

2123

**B.E. (Mechanical Engineering)**  
**Third Semester**  
**MEC-303: Kinematics of Machines**

Time allowed: 3 Hours

Max. Marks: 50

**NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.**

x-x-x

- 1a) Classify different types of kinematic pairs.
- b) What is Coriolis component of acceleration
- c) Define coefficient of fluctuation of energy
- d) What is the function of flywheel
- e) Define slip and creep in belt drives (10)

**Part -A**

- 2a) Explain all the inversions of four bar chain. (4)
- b) In a pin jointed four bar mechanism,  $AB=300$  mm,  $BC = CD = 360$  mm and  $AD = 600$  mm. The angle  $BAD = 60^\circ$ . The crank  $AB$  rotates uniformly at 100 rpm. Locate all the instantaneous centres and find angular velocity of the link  $BC$ . (6)
- 3a) A 4-bar mechanism is required such that the input and the output angles are co - ordinated as given in the table:

|                                 |            |            |            |
|---------------------------------|------------|------------|------------|
| Input crank angle( $\Theta$ )   | $30^\circ$ | $50^\circ$ | $80^\circ$ |
| Output follower angle( $\phi$ ) | $0^\circ$  | $30^\circ$ | $60^\circ$ |

- Synthesize the 4-bar mechanism. (7)
- b) Explain the importance of least square technique in synthesis of mechanisms: (3)
- 4 a) Derive the relation for hoop stress in flywheel rim. (4)
- b) The equation of turning moment curve of a three crank engine is  $2500 + 750 \sin 3\Theta$  N-m, where  $\Theta =$  is the crank angle in radians. The mean speed of the engine is 300 rpm. The flywheel and other rotating parts attached to the engine have a mass of 500 kg at a radius of gyration of 1m. Calculate
  - i) the power of the engine
  - ii) the total fluctuation of the speed of flywheel in percentage when:
    - a) the resisting torque is constant
    - b) the resisting torque is  $2500 + 300 \sin \Theta$  N-m (6)

**Part -B**

- 5a) The lengths of the upper and lower arms of a Porter governor are 200 mm and 250 mm respectively. Both the arms are pivoted on the axis of rotation. The central load is 150 N, the weight of each ball is 20 N and the friction of the sleeve together with the resistance of operating gear is equivalent to a force of 30 N at sleeve. If the limiting inclinations of the upper arms to the vertical are  $30^\circ$  and  $40^\circ$ , determine the range of speed of the governor: (5)

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(2)

- b) Explain the terms :i) Sensitivity. ii) Stability iii) Isochronism (3)
- c) Differentiate between self- locking and self- energizing brakes (2)
- 6a) Derive the relation for maximum efficiency of screw jack. (5)
- b) A cone clutch with cone angle  $25^\circ$  is to transmit 8 kW at 750 rpm. The normal intensity of pressure between the contact faces is not to exceed 0.15 MPa. The coefficient of friction is 0.25. If face width is one-fifth of mean diameter, find: a) the main dimensions of the clutch and b) axial force required while running. Also sketch the arrangement. (5)
- 7a) Sketch and explain the working of Bevis Gibson flashlight dynamometer. (3)
- b) Classify different types of chains. (2)
- c) A leather belt is required to transmit 9 kW from a pulley 120 cm in a diameter running at 200 rpm. The angle embraced is  $165^\circ$  and the coefficient of friction between leather belt and pulley is 0.3. If the safe working stress for leather belt is  $140 \text{ N/cm}^2$ , density of leather belt is  $1 \text{ g/cm}^3$  and the thickness of the belt is 10 mm, determine the width of the belt taking centrifugal tension into account. (5)

x-x-x