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10MT43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Kinematics of Machines

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
at least TWO full questions from each part.**

PART – A

- 1 a. Define the following terms:
- i) Kinematic pair
 - ii) Kinematic chain
 - iii) Mechanism
 - iv) Machine
 - v) Degree of freedom
 - vi) Higher pair
 - vii) Lower pair
 - viii) Inversions
 - ix) Structure
 - x) Constrained motion. (10 Marks)
- b. Sketch and explain the single slider crank mechanism. Explain with a neat sketch any two of its inversions. (10 Marks)
- 2 Sketch and explain the following mechanism:
- a. Crank and slotted lever mechanism (08 Marks)
 - b. Peaucellier mechanism (07 Marks)
 - c. Pantograph. (05 Marks)
- 3 a. Derive an expression for velocity and acceleration of the piston of a reciprocating engine by analytical method. (10 Marks)
- b. The crank of an engine is 200mm long and connecting rod length to crank radius 4. Determine the acceleration of the piston when the crank has turned through 45° from the inner dead centre position and moving towards the other centre at 240rpm CCW direction by complex algebra analysis. (10 Marks)
- 4 a. Explain the classification of follower. (06 Marks)
- b. A cam rotating clockwise at uniform speed of 300rpm operates a reciprocating follower through a roller 15mm diameter. The follower motion is defined as below:
- i) Outward during 150° with UARM
 - ii) Dwell for next 30°
 - iii) Return during next 120° with SHM
 - iv) Dwell for the remaining period.
- Stroke of the follower is 30mm, minimum radius of the cam is 30mm. Draw the cam profile follower axis passes through cam axis. (14 Marks)

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PART – B

- 5 a. Discuss the types of friction and the laws of friction. (04 Marks)
 b. Derive an expression for the ratio of tensions in flat belts drive. (08 Marks)
 c. An open belt drive is required to transmit 10kW from a motor running at 600rpm. The belt is 12mm thick and has a mass density of 0.001 gm/mm^3 , safe stress in the belt is not to exceed 2.5MPa. Effective diameter of the driving pulley is 250mm, whereas the speed of driven pulley is 220rpm. The two shafts are 1.25m apart. If the coefficient of friction is 0.25, determine the width of the belt. (08 Marks)
- 6 a. Derive an expression relating the angle of heel and linear velocity of dynamic stability of a two wheel vehicle. (08 Marks)
 b. The rotor of the turbine of a ship has a mass of 2500 kg and rotates at a speed of 3200 rpm CCW when viewed from stern. The rotor has radius of gyration of 0.4m. Determine the gyroscopic couple and its effect when,
 i) The ship steers to the left in a curve of 80m at speed of 27,900 m/hr.
 ii) The ship pitches 5° above and 5° below the normal position and the bow is descending with its maximum velocity. The pitching motion is SHM with a periodic time of 40sec.
 iii) The ship rolls and at the instant the angular velocity is 0.04 rad/sec clockwise when viewed from stern. (12 Marks)
- 7 a. Define the following terms with reference to governor:
 i) Sensitiveness
 ii) Governor effort
 iii) Power
 iv) Isochronisms
 v) Controlling force
 vi) Hunting of governor. (06 Marks)
 b. Each arm of a porter governor is 300mm long and is pivoted on the axis of the governor. Each ball has a mass of 6kg and the mass of sleeve is 18kg. The radius of rotation of ball is 200mm when the governor begins to lift and 250mm when the speed is maximum. Determine the maximum and minimum speed and the range of governor. (14 Marks)
- 8 a. Explain simple and compound gear, train with neat sketches. (04 Marks)
 b. In an epicyclic gear of sun and planet type shown in Fig.Q.8(b), the pitch circle diameter of the annular wheel A is to be nearly 216mm and module 4mm. When the annular ring is stationary. The spider that carries three planet wheels P of equal size to make one revolution for every five revolution of the driving spindle carrying the sun wheel. Determine the number of teeth for all the wheels and the exact pitch circle diameter of the annular wheel. If an input torque 20N-m is applied to the spindle carrying the sun wheel, determine the fixed torque on the annular wheel. (16 Marks)

Fig.Q.8(b)


