

**Fourth Semester B.E. Degree Examination, June/July 2011**  
**Kinematics of Machines**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions.**  
**selecting atleast TWO from each part.**

**PART - A**

- 1 a. Define :
  - i) Kinematic chain
  - ii) Machine
  - iii) Structure
  - iv) Self closed pair
  - v) Force closed pair. (10 Marks)
- b. Sketch and explain any two inversions of four bar chain. (10 Marks)
  
- 2 Sketch and explain the following :
  - a. Whitworth quick return mechanism. (08 Marks)
  - b. Ratchet and pawl mechanism. (08 Marks)
  - c. Toggle mechanism. (04 Marks)
  
- 3 A four bar chain of links PQ, QR and RS are 62.5 mm, 175 mm and 120 mm long respectively, the link PS of chain PQRS is fixed and having length of 200 mm. The link PQ makes an angle of  $60^\circ$  with PS and rotates at 10 rad/ sec clockwise. Determine :
  - i) Angular velocity of links QR and RS
  - ii) Angular acceleration of link QR and RS. (20 Marks)
  
- 4 a. In a reciprocating engine the length of crank is 250 mm and length of connecting rod is 1000 mm. The crank rotates an 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. Locate all instantaneous centers for the following mechanism. (10 Marks)

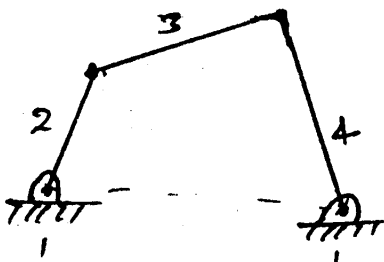


Fig. Q4(b)(i)

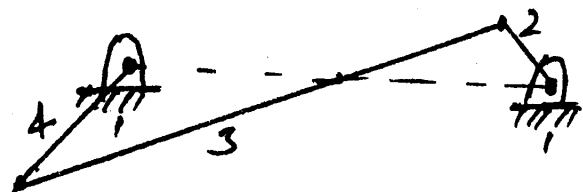


Fig. Q4(b)(ii)

**PART - B**

- 5 a. Explain the significance of loop closure equation, with example. (05 Marks)
- b. The crank of an engine mechanism is 200 mm 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 gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form module = 6 mm, addendum = one module, pressure angle =  $20^\circ$ . The pinion rotates at 90 rpm. Determine :
- Minimum no. of teeth on each wheel to avoid interference
  - The number of pair of teeth in contact. (10 Marks)
- 7 An epicyclic gear train consist of a sun wheel S, a stationary internal gear 'E' and three identical planet wheels 'P' carried on a stat – shape planet carrier 'C'. The size of different toothed wheels are such that the planet carrier C rotates one revolution for every 5 revolutions of the sun wheel S. The minimum number of teeth on any wheel (say P) is 16. the driving torque on the sun wheel is 100 N –m. Determine
- Number of teeth on different wheels of the train.
  - Toque necessary to keep the internal gear stationary. (20 Marks)

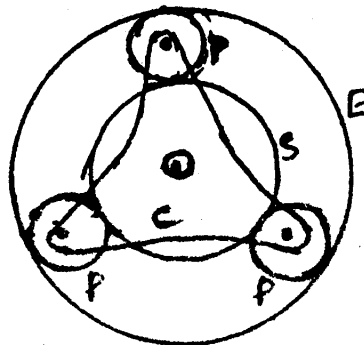


Fig. Q7

- 8 The following data relate to cam profile in which the roller follower moves with SHM during ascent and uniform acceleration and retardation motion during descent.
- Minimum radius of cam = 30 mm  
 Roller radius = 8 mm  
 Lift = 28 mm  
 Offset of follower axis = 12 mm towards right  
 Angle of ascent =  $90^\circ$   
 Angle of descent =  $60^\circ$   
 Angle of dwell between ascent and descent =  $45^\circ$   
 Speed of cam = 200 rpm
- Draw the profile of cam and determine the maximum velocity and acceleration during outstroke and return stroke. (20 Marks)

\*\*\*\*\*