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Roll No. ....

**337454(37)**

**B. E. (Fourth Semester) Examination, 2020**

**APR-MAY 2022**  
(New Scheme)

**(Mech., Production and Automobile Branch)**

**KINEMATICS of MACHINES**

***Time Allowed : Three hours***

***Maximum Marks : 80***

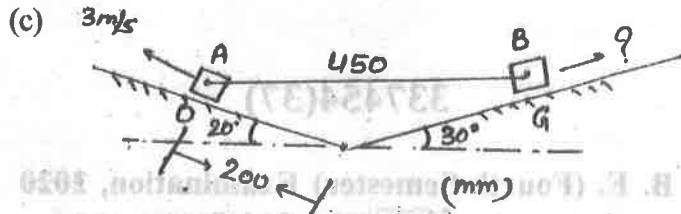
***Minimum Pass Marks : 28***

***Note : Attempt all questions. Part (a) of each question is compulsory. Attempt any two parts from (b), (c) and (d).***

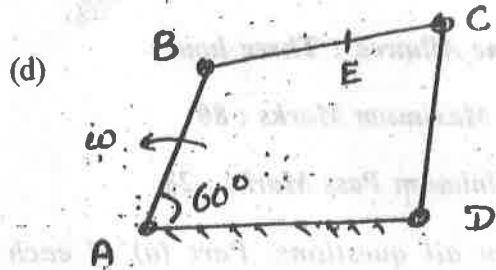
**Unit - I**

1. (a) What is configuration diagram? What is its use? 2
- (b) (i) Discuss various types of constrained motion. 2
- (ii) What is a redundant link in a mechanism? 2

(iii) What are usual types of joints in a mechanism? 3



For the position of the mechanism shown in figure, find the velocity of the slider B for given configuration if the velocity of the slider A is 3 m/s. 7



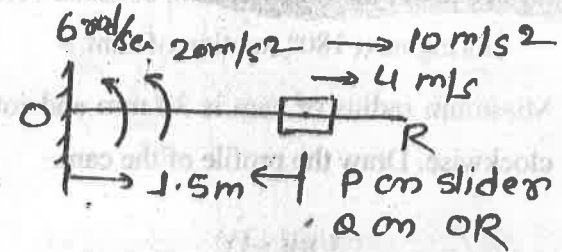
In a four link mechanism,  $AB = 50$  mm,  $BC = 66$  mm,  $CD = 56$  mm and  $AD = 100$  mm. at the instant when  $\angle DAB = 60^\circ$ , the link AB has an angular velocity of  $10.5$  rad/sec in the counter clockwise direction. Determine the velocity of the point E on the link BC when  $BE = 40$  mm. 7

Unit - II

2. (a) What is an acceleration image? How is it helpful in determining the accelerations of offset points on a link? 2

(b) Derive Coriolis acceleration component. 7

(c) Determine the absolute accelerations of the slider for shown configuration diagram : 7



(d) Draw acceleration diagram for slider-crank mechanism. Assume all suitable data required. 7

Unit - III

3. (a) Define trace point and pressure angle. 2

(b) What is a tangent cam? Find the expression for the velocity of a roller follower for such a cam. 7

(c) Plot motion of the follower for :

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- (i) Simple Harmonic Motion (SHM)
- (ii) Constant velocity
- (d) A cam is to give the following motion to a knife edged follower :
- (i) To raise the follower through 30 mm with uniform acceleration and deceleration during 180° rotation of the cam.
- (ii) To lower the follower with constant velocity during next 180° rotation of cam.

Minimum radius of cam is 30 mm and rotates clockwise. Draw the profile of the cam.

#### Unit - IV

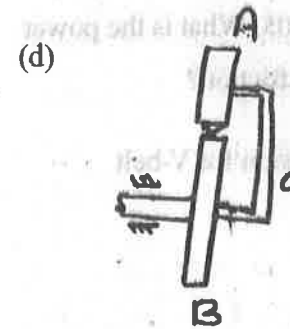
4. (a) What is a reverted gear train? Where is it used?
- (b) Each of two gears in a mesh has 48 teeth and a module of 8 mm. The teeth are of 20° involute profile. The arc of contact is 2.25 times the circular pitch. Determine the addendum.
- (c) Two 20° involute spur gear mesh externally and give a velocity ratio of 3.  $m = 3$  mm and addendum

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is equal to 1.1 module. If the pinion rotates at 120 rpm determine :

- (i) Minimum number of teeth on each wheel to avoid interference.
- (ii) Constant ratio



An epicyclic gear train shown in figure. Find the speed of gear B if

- (i) the gear A is fixed and
- (ii) the gear A revolves at 240 rpm clockwise instead of being fixed.

$$T_A = 30, T_B = 40, N_{\text{arm}(a)} = 80^{\text{(ccw)}}$$

#### Unit - V

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5. (a) Define friction. 2

(b) A conical pivot with angle of cone as  $100^\circ$  supports a load of 18 kN. The external radius is 2.5 times the internal radius. The shaft rotates at 150 rpm. If the intensity of pressure is to be  $300 \text{ kN/m}^2$ , and coefficient of friction as 0.05. What is the power lost in working against the friction? 7

(c) Derive ratio of friction:tension for V-belt

$$\frac{T_1}{T_2} = e^{\mu\theta/\sin\alpha}$$

(d) A bicycle and rider, travelling at 12 km/h on a level roads have a mass of 105 kg. A brake is applied to the rear wheel which is 800 mm in diameter. The pressure on the brake is 80 N and the coefficient of friction is 0.06. Find distance covered by the bicycle and number of turns of its wheel before coming to rest. 7