(Based on remember)
Answer any five Questions.

GROUP—A

1) **Indicate the correct answer in each of the following : (10)**

(a) Gauss's divergence theorem permits changeover from
   (i) Volume integral to surface integral and vice versa
   (ii) surface integral to Volume integral and vice versa
   (iii) surface integral to line integral and vice versa
   (iv) None of the above

(b) Work done twisting a wire of torsional rigidity C through an angle θ is
   (i) $\frac{1}{2}C\theta$ (ii) $\frac{1}{2}C\theta^2$ (iii) $C.\theta$ (iv) $C.\theta^2$

(c) When temperature increases, the surface tension of a liquid
   (i) increases   (ii) decreases
   (iii) remains constant   (iv) None of the above

(d) The mean kinetic energy of molecule of a monatomic gas is
   (i) $\frac{1}{2}KT$ (ii) $\frac{3}{2}KT$ (iii) $\frac{2}{3}KT$ (iv) KT

(e) According to van der Waals' equation of state, the   critical temperature (T_c) of gas is
   (i) $\frac{8a}{27Rb}$ (ii) $\frac{a}{27Rb}$ (iii) $\frac{a}{27Rb^2}$ (iv) $\frac{a^2}{27Rb}$

(f) The relation between path difference x and phase   difference ϕ is
   (i) $\phi = 2\pi\lambda x$ (ii) $\phi = \frac{2\pi}{\lambda}x$ (iii) $\phi = \frac{2\pi}{x}$ (iv) $\phi = \frac{2\pi}{\lambda x}$

(g) Name a physical quantity whose dimensions are the   same as those of Planck's constant
   (i) Angular momentum   (ii) Energy
   (iii) Work   (iv) None of the above

(h) The expression involving $\vec{D}$, $\vec{P}$ and $\vec{E}$ in a dielectric is
   (i) $\vec{P} = \vec{E} + \vec{D}$ (ii) $\vec{E} = \vec{\varepsilon_0}\vec{P} + E$
   (iii) $\vec{D} = \varepsilon_0\vec{P} + \vec{D}$ (iv) $\vec{D} = \varepsilon_0\vec{E} + \vec{P}$

(i) The cause of reverberation is
   (i) reflection   (ii) refraction
   (iii) interference   (iv) diffraction

(j) A zone plate is similar to a
   (i) convex lens   (ii) concave lens
   (iii) convex mirror   (iv) concave mirror

GROUP—B

2) Answer any *two* of the following questions : (5X2=10)
 (a) Prove that $\vec{\Delta} \times (\vec{\nabla}\phi) = 0$.
 (b) Explain the relation between surface tension and surface energy.
 (c) Explain the action of a plane diffraction grating.
 (d) What are reverberation, optimum reverberation and time of reverberation?

GROUP—C

Answer any *four* of the following questions: (10X4=40)

3) Prove that line integral of a vector along any closed path is equal to the surface integral of the curl of the vector carried throughout the area bounded by the path.

4) Distinguish between waves and ripples. Describe, with theory, the ripples method of determining the surface tension of a liquid.

5) Describe capillary method of determining the surface tension of a liquid.

6) Explain what is meant by degree of freedom of a system. State the principle of equipartition of energy and use it to obtain the ratio of two specific heat capacities of monatomic diatomic and triatomic gases.

7) State and discuss the two well-known statements of the second low of thermodynamics. Show that the they are equivalent to each other.

8) Describe, with theory, production and detection of plane polarized, circularly polarized and elliptically polarized light.

9) Describe Fraunhofer diffraction due to single slit. Deduce the positions of maxima and minima. Show the intensity distribution curve.

GROUP—D

Answer any *three* of the following questions: (5X3=15)

10) Prove that
 (i) $\vec{\nabla}.\vec{r} = 3$ (ii) $\vec{\nabla} \times \vec{r} = 0$

11) A U-tube has its ends open and its limbs vertical. It contains a liquid of surface tension $0.052 N/m$ and density $800 kg/m^3$. The angle of contact between the liquid and the wall of the tube being 380. The diameter of one of the limbs is $0.4mm$ and the other is $0.2mm$. Find the difference in the levels.

12) Calculate critical volume, pressure and temperature assuming the equation of state

$$P = \frac{RT}{V-b} e^{-\frac{a}{RVT}}$$

13) When a monochromatic source of light was placed at a distance of $50cm$ from a Fresnel biprism, the distance between the consecutive fringes formed on the screen placed at a distance of $100cm$ from the biprism was found to be $0.012cm$. If the wavelength of light was 5893A, find the distance between the coherent sources.

14) A particle of mass $2\ gm$ is subjected to an elastic force $0.03\ N/m$ and frictional force $0.005\ N/m\dot{s}^{-1}$. It is displaced through $2\ cm$ and then released , find whether the motion is oscillatory. If so, find its period.