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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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.



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- 7 a. Sketch and explain:  
i) Compound gear train, (06 Marks)  
ii) Epicyclic gear train.
- 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 =  $60^\circ$   
Angle of descent =  $90^\circ$   
Angle of dwell between ascent and descent =  $45^\circ$   
Speed of the cam = 200 rpm  
Draw the profile of the cam. (20 Marks)

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