

17202

21819

2 Hours / 50 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.

**Marks**

1. Attempt any NINE of the following :

18

- (a) State kinematical equations of angular motion along with the meanings of symbols used in it.
- (b) State Newton's second law of motion. Give one example.
- (c) A force of 80 N applied to a wooden block at  $35^\circ$  to the horizontal displaces it through 40 m. Calculate the work done in the process.
- (d) A flywheel starting from rest accelerates to 1200 rev/sec in 30 seconds. Calculate the angular acceleration.
- (e) State any two properties of ultrasonic waves.
- (f) State concept of electromotive force (emf).
- (g) State the thermoelectric series. State its significance.
- (h) State any two applications of photoelectric cell.
- (i) Draw neat circuit diagram for the demonstration of photoelectric effect.

- (j) Calculate the minimum wavelength of X-rays emitted from an X-ray tube operating at 50 kV.
- (k) Draw neat labelled diagram of Coolidge's X-ray tube.
- (l) Explain the concept of population inversion in lasers.

**2. Attempt any FOUR of the following :****16**

- (a) Define potential energy. A box of 15 kg falls down from a height of 400 cm. Calculate the loss of potential energy. (Take  $g = 9.81 \text{ m/sec}^2$ )
- (b) Define angle of projection, trajectory, time of flight, range in projectile motion.
- (c) Explain the production of ultrasonic waves by piezoelectric method.
- (d) State any four limitations of NDT methods.
- (e) State principle, procedure and applications of liquid penetration technique for detection of surface imperfections.
- (f) A train crosses a tunnel in 10 seconds. At the entry of the tunnel its velocity is 40 km/hr and at exit of tunnel it is 20 km/hr. Find the length of the tunnel.

**3. Attempt any FOUR of the following :****16**

- (a) Distinguish between Peltier effect and Seebeck effect.
  - (b) Explain variation of thermo emf with temperature using characteristic curve. Hence define neutral temperature and inversion temperature.
  - (c) Calculate the maximum kinetic energy of the photoelectrons ejected from a metal surface when light of frequency  $1 \times 10^{15} \text{ Hz}$  is incident upon it.  
(Threshold wavelength for metal = 4500 Å; Planck's constant,  $h = 6.625 \times 10^{-34} \text{ J-sec}$  & velocity of light in air,  $C = 3 \times 10^8 \text{ m/sec}$ )
  - (d) State any four properties of X-rays.
  - (e) State any four engineering applications of laser.
  - (f) Define recoil velocity of gun. A bullet of mass 70 gm is fired with muzzle velocity of 300 m/s from a gun of mass 7 kg. Calculate recoil velocity of gun.
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