Roll No. ..... Total Pages : 07

BT-3/D-19 33155

THEORY OF MACHINE

Course No MEC201A/MTC205A

Time : Three Hours] [Maximum Marks : 75

Note : All questions in Part A and Part B are compulsory. Attempt any *four* questions from Part C selecting *one* from each Unit.

Part A

1. Answer the following questions :

   (i) Explain various inversions of single slider crank chains.

   (ii) Discuss .prime circle and Trace point for a cam with a translating roller follower.

   (iii) Describe the applications of Balancing in detail.

   (iv) Explain initial tension in belt.

   (v) Define the following terms :

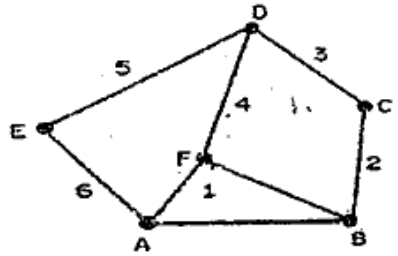
   circular pitch, velocity ratio, pitch circle diameter.

   5×3=15

Part B

Unit I

2. Consider a pentagonal ABCDE with a point F inside this pentagonal. Let a machanism be constructed with links ABF, BC, CD, DE, DF and AE. These links are connected by revolute pairs at the points A, B, C, D, E and F. Determine the degree of freedom of this mechanism with one of the links fixed. Also identify which links are binary and with are ternary. 5

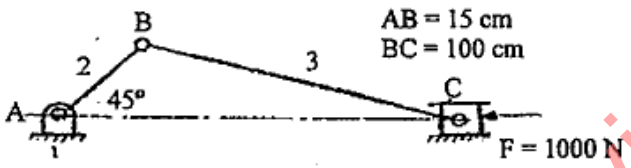


Unit II

3. In a slider crank mechanism shown in fig. block P reciprocates along the fixed line OB and the crank has a uniform speed of 230 r.p.m. Determine the acceleration of the block P. OC = 150 mm. Assume necessary data. 5

Unit III

4. Refer to fig. find the driving moment applied to link 2. Determine the various forces also. 5



Unit IV

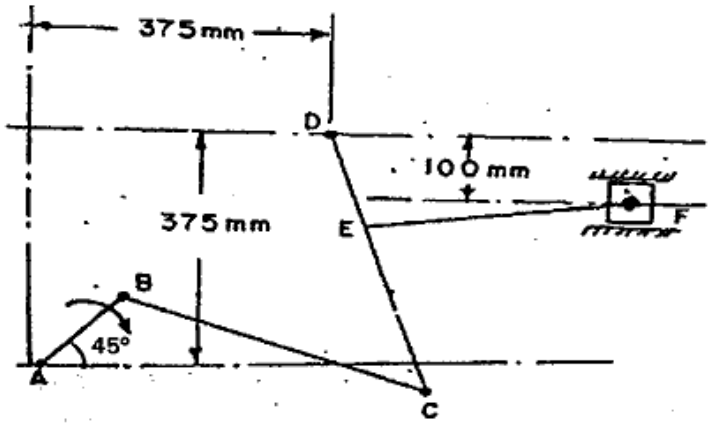
5. The following data relate to a flat drive :
Power transmitted 18 kW, pulley diameter 180 cm, angle of contact 175°, speed of pulley 300 r.p.m., coefficient of friction between belt and pulley surface 0.3, Permissible stress for belt 300 N/cm^2, Thickness of the belt 8 mm, Density of belt material 0.95×10^{-3} gm/cm^3.
Determine the width of belt required taking centrifugal tension into account. 5

Part C

Unit I

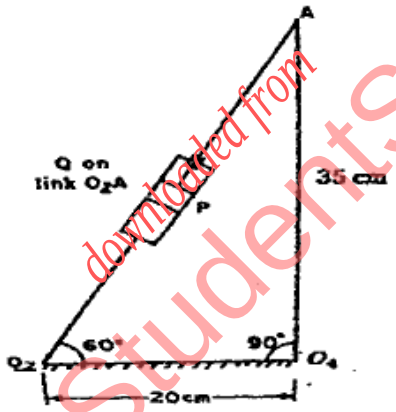
6. In a crank and slotted lever quick return mechanism the distance between the fixed centers is 150 mm and the driving crank is 75 mm long. Determine the ratio of the time taken on the cutting and return strokes. 10

7. The mechanism as shown in fig. has dimensions of various links as follows :
AB = DE = 150 mm; BC = DC = 450 mm; EF = 375 mm
The crank AB makes an angle of 45° with the horizontal and rotates about A in the clockwise direction at a uniform speed of 120 r.p.m. The lever DC oscillates about the fixed point D, which is connected to AB by the coupler BC. The Block F moves in the horizontal guides, being driven by the link EF. Determine :
(i) Velocity of the block F
(ii) Angular velocity of DC. 10



Unit II

8. Fig. shows a mechanism in which the hydraulic actuator O_2A is expanding at a constant rate of 10 cm/sec. Determine the directions and magnitudes of angular velocity and acceleration of link O_4A. **10**

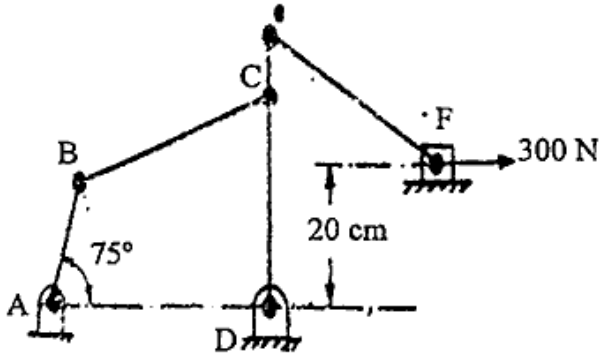


9. A follower is the move outward 5 cm with simple harmonic motion while the cam turns through 180° with angular velocity ω. The follower is to return with simple harmonic motion during the next 150° rotation and dwell for 30°. Sketch and dimenstion the displacement, velocity and acceleration diagrams of the follower. **10**

Unit III

11. (a) What are the conditions of static equilibrium of a three force member and a member with two forces and a torque ?

(b) AB = 15 cm, BC = 50 cm, AD = 60, DC = 30 cm, CE = 10 cm, EF = 50 cm. http://www.kuonline.in For the static equilibrium of the mechanism shown in fig. find the input torque on AB. **10**



11. The pistons o a 60° twin V engine has strokes of 120 mm. The connecting rods driving a common crank has a length of 200 mm. The mass of the reciprocating parts per cylinder is 1 kg and the speed of the crank shaft is 2500 r.p.m. Determine the magnitude of the primary and secondary forces. **10**

Unit IV

12. An open belt drive connects two pulleys 1.20 m and 5.0 m diameter, on parallel shafts 4 metres apart. The mass of the belt is 0.9 kg per metre length and the maximum tension is not exceed 2000 N. The coefficient of friction is 0.3. The belt 1.2 m pulley, which is the driver, runs at 200 r.p.m. due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 r.p.m. Calculate the torque on each of the shafts, the power transmitted and power lost in friction. What is the efficiency of the driver ? **10**

13. A right angle drive on a machine is to be made by two spiral wheels. The wheels are of equal diameter with normal pitch of 1 cm and centre distance is approximately 15 cm. If the speed ratio is 2.5 to 1, find (a) spiral angles of teeth, (b) Number of teeth on each wheel, (c) the exact center distance, (d) Transmission efficiency, if friction angle is 6°. **10**