

Bachelor of Science (B.Sc.) Semester—III (C.B.S.) Examination**PHYSICS****(Sound Waves, Applied Acoustics, Ultrasonics And Power Supply)****Paper—I**

Time : Three Hours]

[Maximum Marks : 50

N.B. :— (1) **ALL** questions are compulsory.

(2) Draw neat diagrams wherever necessary.

EITHER

1. (A) Explain phase velocity and group velocity. Obtain the relation between them for dispersive and non-dispersive medium. 5
- (B) (i) Obtain an expression for the velocity of transverse wave on a stretched string. 3
- (ii) The linear density of a vibrating string is 1.3×10^{-4} kg/m. A transverse wave is propagating on the string and is described by equation $Y = 0.021 \sin(30t + x)$, where x and y are in meters and t is in seconds. Find out the tension of the string. 2

OR

- (C) What is the temperament in musical scale ? Describe equally tempered musical scale. 2½
- (D) Explain the limit of human audibility with the help of suitable diagram. 2½
- (E) Describe the different characteristics of musical sound. 2½
- (F) Intensity level in a conversation is 70 dB above the threshold of 10^{-6} w/cm². Calculate the amplitude of vibration of air particles in the sound wave.

[velocity of sound in air = 350 m/s, density of air = 1.25 gm/liter, mean frequency = 500 Hz] 2½

EITHER

2. (A) What are transducers ? Explain with neat diagram the construction and working of moving coil loudspeaker. 5
- (B) (i) Define reverberation time. Derive Sabine's formula for the reverberation time by Jaegar's method. 3

(ii) The volume of big hall is 1500 m^3 and reverberation period for it is 1.5 second. If total surface area of absorption of sound is 800 m^2 . Calculate :

(a) total absorbing power of all the surfaces of hall.

(b) the mean absorption coefficient.

2

OR

(C) What are the important requirements of a good auditorium ?

2½

(D) Explain how sound is recorded and reproduced from compact discs.

2½

(E) Explain variable density method for the recording of sound on Cine film.

2½

(F) The reverberation time is found to be 1 sec. when a curtain cloth of 20 m^2 is suspended at the center of the hall. If the dimensions of hall are $10 \times 8 \times 6 \text{ m}$. Calculate the coefficients of absorption of curtain cloth.

2½

EITHER

3. (A) What are Ultrasonic waves ? Explain how it can be used as acoustic grating for the determination of wavelength and velocity of Ultrasonic waves in liquid.

5

(B) (i) What is piezoelectric effect ? Explain with circuit diagram the piezoelectric method for the production of ultrasonic waves.

3

(ii) Calculate the thickness of quartz crystal which can generate a fundamental frequency of 5.5 MHz. ($Y = 8 \times 10^{11} \text{ dynes/cm}^2$ and $\rho = 2.65 \text{ g/cm}^3$).

2

OR

(C) Describe the production of ultrasonic waves by magnetostriction method with suitable diagram.

2½

(D) What is meant by SONAR ? Explain.

2½

(E) A Nickel rod of 10 cm length having a density $8.1 \times 10^3 \text{ kg/m}^3$ and Young's modulus $82 \times 10^{10} \text{ N/m}^2$ is used in a magnetostriction oscillator. Find frequency of vibration of the rod.

2½

(F) Explain any two applications of ultrasonic waves in medical science.

2½

EITHER

4. (A) Draw the circuit diagram of bridge rectifier. Explain its working with input-output waveforms.

5

(B) (i) Explain with circuit diagram the working of zener diode as a voltage regulator under the following two situations :

(a) Load regulation

(b) Line regulation.

3

- (ii) A 10 V zener diode along with a series resistance is connected across a 40 V supply. Calculate the minimum value of resistance required, if the maximum zener current is 50 mA.

2

OR

- (C) What are the main features of IC-LM 317 ? Draw a neat circuit diagram of an electronic voltage regulator using IC-LM 317. 2½
- (D) What do you mean by ripple factor ? Show that ripple factor for half wave rectifier is 1.21 %. 2½
- (E) Describe the action of shunt capacitor filter with necessary diagram. 2½
- (F) Two power supplies A and B are available in the market. The power supply A has no load and full load voltage of 20 V and 15 V respectively, whereas these values are 20 V and 19V for power supply B. Justify which power supply is better. 2½

5. Solve any **ten** (1 mark each) :

- (i) Why tempered scale is used in keyed instruments ?
- (ii) Two sinusoidal waves $y_1 = 0.07 \cos (3t - 4x)$ m and $y_2 = 0.07 \cos (t - 2x)$ m are superimposed. Calculate the group velocity.
- (iii) State the conditions for formation of stationary waves in medium.
- (iv) What is the main difference between a live room and dead room ?
- (v) How Echelon effect is eliminated ?
- (vi) Why is a speaker usually housed in a large box ?
- (vii) What is Y-cut piezoelectric crystals ?
- (viii) Find the velocity of longitudinal waves produced in a quartz crystal of thickness 1 mm if $Y = 8.516 \times 10^{11}$ dynes/cm² and density $\rho = 2.65$ gm/cm³.
- (ix) Why is a rod of ferromagnetic material used in magnetostriction oscillator ?
- (x) Draw the circuit diagram of a half wave rectifier.
- (xi) What is the use of bleeder resistor in filter circuits of a power supply ?
- (xii) If $I_{dc} = 0.27$ A and $R_L = 1000 \Omega$ calculate P_{dc} . 1×10