



Bachelor of Science (B.Sc.) Semester—III Examination
PHYSICS-301

Sound Waves, Applied Acoustic, Ultrasonic and
Power Supply
Paper—I

Time—Three Hours]

[Maximum Marks—50

N.B. :— (1) All questions are compulsory.

(2) Draw neat diagram wherever necessary.

1. (a) What are transverse waves ? Obtain an expression for the velocity of transverse wave and hence show that the frequency of wave is proportional to the square root of the tension in the string.

5

(b) (i) Explain diatomic scale of music with defects in it.

(ii) If the diatomic scale starts at 256 Hz, then find out the frequency after second interval in a sequence.

3+2

OR

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(Contd.)



- (c) Explain how the standing waves are formed in a closed pipe at one end. $2\frac{1}{2}$
- (d) Write note on limit of human audibility and response of ear. $2\frac{1}{2}$
- (e) Discuss about the different characteristics of musical sound. $2\frac{1}{2}$
- (f) If a 20 meter long rope wire having mass 2.5 kg is stretched by a load of 20 kg, then find out the time taken by transverse wave to travel the other end of the rope. (Take $g \approx 10 \text{ m/sec}^2$) $2\frac{1}{2}$
2. (a) What is loud speaker ? Explain the principle, construction and working of it with neat labelled diagram. 5
- (b) (i) Derive Sabine's formula of reverberation time. 3
- (ii) The absorption coefficient of plaster material and wooden floor is 0.03 and 0.06. If the area of plaster material and wooden floor is 112 m^2 and 130 m^2 respectively, calculate the average value of absorption coefficient. 2

OR



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(c) Explain in detail the principle and working of reproduction of sound from a magnetic tape.

2½

(d) Give in detail any two factors affecting the acoustics of building.

2½

(e) What is the purpose of a microphone ? State in brief what are the different types of microphones normally used.

2½

(f) Calculate the reverberation time of the hall of volume 6000 m^3 and having average coefficient of absorption to be 0.2 for the 5 main absorbing mediums in a hall with surface area 400 m^2 each ?

2½

3. (a) What is piezoelectric effect ? Discuss the construction and working of piezoelectric ultrasonic generator with its circuit diagram.

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(b) (i) What are the properties of Ultrasonic Waves ?

(ii) Calculate the thickness of crystal used for production of ultrasonic waves of 2.75 MHz frequency, if Y and P for the crystal are $8 \times 10^{11} \text{ dyne/cm}^2$ and 2.65 gm/cm^3 .

3+2

OR



(c) What is magnetostriction effect ? Give its application. $2\frac{1}{2}$

(d) Explain how the depth of a sea can be measured using ultrasonic waves. $2\frac{1}{2}$

(e) What are the advantages and disadvantages of Piezoelectric generator ? $2\frac{1}{2}$

(f) Obtain the fundamental frequency of Ultrasonic Waves, if a quartz plate of 0.7 mm thickness and 2800 kg/m^3 density is used in a quartz generator. The Young's modulus of quartz is $10 \times 10^{10} \text{ N/m}^2$. $2\frac{1}{2}$

4. (a) Explain the working of half wave rectifier and obtain an expression for average DC current at output and r.m.s. current. 5

(b) (i) Explain Zener diode as a voltage regulator with :

(a) Change in input voltage and

(b) Change in load current. 3



- (ii) Find out the minimum value of resistance to be connected in series across the 40 V power supply so that maximum 50 mA current can be obtained through a power supply having Zener diode of 10 V. 2

OR

- (c) What is ripple factor ? Show that the ripple factor of half wave rectifier is 1.21. 2½
- (d) Explain bridge rectifier with neat diagram. 2½
- (e) Draw the characteristics of P-N junction diode in forward bias and reverse bias. Explain in brief. 2½
- (f) Full wave rectifier uses two diodes. The forward dynamic resistance of each diode is $20\ \Omega$, transformer secondary voltage from centre tap to each end is 50 V and the load resistance is $980\ \Omega$. Find :
- (a) average dc current through load resistance
- (b) r.m.s value of current . 2½



5. Solve any TEN (1 mark each) :

$$10 \times 1 = 10$$

- (i) Define node and antinode in stationary wave.
- (ii) Find the amplitude and angular frequency of the transverse wave in a string represented by $Y = 5 \sin 2\pi (t - 0.04x)$ in S.I. unit.
- (iii) What is the relation between bel and decibel ?
- (iv) State the advantages of digital recording.
- (v) What are live and dead zones ?
- (vi) What is transducer ?
- (vii) What is an acoustical grating ?
- (viii) Define electrical and mechanical axes of quartz crystal.
- (ix) If the distance between two consecutive nodes is $0.55 \times 10^{-3} \text{ m}$, find the frequency of ultrasonic waves produced by crystal. (Given velocity = 1650 m/s)
- (x) A dc and ac voltmeter are used to measure the output voltage of the rectifier circuit. The readings of two voltmeters are 50 V and 5 V respectively. Calculate the ripple factor of the circuit.
- (xi) What is the necessity of filter circuits in power supply ?
- (xii) Write the formula for percentage efficiency of a full wave rectifier. When will it be maximum ?