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10ME/AU44

**Fourth Semester B.E. Degree Examination, Aug./Sept.2020**  
**Kinematics of Machines**

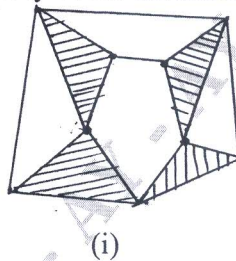
Time: 3 hrs.

Max. Marks:100

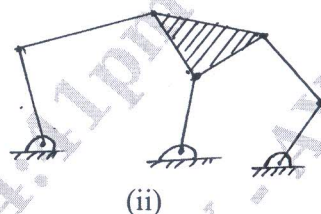
**Note:** 1. Answer any FIVE full questions, selecting atleast TWO questions from each part.  
2. Graphical solutions are to be drawn only in answer book or in graph sheets.

**PART - A**

- 1 a. Define the following :  
(i) Kinematic chain      (ii) Machine      (iii) Inversion  
(iv) Force closed pair      (v) Degrees of freedom      (10 Marks)
- b. Sketch and explain any two inversions of four bar chain.      (10 Marks)
- 2 a. Sketch and explain the following :  
(i) Crank and slotted lever quick return mechanism  
(ii) Ratchet and pawl mechanism.      (16 Marks)
- b. Determine the mobility of the mechanisms as shown in Fig.Q2(b)(i) and (ii).



(i)



(ii)

Fig.Q2(b)

(04 Marks)

- 3 A four bar chain of links PQ, QR and RS are 62.5mm, 175mm and 120mm long respectively. The link PS of chain PQRS is fixed and having length of 200mm. The link PQ makes an angle  $60^\circ$  with PS and rotates at 10 rad/sec clockwise. Determine  
(i) Angular velocity of links QR and RS.  
(ii) Angular acceleration of links QR and RS.      (20 Marks)
- 4 a. In a reciprocating engine the length of crank is 250mm and length of connecting rod is 1000mm. The crank rotates at a uniform speed of 300 rpm. Determine the velocity and acceleration of piston when the crank is  $30^\circ$  from inner dead centre. Use Klein's construction.      (10 Marks)
- b. In four bar mechanism the link AB is 300mm long. BC = CD = 360mm and AD the fixed link is 600mm long. The crank makes an angle of  $60^\circ$  with fixed link and it rotates uniformly at 100rpm. Locate all the instantaneous centers and find the angular velocity of link BC.      (10 Marks)

**PART - B**

- 5 a. Explain the significance of loop closure equation with example.      (05 Marks)
- b. The crank of mechanism is 200mm long and the ratio of connecting rod length to the crank radius is 4. Determine the acceleration of the piston when crank has turned through an angle  $45^\circ$  from inner dead centre and rotating at a speed of 240 rpm counter clockwise direction by complex number approach.      (15 Marks)

- 6 a. What is interference in involute gears? Derive an expression for the length of arc of contact in a pair of meshed spur gears. (10 Marks)
- b. Two spur gears having 30 and 40 teeth respectively are in mesh of pressure angle  $20^\circ$ . The module is 12mm, line of contact on each side of pitch point is half the maximum possible length. Find the length of addendum for each gear wheel and contact ratio. (10 Marks)
- 7 In an epicyclic gear train shown in Fig.Q7 the compound wheels A and B as well as internal wheels C and D rotates independently about axis 'O'. The wheels E and F rotates on the pins fixed to the arm a. All the wheels are of the same module. The number of teeth on wheels are  $T_A = 52$ ,  $T_B = 56$ ,  $T_E = T_F = 36$ . Determine the speed of 'C' if:
- (i) The wheel 'D' is fixed and arm 'a' rotates at 200 rpm clockwise.
- (ii) The wheel 'D' rotates at 20 rpm counter clockwise and the arm a rotates at 200 rpm clockwise.

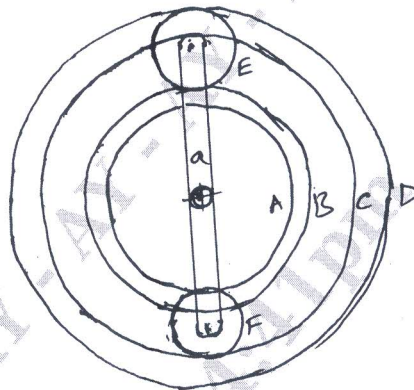


Fig.Q7

(20 Marks)

- 8 The following data relate to a cam profile in which the follower moves with UARM during ascent and SHM during descent. Minimum radius of the cam = 30mm. Roller diameter = 14mm, Lift = 30mm, Offset = 12mm towards right, Angle of ascent =  $60^\circ$ , Angle of descent =  $90^\circ$  dwell between ascent and descent =  $60^\circ$ , speed of cam = 200 rpm. Draw the profile of cam and determine the maximum velocity and acceleration during instroke and outstroke. (20 Marks)

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