

(4)

16. Define 'reverberation time'. 2
17. Write Sabine's formula for 'reverberation time'. 2
18. Show that $\psi(x, t) = Ae^{i(ct-x)}$ is a solution of one-dimensional wave equation. 2
19. Define sharpness of resonance. 2
20. How sharpness of resonance is measured ? 2

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Ex./B.Sc./PHY/12/HO3/90/2018(OLD)

BACHELOR OF SCIENCE EXAMINATION, 2018

(1st Year, 2nd Semester)

PHYSICS (HONOURS)

Paper : HO 3

Time : Two hours

Full Marks : 50

Use a separate Answer Script for each group.

GROUP - A (25 marks)

(Heat Thermodynamics)

Answer *q.no. 1* and any *three* from the rest.

1. (a) State 1st law of thermodynamics. What state function do you get from this law ?
(b) Distinguish clearly between isothermal process and adiabatic process.
(c) Show that for an adiabatic process the work done by any system is path independent.
(d) What is Helmholtz free energy (F) ? Show that F is constant for isothermal isochoric process. $4 \times 2^{1/2} = 10$
2. (a) A Carnot engine draws Q_1 amount of heat from a reservoir and rejects Q_2 amount of heat to a heat sink. Show that the efficiency of the engine is $1 - Q_2/Q_1$.

(Turn Over)

(2)

- (b) A thermal engineer develops an engine working between 327°C and 27°C and claims to have an efficiency of 52%. Does he claim correctly ? 3+2
3. For adiabatic process of an ideal gas show that $T^{\gamma}/P^{\gamma-1}$ is constant, where the symbols have their usual meanings. 5
4. Derive Maxwell's 2nd and 3rd thermodynamic relations by using Jacobian method. 5
5. (a) Briefly explain what do you mean by 'Entropy' of a system.
(b) 40 g of water at 50°C is mixed with 80 g of water at 20°C . Calculate the change in entropy. [The specific heat of water is $1 \text{ Cal/gm } ^{\circ}\text{C}$.] 3+2
6. State and prove Stefan-Boltzmann law of radiation. 1+4

GROUP - B

(Vibrations, Wave and Acoustics)

Answer *q.no. 7* and *eleven* from the rest.

7. A mass of 0.01 kg is acted upon by a restoring force of 0.01 N/m and a resisting force of $2 \times 10^{-3} \text{ N.S.m}^{-1}$. Find out whether the motion is oscillatory or non-oscillatory. 3

(3)

8. Plot displacement versus time in case of underdamped motion. 2
9. Can $\log(ct-x)$ represent a plane wave ? 2
10. In case of plane progressive wave. What is the phase difference between instantaneous potential energy and kinetic energy ? 2
11. What is decibel ? 2
12. If two simple harmonic motion superpose perpendicularly how many loops will be formed if the frequency ratio is $1 : n$. 2
13. The phase velocity c of a wave depends on the wavelength λ according to the formula $C = A\sqrt{\lambda}$, where A is a constant. Show that group velocity is $\frac{1}{2}C$. 2
14. Which one is more melodious – struck string or plucked string and why ? 2
15. Write the expression of velocity of transverse wave along a stretched string. 2

(Turn over)