

## Fourth Semester B.E. Degree Examination, June/July 2023

### Kinematics of Machines

Time: 3 hrs.

Max. Marks: 100

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

#### Module-1

- 1 a. Define the following :  
 i) Link    ii) Kinematic pair    iii) Kinematic chain    iv) Degree of freedom    v) Structure. (05 Marks)  
 b. Differentiate between machine and mechanism. (05 Marks)  
 c. With neat sketch, explain any two inversions of four bar chain. (10 Marks)

**OR**

- 2 a. Explain Peauellier straight line motion mechanism with a neat sketch. (10 Marks)  
 b. With a neat sketch, explain the pantograph. (10 Marks)

#### Module-2

- 3 a. Explain velocity and acceleration analysis of four bar mechanism. (10 Marks)  
 b. Explain velocity and acceleration analysis of slider crank mechanism. (10 Marks)

**OR**

- 4 a. Explain and derive an expression for Coriolis components of acceleration. (10 Marks)  
 b. A four bar chain ABCD has fixed link AD = 1m. The driving crank AB = 0.3. The follower link CD = 0.6m and the connecting link BC = 1.2m. The crank AB rotates at a speed of 300rpm clock wise with an angular acceleration of  $200 \text{ rad/sec}^2$  in anti-clock wise direction. When the angle made by the crank with the fixed link is  $135^\circ$  in anti clock wise direction. Determine :  
 i) Angular velocity of link BC and CD  
 ii) Acceleration of B and C (10 Marks)

#### Module-3

- 5 a. Sketch and explain Klein's construction for single slider – crank mechanism. (10 Marks)  
 b. In a pin jointed four bar mechanism as shown in Fig Q5(b), AB = 150mm, BC = CD = 180mm and AD = 300mm. The angle of BAD =  $60^\circ$ . The crank AB rotates uniformly at 100rpm. Locate all the instantaneous center and find the angular velocity of the link BC.

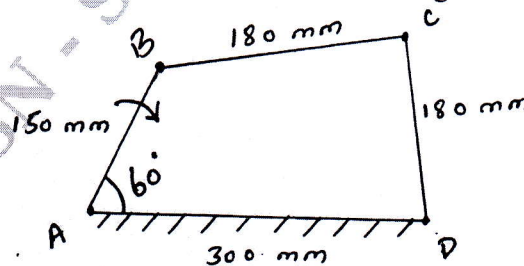


Fig Q5(b)

(10 Marks)

OR

- 6 For an inclined slider crank mechanism of crank length of 5mm, crank angle of  $30^\circ$  and connecting rod length 150mm, determine the velocity and acceleration of the slider using complex algebra method. Take the constant speed of the crank as 2100 rpm in clockwise direction. (20 Marks)

Module-4

- 7 a. Derive an expression for path of contact. (10 Marks)  
b. A pair of spur gears has 16 teeth and 18 teeth, a module 12.5mm an addendum 12.5mm and a pressure angle  $14.5^\circ$ . Prove that the gears have interference. Determine the minimum number of teeth and the velocity to avoid interference. (10 Marks)

OR

- 8 a. An epicyclic gear consists of three gears A, B and C as shown in Fig Q8(a). The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 rpm. If the gear A is fixed, determine the speed of gears B and C.

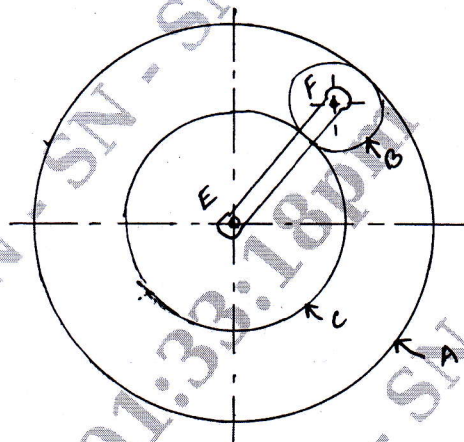


Fig Q8(a)

- b. Explain the types of gear train.

Module-5

- 9 a. With a neat sketch, explain the types of cams. (10 Marks)  
b. Explain the types of followers with a neat sketch. (10 Marks)

OR

- 10 Draw the profile of a cam operating a roller reciprocating follower and with the following data :  
Minimum radius of cam = 25mm  
Lift = 30mm  
Roller diameter = 15mm  
The cam lifts the follower for  $120^\circ$  with SHM, followed by a dwell period of  $30^\circ$ . Then the follower lowers down during  $150^\circ$  of cam rotation with uniform acceleration and retardation followed by a dwell period. If the cam rotates at a uniform speed of 150 rpm. Calculate the maximum velocity and acceleration of follower during the descent period. (20 Marks)

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