Enrollment No.____________________

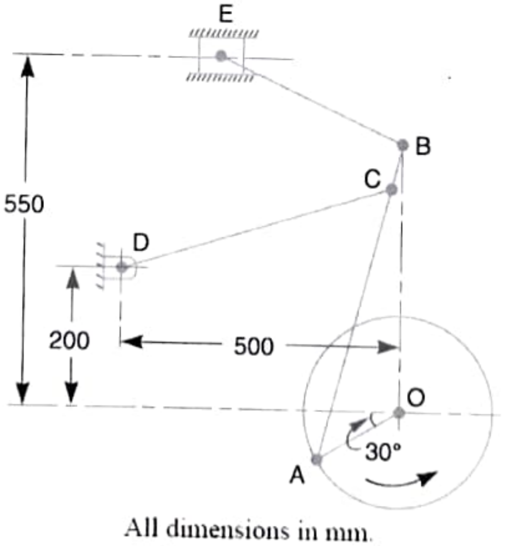
NAVRACHANA UNIVERSITY
a UGC recognized University

School: School of Engineering and Technology
Program/s: B.Tech Mechanical Engineering
Year: 2nd **Semester:** 4th
Examination: End Examination
Examination year: May - 2023

Course Code: ME 212 **Course Name:** Kinematics and Dynamics of Machines I
Date: 19/05/2023
Time: 10:00 am to 12:00 pm
Total Marks: 40
Total Pages: 02

Instructions:

- *Write each answer on a new page.*
- *Assume the data when required.*
- *Use of calculator is allowed.*

Q. No.1	Answer all the questions (Each of 05 marks)		COs*	BTL#
Q 1	Figure 01 shows the mechanism of a radial valve gear. The crank OA turns uniformly at 150 r.p.m and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as centre and DC as radius. The dimensions of various links are: OA = 150 mm ; AB = 550 mm ; AC = 450 mm ; DC = 500 mm ; BE = 350 mm. Determine velocity and acceleration of the ram E for the given position of the mechanism.  All dimensions in mm. Figure 01	13	CO2	BT1, BT2
	OR		CO1	BT1, BT2
	A cam rotating clockwise at a uniform speed of 200 r.p.m. is required to move an offset roller follower with a uniform acceleration and retardation on both the outward and return strokes. The angle of ascent, the angle of dwell (between ascent and descent) and the angle of descent is 120°, 60° and 90° respectively. The follower		CO1	BT4, BT6,

<table>
<tr><td></td><td>dwells for the rest of cam rotation. The least radius of the cam is 50 mm, the lift of the follower is 25 mm and the diameter of the roller is 10 mm. The line of stroke of the follower is offset by 20 mm from the axis of the cam. Draw the cam profile and find the maximum velocity and acceleration of the follower during the outstroke.</td><td></td><td></td><td></td></tr>
<tr><td>Q 2</td><td>Attempt the following (Attempt any 03, Each of 04 Marks):

(A) Explain with neat sketch the different types of cams and followers.
(B) For the belt drive prove that $\frac{T_1}{T_2} = e^{\mu\theta}$. Consider usual notations.
(C) Using neat sketch define path of contact and arc of contact. Also derive the expression for both.
(D) What do you understand by gears train? Discuss the various types of gears trains.</td><td>12</td><td>CO1</td><td>BT 2
BT 4</td></tr>
<tr><td>Q 3</td><td>Attempt the following (Attempt any 03, Each of 05 Marks)

(A) Two mating involute spur gear of 20° pressure angle have a gear ratio of 2. The number of teeth on the pinion is 20 and its speed is 250 r.p.m. The module pitch of the teeth is 12 mm. If the addendum on each wheel is such that the path of approach and the path of recess on each side are half the maximum possible length, find: 1. the addendum for pinion and gear wheel; 2. the length of the arc of contact; and 3. the maximum velocity of sliding during approach and recess. Assume pinion to be the driver.
(B) Locate all the instantaneous centres for a four bar mechanism for the four bar mechanism shown in Figure 02. The length of various links is AD = 125 mm, AB = 62.5 mm, BC = CD = 85 mm. If the link AB rotates at a uniform speed of 10 rpm in clockwise direction, find the angular velocity of link BC and CD.

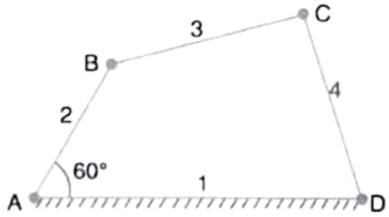


Figure 02

(C) In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have the same module and the number of teeth are : TC = 28; TD = 26; TE = TF = 18. 1. Sketch the arrangement ; 2. Find the number of teeth on A and B ; 3. If the arm G makes 100 r.p.m. clockwise and A is fixed, find the speed of B ; and 4. If the arm G makes 100 r.p.m. clockwise and wheel A makes 10 r.p.m. counter clockwise ; find the speed of wheel B.
(D) An open belt drive connects two pulleys 1.2 m and 0.5 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 to exceed 2000 N.The coefficient of friction is 0.3. The 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 two shafts, the power transmitted, and power lost in friction. What is the efficiency of the drive ?</td><td>15</td><td>CO2</td><td>BT1,
BT2</td></tr>
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***********End of Question Paper***********