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10ME/AU44

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017

Kinematics of Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define with suitable examples:
i) Structure ii) Machine
iii) Mechanism iv) Lower pair **(08 Marks)**

b. Sketch and explain the inversions of double slider crank chain. **(12 Marks)**

2 a. Sketch and explain the crank and slotted lever mechanism. **(06 Marks)**

b. Sketch and explain Geneva wheel mechanism. **(07 Marks)**

c. Sketch Ackerman steering mechanism and obtain condition for correct steering. **(07 Marks)**

3 a. Define the following:
i) Linear and angular velocity.
ii) Linear and angular acceleration **(06 Marks)**

b. The crank of a slider crank mechanism is 480 mm long and rotates uniformly at 20 rad/sec in the counter clockwise direction. It has a connecting rod of 1600 mm long. Determine the following when the crank is at 60° from the inner dead centre.
i) Velocity of slider
ii) Angular velocity of connecting rod and
iii) The position and velocity of a point 'p' on the connecting rod having least absolute velocity. **(14 Marks)**

4 a. Define instantaneous centre and state the types of instantaneous centres. **(04 Marks)**

b. In a slider crank mechanism the crank OA = 300 mm and connecting rod AB = 1200 mm. The crank OA is turned 30° from inner dead centre. Locate all the instantaneous centres. If the crank rotates at 15 rad/sec clockwise, find: i) velocity of slider, B; ii) angular velocity of connecting rod AB. **(08 Marks)**

c. Explain Klein's construction for slider-crank mechanism. **(08 Marks)**

PART – B

5 Using complex algebra, derive expression for velocity and acceleration of the piston and angular acceleration of connecting for a reciprocating engine mechanism. Use these expressions to find the above, if the crank length is 50 mm, connecting rod is 200 mm long, crank angle is 30°, the crank rotates at a constant speed of 3000 rpm. **(20 Marks)**

6 a. Compare cycloidal and involute gear tooth profile. **(04 Marks)**

b. Derive an equation to determine the length of path of contact by a pair of mating spur gear. **(08 Marks)**

c. Two mating gears with module pitch 6 mm have 20 and 50 teeth of pressure angle 20° and addendum 6 mm. Determine the number of pairs of teeth in contact. **(08 Marks)**

7 a. Sketch and explain:
   i) Compound gear train,
   ii) Epicyclic gear train. **(06 Marks)**

b. A fixed annular gear A and a smaller concentric rotating gear B are connected by a compound gear C and D. The gear C mesh with gear A and D with B. The compound gears revolved in a pin on the arm R, which revolves about the axis of A and B. The number of teeth on gears A, B and D are 150, 40 and 100 respectively. Determine the number of teeth on gear C, if the gear A and C have twice the module of gear B and D. How many revolutions will B make for one complete revolution of the arm R? **(14 Marks)**

8 The following data relate to a cam profile in which the follower moves with UARM during ascent and descent.
Minimum radius of the cam = 25 mm
Roller diameter = 10 mm
Lift = 30 mm
Offset of follower axis = 10 mm towards right
Angle of ascent = 60°
Angle of descent = 90°
Angle of dwell between ascent and descent = 45°
Speed of the cam = 200 rpm
Draw the profile of the cam. **(20 Marks)**

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