JANUARY 2025

APPLIED PHYSICS-I

Time Allowed: 3 Hours *Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 marks is allotted for right answer and 1 marks is allotted for correct explanation of the answer.
Answer any Five (05) Questions from Group-B.

GROUP-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten):2x10=20

i) Which one of the followings is derived unit?- (a) gram (b) cm/second (c) second (d) cm

ii) The dimension of thermal conductivity is - (a) $MLT^{-2}K^{-1}$, (b) MLT^{-3}, (c) $MLT^{-3}K^{-1}$, (d) MLT^{-1}.

iii) If the percentage error in measurement of radius of a sphere is 2%, then the percentage error in measurement of its volume is- (a)4%, (b)6%, (c)40%, (d)60%.

iv) Rate of change of linear momentum with respect to time is- (a) work (b) force (c) acceleration (d) torque.

v) A ball of mass 5 Kg strikes a wall with a speed of 10 m/sec and rebounds with the same speed. The change in linear momentum of the ball is – (a) Zero (b) 50 Kg-m/sec (c) 100 Kg-m/sec (d) none of these.

vi) A bullet is fired from a gun. If the gun recoils, the linear momentum. of the gun is (a) greater than that of the bullet (b) less than that of the bullet (c) equal to that of the bullet (d) zero.

vii) The direction of the angular velocity vector is along – (a)The tangent to the circular path (b) The inward radius (c) The outward radius (d) The axis of rotation.

viii) The angular velocity of 30r.p.m. can be expressed in rad/s as- (a) π (b) 30π (c) 60π (d) none of these.

ix) Relation between kinetic energy (E) and linear momentum (P) is
(a) $P = \sqrt{4mE}$ (b) $P = \sqrt{2mE}$ (c) $P = \sqrt{mE}$
(d) $P = \sqrt{\frac{1}{2}mE}$; (where $m = mass$).

x) Among the following substances which one is the most elastic? (a) rubber (b) glass (c) steel (d) wood

xi) S.I. unit of surface tension is- (a) Nm^{-1} (b) Nm (c) Nm^2 (d) Nm^3

xii) The rise of liquid in a capillary tube depends on- (a) the material (b) the length of tube (c) nature of the liquid (d) inner radius of the tube.

xiii) In a horizontal pipe, water is flowing at a speed of 10cm/s, what will be the speed if the radius of the pipe is doubled? -(a)10 cm/s (b)5cm/s (c)2.5cm/s (d)1cm/s.

xiv) At what temperature, do the Celsius and Fahrenheit scale gives the same reading? (a) 40° (b) 0° (c) -40° (d) none of these.

xv) Which of the following statements are true for C_p & C_v – (a) $C_p = C_v$ (b) $C_p > C_v$ (c) $C_p < C_v$ (d) none of these.

GROUP-B

Answer any Five (05) questions.

2. a) State Principle of dimensional homogeneity. b) The centripetal force depends on the mass 'm' of a body, the velocity 'v' and the radius 'r'. Find the expression of centripetal force with the help of dimensional analysis c) In an experiment refractive index (μ) of glass was observed to be 1.56, 1.45, 1.54, 1.44, 1.53, and1.54. Calculate (i) mean absolute error (ii) relative error & (iii) percentage error. 2+3+3

3. a) State Newton's second law of motion & using that law establish Newton's first law of motion. b) Define impulse of force and state its S.I. unit. c) A 60gm bullet is shot from a 20 kg gun with a velocity of 100 m/s. What is the recoil velocity of the gun? (1+2)+2+3

4. a) A man is walking on a plane road with a suitcase of 5 kg on his head. What is the amount of work done by him? b) State the law of conservation of mechanical energy. c) A man of mass 60 Kg. carries a load of 20 Kg. to the top of a building of height 15 m. in 2 min. Find the power of the man. Take g = 10m. /sec^2. 2+2+4

5. a) Define angular velocity & establish the relation between linear velocity and angular velocity. b) "Centrifugal force is a pseudo force" Explain. c) State the laws of limiting friction. (1+2)+2+3

6. a) Define torque and angular momentum & establish the relation between them. b) State & explain parallel axis theorem of moment of inertia. c) What is the moment of inertia of a solid sphere of mass 10 kg and radius 20 cm about its diameter? (1+1+2)+2+2

7. a) "Young's modulus of copper is $1.3 \times 10^{11} N/m^2$" - what do you mean by the statement ? b) Draw with proper labelling a stress-strain diagram for a steel wire which is subjected to longitudinal tensile force. c) State Stoke's Law on viscosity. d) The ratio of terminal velocities of two water drops while falling on the ground is 4:9. Find the ratio of their radii. 2+2+2+2

8. a) State & explain Bernoulli's theorem in fluid dynamics. b) Define coefficient of viscosity. On which factors does the coefficient of viscosity of a fluid depend? c) How does surface tension of a liquid depend on presence of impurity, temperature & density? 2+ (2+2)+2

9. a) Distinguish between conduction, convection and radiation. b) Define molar specific heat at constant pressure & constant volume and write down the relation between them. c) If linear expansion coefficient of a metal is $18 \times 10^{-6}/^0C$, then find the value of volume expansion coefficient of the metal in ^0F. 3+ (1+1+1) +2