

Roll No. ....

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**007305**

**December 2023**

**B.Tech. (EL) IIIrd SEMESTER**

**Engineering Mechanics (ELES-305)**

Time : 3 Hours]

[Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) Define tensor. (1.5)
- (b) Differentiate vector and scalar. (1-5)
- (c) State Euler's theorem. (1,5)
- (d) State Parallel and perpendicular axes theorems. (1.5)
- (e) What is Newton-Euler's laws of rigid body motion? (1.5)
- (f) What is kinematic and kinetic constraints? (1.5)
- (g) Define general planar motion. (1.5)
- (h) What is free precession? (1.5)

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**ab** [P.T.O.]

(i) Define the angle of repose. (1.5)

(j) Define the coefficient of friction. (1.5)

### PART-B

2. (a) Calculate the angle between two vectors :

$$A = li - 2j + 3k \text{ and } B = 3i - 2j + k. \quad (10)$$

(b) Define Eigen values and Principal axes. (5)

3. (a) What do you understand by Three-dimensional rotation?

Explain with an example. (10)

(b) Explain the concept of free body diagrams. (5)

4. Two trains one express and the other shatabdi leave simultaneously delhi junction railway station. Shatabdi has a velocity of 120 km/hr and moves in the direction of N 30° W and the express train has a velocity of 60 km/hr in the direction S 60° E. Find the relative velocity of shatabdi with respect to the express train and the distance between them after 30 minutes. (15)

5. Two blocks A and B weighing 60 N and 40 N respectively are hung at each end of a thin rope over a frictionless pulley. Find the acceleration with which the block A will be coming down. Also find the tension in the rope. (15)

6. (a) Describe the assumptions made while deriving the equation for bending stress and explain their importance. (10)

(b) Define the neutral surface and neutral axis. (5)

7. A ladder of weight  $W$  and length  $L$  is placed along with a horizontal wall and it makes angle  $\theta$  with the floor. If the coefficient of friction between wall and ladder and between floor and ladder is 0.2, find the minimum value of  $\theta$  so that it does not slip. (15)