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**1 SEM TDC PHYH (CBCS) C 2**

**2025**

( Nov/Dec )

**PHYSICS**

( Core )

Paper : C-2

( **Mechanics** )

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct option from the following :

1×5=5

(a) In Galilean transformation

- (i) space and time are both relative
- (ii) space is relative but time is absolute
- (iii) space is absolute but time is relative
- (iv) space and time both are absolute

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(b) Which of the following remains constant in Lorentz transformation?

- (i) Mass
- (ii) Length
- (iii) Energy
- (iv) None of the above

(c) Moment of force is called

- (i) angular momentum
- (ii) moment of inertia
- (iii) torque
- (iv) None of the above

(d) Which of the following statements about resonance is correct?

- (i) Resonance occurs when amplitude is minimum
- (ii) Resonance occurs when driving frequency equals natural frequency
- (iii) Resonance never increases amplitude
- (iv) Resonance makes velocity zero

(e) Weightlessness experienced while orbiting the earth in spaceship is the result of

- (i) inertia
- (ii) acceleration
- (iii) zero gravity
- (iv) free fall towards the earth

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2. Answer briefly the following : 2×6=12

- (a) Prove that  $Y = 3K(1 - 2\sigma)$ , where  $Y$  = Young's modulus,  $K$  = bulk modulus, and  $\sigma$  = Poisson's ratio. 2
- (b) State and explain fictitious forces. 1+1=2
- (c) What are inertial and non-inertial frames of reference? 1+1=2
- (d) Show that a conservative force is a negative gradient of potential energy  $U$ . 2
- (e) State the work-energy theorem. 2
- (f) Show that, in SHM, the acceleration is directly proportional to its displacement. 2

3. Answer any four of the following : 4×4=16

- (a) Derive the Poiseuille's formula for determination of coefficient of viscosity of a liquid. 4
- (b) What are forced and damped oscillations? Write their differential equation and show them graphically. 2+2=4
- (c) Derive the formula of variation of mass of a particle with its relativistic velocity. 4

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- (d) Compute the moment of inertia of a thin rod of length  $L$  and mass  $M$  about an axis passing through its centre in a perpendicular direction. 4
- (e) What are centre of mass and laboratory frame of references? 2+2=4

4. Answer any four of the following : 5×4=20

- (a) Describe the Michelson-Morley experiment and its outcome.
- (b) Write a short note on the global positioning system (GPS).
- (c) State and discuss Kepler's laws of planetary motion.
- (d) Define moment of inertia and radius of gyration. Prove that  $\tau = I\alpha$ , where  $\tau$  = torque,  $I$  = moment of inertia and  $\alpha$  = angular acceleration.
- (e) Write down Galilean transformation equations and establish that velocity is variant but acceleration is invariant under Galilean transformation.

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