Total No. of printed pages = 4

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PH 181201

4/7/23

Roll No. of candidate | | | | | | | | | | |

2023

B.Tech. 2nd Semester End-Term Examination

PHYSICS – 201

New Syllabus (Group A) (w.e.f. 2018-19)

(New Regulation (w.e.f. 2017-18) and (New Syllabus)

Full Marks – 70 Time – Three hours

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

Answer Question No. 1 and any *four* from the rest.

1. Write the correct answer from MCQ : $(10 \times 1 = 10)$

(a) The Coriolis force is maximum at

(i) equator (ii) poles

(iii) tropics (iv) mountain peaks

(b) When the potential energy of a particle executing SHM is one-fourth of its maximum value during the oscillation, the displacement of the particle from the equilibrium position, in terms of its amplitude A, Is

(i) A/4 (ii) A/3

(iii) A/2 (iv) 2A/3

(c) The modulus of elasticity is dimensionally equivalent to

(i) Stress (ii) Strain

(iii) Poisson's ratio (iv) Surface tension

(d) What happens to the viscosity of liquid with the increase in temperature

(i) It increases (ii) It decreases

(iii) It may increase or decrease (iv) No change

(e) Succession of echoes from a set of regularly spaced obstacles in a hall cause

(i) reverberation (ii) resonance

(iii) focusing (iv) echelon effect

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(f) In piezoelectric effect, the natural frequency of vibration of crystal is

(i) inversely proportional to thickness

(ii) directly proportional to thickness

(iii) directly proportional to square root of thickness

(iv) inversely proportional to square root of thickness

(g) Spherical aberration in a lens is due to

(i) larger focal length for paraxial rays as compared to marginal rays

(ii) larger focal length for marginal rays as compared to paraxial rays

(iii) variation of refractive index

(iv) irregularities on lens surface

(h) Two lenses of focal lengths 8 cm and 6 cm are placed at a certain distance apart. If they form an achromatic combination, the separation between

(i) 5cm (ii) 2cm

(iii) 7cm (iv) 14cm

(i) The bending moment of beam is equal to

(i) YRI_g (ii) $\frac{Y}{R}I_g$

(iii) $\frac{YR}{Ig}$ (iv) $\frac{Y}{R}I^2g$

(j) Shape memory alloys owe their behaviour to

(i) liquid-state phase change

(ii) liquid-gas-state phase change

(iii) gas-state phase change

(iv) solid-state phase change

2. (a) What is a conservative force? How is it related to the potential energy? (1+2=3)

(b) What is Coriolis force? State the conditions under which the Coriolis force acting on a particle is zero. (1+2=3)

(c) What is meant by damped harmonic motion? Obtain the differential equation for a damped harmonic oscillator when the damping force is proportional to the velocity. What conclusions do you draw regarding the amplitude and angular frequency of oscillation? (1+3+2=6)

(d) The displacement of a particle executing SHM is given by $= \cos \omega_0 t$. Find the displacement at which kinetic energy of the particle is equal to its potential energy. (3)

3. (a) Prove that Young's modulus Y, bulk modulus K and rigidity modulus η are related by the relation. (5)

$$\frac{9}{Y}=\frac{1}{K}+\frac{3}{\eta}$$

(b) Derive an expression for the depression of the free end of a cantilever. What are the applications of cantilevers? (5+2=7)

(c) What couple must be applied to a 1 m long wire with 1 mm diameter in order to twist one end of it through 90°, the other end remaining fixed? (The rigidity modulus is 2.8×10^{10} Nm^{-2}). (3)

4. (a) Define coefficient of viscosity of a liquid. What is its dimension? (2+1=3)

(b) Distinguish between streamline and turbulent motion of a liquid. (2)

(c) State and prove Bernoulli's theorem for fluid motion. Describe its application to the working of a venturimeter. (1+4+2=7)

(d) Water is conveyed through a horizontal tube 0.08 m in diameter and 4 km in length at the rate of 20 litres per second. Assuming only viscous resistance calculate the pressure difference required to maintain the flow $\left(\eta = 10^{-3}\ N-s/m^2\right)$. (3)

5. (a) What are the basic requirements of an acoustically good hall? (4)

(b) Calculate the increase in acoustic intensity level when the sound intensity is doubled. (2)

(c) A hall with a volume of 1000 m^3 has a sound absorbing surface of area 400 m^2. If the average absorption coefficient of the hall is 0.2 sabines, what is the reverberation time of the hall? (2)

(d) What is meant by magnetostriction effect? Explain with a neat sketch how the ultrasonic waves are produced using a magnetostriction oscillator. (2+5=7)

6. (a) What is meant by spherical aberration in a lens? If f_1 and f_2 be the focal lengths of two thin lenses separated by a distance d, show that the spherical aberration for such a combination is minimum if $d = f_1 - f_2$. (2+4=6)

(b) What is achromatism? Derive the condition of achromatism for two thin lenses in contact. Also prove that this achromatism is possible only when the two lenses are made of suitable different materials. (1+3+2=6)

(c) An achromatic doublet of focal length 90 cm is to be made of two lenses, the material of one having 1.5 times the dispersive power of the other. The doublet is converging type. Find the focal length of each lens. (3)

7. (a) How nanomaterials are different from bulk materials? What do you understand by quantum confinement? (2+2=4)

(b) Explain the difference between top-down and bottom-up approach needed for nano synthesis. (4)

(c) Explain pseudo elastic effect in shape memory alloys. (3)

(d) What are biomaterials? Mention two important properties of biomaterials. (2+2=4)

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