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## Fourth Semester B.E. Degree Examination, Jan./Feb.2021 Kinematics of Machinery

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. Explain :
- (i) Kinematic chain      (ii) Mechanism      (iii) Degrees of freedom. (06 Marks)
- b. Explain with neat sketches:
- (i) Whit worth quick return motion mechanism.      (ii) Toggle mechanism. (10 Marks)

OR

- 2 a. Explain :
- (i) Grubler's criterion. (02 Marks)
- (ii) Sketch and explain inversions of Grashoff's chain. (09 Marks)
- b. Sketch and explain Pantograph mechanism. (05 Marks)

### Module-2

- 3 Fig. Q3 shows configuration diagram of an engine mechanism. The dimensions are the following : Crank OA = 200 mm, Connecting rod AB = 600 mm; Distance of centre of mass from Crank end AD = 200 mm. At the instant, the crank has an angular velocity of 50 rad/s clockwise and an angular acceleration of 800 rad/s<sup>2</sup>. Calculate the
- (i) Velocity of 'D' and angular velocity of AB. (16 Marks)
- (ii) Acceleration of 'D' and angular acceleration of 'AB'.

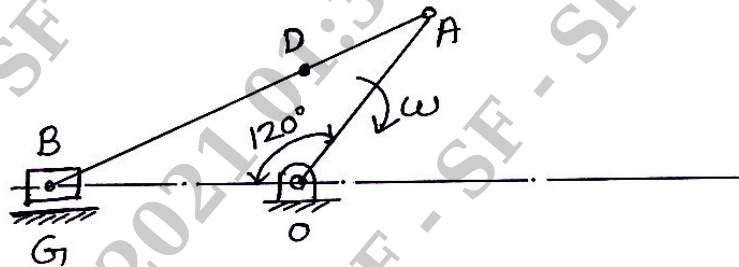


Fig. Q3

OR

- 4 a. Explain Klein's construction for slider crank mechanism to find velocity and acceleration of piston. (06 Marks)
- b. In a slider crank mechanism the length of the crank and connecting rod are 200 mm and 800 mm respectively. Locate all the I-centres of the mechanism for the position of the crank when it has turned 30° from the inner dead centre. Also find the velocity of the slider and the angular velocity of the connecting rod if the crank rotates at 40 rad/s. (10 Marks)

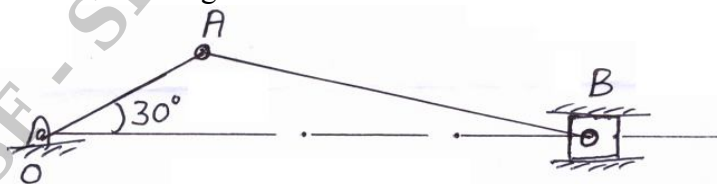


Fig. Q4 (b)

**Module-3**

- 5 In a four bar mechanism ABCD, link AB = 300 mm, BC = 360 mm, CD = 360 mm and the fixed link AD = 600 mm; The angle BAD = 60°, the link AB has an angular velocity of 10 rad/sec and an angular acceleration of 30 rad/sec<sup>2</sup>, both clockwise. Determine the angular velocity and angular acceleration of link BC and CD by using complex algebra method. (16 Marks)

**OR**

- 6 a. Derive Freudensteins equation for four bar mechanism. (10 Marks)  
b. Explain function generation for Four bar mechanism, by any method (two position synthesis). (06 Marks)

**Module-4**

- 7 a. Derive an expression for minimum number of teeth to avoid interference on a gear wheel. (06 Marks)  
b. Two involute gear wheels having module 3 mm and pressure angle 20° mesh externally to give a velocity ratio of 3. The pinion rotates at 75 rpm and addendum is equal to one module. Determine (i) The number of teeth on each wheel to avoid interference (ii) The length of path and arc of contact (iii) The number of pairs of teeth in contact. (10 Marks)

**OR**

- 8 a. Define gear trains. Explain different types of gear trains. (07 Marks)  
b. An epicyclic gear train is shown in Fig. Q8 (b). The number of teeth on A and B are 80 and 200 respectively. Determine the speed of the arm 'a',  
(i) If A rotates at 100 rpm clockwise and B at 50 rpm counter clockwise.  
(ii) If A rotates at 100 rpm clockwise and B is stationary. (09 Marks)

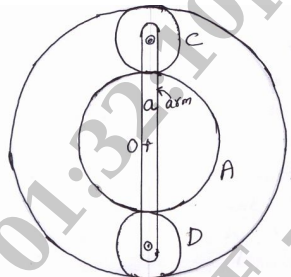


Fig. Q8 (b)

**Module-5**

- 9 The following data relate to a cam profile in which the follower moves with uniform acceleration and deceleration during ascent and descent:  
Minimum radius of cam = 25 mm, Roller diameter = 7.5 mm, Lift = 28 mm, Offset of the follower axis = 12 mm towards right angle of ascent = 60°, Angle of descent = 90°, Angle of dwell between ascent and descent = 45°, Speed of the cam = 200 rpm. Draw the profile of the cam and determine the maximum velocity and uniform acceleration of the follower during outstroke. (16 Marks)

**OR**

- 10 a. Define the terms:  
(i) Cam profile (ii) Pressure angle  
(iii) Trace point (iv) Pitch circle. (04 Marks)  
b. Derive expressions for displacement, velocity and acceleration of the follower when the flat faced follower touching circular flank (Arc cam). (12 Marks)

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