

# CBCS SCHEME

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18IP/IM43

## Fourth Semester B.E. Degree Examination, July/August 2022

### Kinematics of Machines

Time: 3 hrs.

Max. Marks: 100

**Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.**

**2. Graphical solutions may be obtained either on graph sheets or in answer book itself.**

#### Module-1

- 1 a. Define the following terms with example  
 i) Kinematic pair ii) Kinematic chain iii) Mechanism iv) Degree of freedom. (10 Marks)
- b. Explain with neat sketch any two inversions of double slider crank chain. (10 Marks)

**OR**

- 2 a. Differentiate between the following :  
 i) Higher pair and Lower pair ii) Machine and Structure. (08 Marks)
- b. Sketch and explain the single slider crank mechanism. Explain with a neat sketch, any two of its inversions. (12 Marks)

#### Module-2

- 3 Sketch and explain the following mechanism  
 i) Crank and slotted lever quick return mechanism (08 Marks)  
 ii) Peaucelliers mechanism (06 Marks)  
 iii) Ratchet and Pawl mechanism (06 Marks)

**OR**

- 4 a. Explain the Whitworth quick return motion mechanism, with a neat sketch. (08 Marks)
- b. Explain with a neat sketch, Roberti's mechanism. (06 Marks)
- c. Explain with a neat sketch, Geneva wheel mechanism. (06 Marks)

#### Module-3

- 5 The crank of a slider crank mechanism rotates clockwise at a constant speed of 300rpm. The crank is 150mm and the connecting rod is 600mm long. Determine :  
 i) Linear velocity and acceleration of the midpoint of the connecting rod  
 ii) Angular velocity and angular acceleration of the connecting rod at a crank angle of  $45^\circ$  from inner dead center position. (20 Marks)

**OR**

- 6 PQRS is a four bar chain with link PS is fixed as shown in Fig Q6. The lengths of the links are PQ = 62.5mm QR = 175mm, RS = 112.5mm and PS = 200mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram. When angle QPS =  $60^\circ$ , Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.

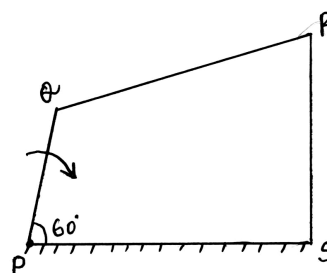


Fig Q6  
1 of 2

(20 Marks)

**Module-4**

- 7 a. State and Derive law of gearing. (08 Marks)  
 b. Two gear wheels mesh externally and are to give a velocity ratio of 3. The teeth are of involute form : module = 6mm, addendum = one module pressure angle =  $20^\circ$ , the pinion rotates at 90 rpm. Determine :  
 i) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel  
 ii) The length of path and arc of contact  
 iii) The maximum velocity of sliding. (12 Marks)

**OR**

- 8 a. List the types of Gear train, explain any one type of gear train with a neat sketch. (10 Marks)  
 b. In a reverted epicyclic train, the arm F carries two wheels A and D and a compound wheel B-C as shown in Fig Q8(b). The wheel A meshes with wheel B and the wheel D meshes with wheel C the number of teeth on wheel A, D and C are 80, 48 and 75 respectively. Find the speed and direction of wheel D, when wheel A is fixed and arm F makes 200rpm CW.

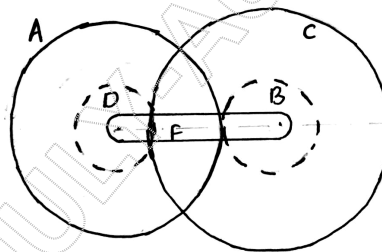


Fig Q8(b)

(10 Marks)

**Module-5**

- 9 Cam rotation with uniform speed is required to give the following motion to a knife edged follower: The outstroke of the follower is 40mm for  $60^\circ$  of cam rotation.  
 i) Dwell period of next  $30^\circ$  of cam rotation  
 ii) The return stroke during next  $60^\circ$  of cam rotation  
 iii) Dwell period for the remaining  $210^\circ$  of cam rotation.  
 The minimum radius of cam is 30mm. The follower moves with uniform velocity for both out stroke and return stroke. Develop a cam profile when the follower passes through the axis of cam shaft. (20 Marks)

**OR**

- 10 A cam drives a flat reciprocating follower in the following manner :  
 During first  $120^\circ$  rotation of the cam, follower moves outwards through a distance of 20mm with simple harmonic motion. The follower dwells during next  $30^\circ$  of cam rotation during next  $120^\circ$  of cam rotation the follower moves inwards with simple harmonic motion. The follower dwells for the next  $90^\circ$  of cam rotation.  
 The minimum radius of the cam is 25mm. Draw the profile of the cam. (20 Marks)

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