

**D-180272****B. Tech. EXAMINATION, 2018**

Semester V(CBS)

KINEMATICS OF MACHINES (ME, AE)

ME-501

Time : 3 Hours

Maximum Marks : 60

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D and all subparts of Section E. Assume the data, if required.

**Section A**

1. Explain and sketch six different examples of the use of planar four-bar linkage in practice. They can be found in workshops, in domestic appliances, vehicles etc.

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2. 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 :

- (a) Angular velocity of links QR and RS.
- (b) Angular acceleration of link QR and RS.

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**Section B**

3. Construct the displacement diagram and the cam profile for a plate cam with an oscillating radial flat-face follower that rises through  $30^\circ$  with cycloidal motion in  $150^\circ$  of counterclockwise cam rotation, then dwells for  $30^\circ$ , returns with cycloidal motion in  $120^\circ$  and dwells for  $60^\circ$ . Determine the necessary lengths for the follower face, allowing 5 mm clearance at the free end. The prime-circle radius is 30 mm, and the follower pivot is 120 mm to the right.
4. The following data relate to cam profile in which the roller follower moves with simple harmonic motion during ascent and uniform acceleration and retardation motion during descent.

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- 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 = 2000 rpm  
 Draw the profile of cam and determine the maximum velocity and acceleration during outstroke and return stroke. 12

### Section C

5. (a) 2.5 kW of power is transmitted by an open belt drive. The linear velocity, of the belt is 2.5 m/s. The angle of lap on the smaller pulley is  $165^\circ$ . The coefficient of friction is 0.3. Determine the effect on power transmission, if the initial tension in the belt is increased by 8%. 8
- (b) Diagrammatically show the following with reference to a spur gear tooth :  
 Pitch circle, Clearance, Addendum and Dedendum. 4

6. (a) Discuss the various importance factors upon which the selection of a belt drive depends. 4
- (b) In the reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D, E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gear B, C and D are 80, 35 and 95 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 rpm clockwise. 8

### Section D

7. (a) Discuss the various tasks of kinematic synthesis. 4
- (b) Analytically synthesize the four bar crank rocker mechanism for three position motion generation. 8
8. Synthesize a four bar linkage for the purpose of generating a function  $y = x^{3/2}$  in the interval  $1 < x < 5$  using Freudenstein's method, for 3 accuracy points link start and end angle of  $45^\circ$  and  $105^\circ$  respectively, output link start and end angle of  $135^\circ$  and  $225^\circ$  respectively. 12

## Section E

9. Explain the following :

**6×2=12**

- (a) Degree freedom
- (b) Grashof Mechanism
- (c) Trace point of the follower
- (d) Law of toothed gearing
- (e) Transmission angle
- (f) Higher Pair.

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