x
along transverse d

following wave eq

where $v = \sqrt{\frac{T}{p}}$ repre

transverse wave. T b
string and p, the mas
the displacement y(x,
the following bounda

(i) y = 0 at x = 0 a
of t

(ii) At t = 0

(a) $\frac{\partial y}{\partial t} = 0$ for a

(b) y(x, t = 0) =

$$y(x, t = 0) = -$$

L

where L is the l
d is the displace
distance a from

SECTION – II

Marks – 20

4. (a) What is achromatic doublet ? 1

(b) What do you mean by circle of least confusion ? 1

(c) Under what condition the matrix method can be applied to an optical system ? 1

(d) Name one aberration each suffered by image when the point object is on-axis and off-axis for a lens. 1

5. Answer any *one* question : 4×1=4

(a) Find the matrix for a spherical surface of radius of curvature R separated by two media with refractive indices n_1 and n_2 when the object is placed in the first medium at a distance u from the surface. 4

(b) Derive the lens formula for thin lens using Fermat's principle. 4

6. Answer any *two* quest

(a) Find the equivalent with focal lengths distance *d*. Hence second principal point.

(b) Show that the co (made of same ma chromatic aberratio a distance equal t lengths of the two

(c) A thick equi-conve of refractive index of the two surfaces the lens is 1 cm a Obtain the system focal length and plane.