Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S3 (PT) (S, FE) Examination December 2023 (2015 Scheme)

Course Code: ME301

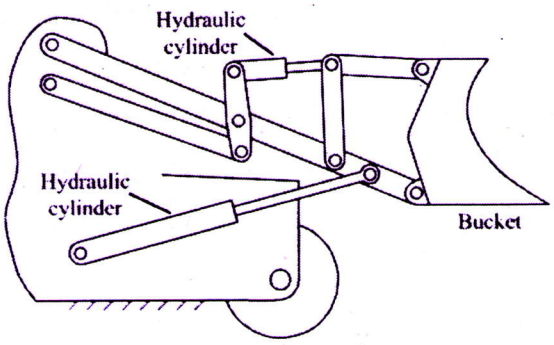
Course Name: MECHANICS OF MACHINERY

Max. Marks: 100 Duration: 3 Hours

PART A

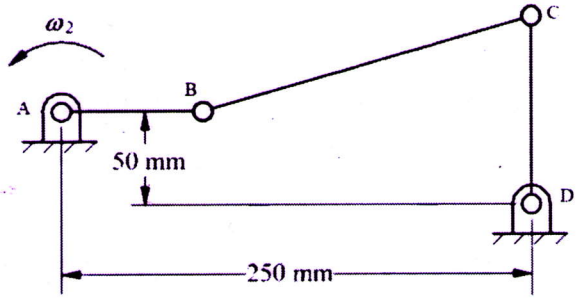
Answer any three full questions, each carries 10marks. Marks

1 a) Find the degrees of freedom of the bucket motion mechanism of the machine shown in figure. (5)



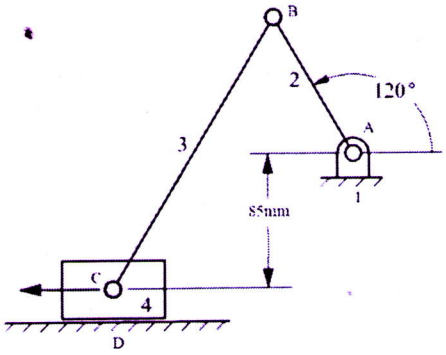
b) State and prove Kennedy's theorem (5)

2 (10)



For the four-bar mechanism shown in figure, link AB is rotating CCW at the rate of 2 rad/s (constant). The link AB is horizontal and link CD is vertical. Given AB = 75 mm, CD = 100 mm. Determine the angular velocity of BC and CD.

3 For the slider crank mechanism shown in figure, the slider 4 is moving to the left at the constant rate of 40mm/s, Determine the angular accelerations of BC and AB. Given AB= 100mm, BC = 200mm. (10)



4 With neat sketch explain the working of i) wedge cam, ii) cylindrical cam, iii) spiral cam and iv) convex globoidal cam. (10)

PART B

Answer any three full questions, each carries 10marks.

5 a) For a given cam, will the choice of the type of follower (knife-edge, flat-faced, roller) affect the displacement diagram? Explain. (3)

b) Why a roller follower is preferred to that of a knife-edged follower? (3)

c) Explain the effects of follower offset on the pressure angle of the cam. (4)

6 A cam drives a flat reciprocating follower in the following manner: (10)

1) Follower moves outward through a distance of 30 mm with simple harmonic motion during the first 60° of cam rotation.
2) Follower dwells during the next 100° of cam rotation.
3) Follower moves inwards with uniform acceleration and deceleration during the next 90° of cam rotation.
4) Follower dwells during the remaining period.

Draw the profile of the cam when the minimum radius of the cam is 40 mm. Also calculate the maximum velocity and acceleration during outward motion of the follower when the cam rotates with 300rpm.

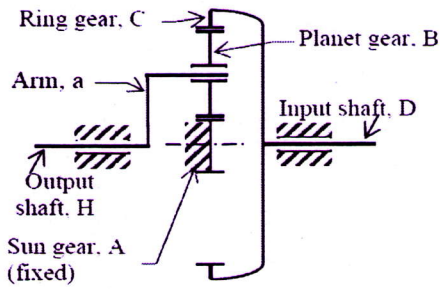
7 The pinion of a pair of spur gears has 16 teeth and a pressure angle of 20°. The velocity ratio is to be 3:2. and the module is 6.5 mm. Determine the initial center distance. If the center distance is increased by 3 mm, find the resulting pressure angle. (10)

8 Two standard gears have a diametral pitch of 2 and a pressure angle of 14½°. The tooth numbers are 14 and 16. Determine whether interference occurs. If it does, compute the amount that the addendum(s) must be shortened to remove the interference and the new contact ratio. (10)

PART C

Answer any four full questions, each carries 10marks.

9 a) In the epicyclic train shown in figure, the input shaft makes 300 rev/min clockwise. Determine the speed and direction of rotation of output shaft. (10)



Given: T_A=20, T_B=30

10 a) Explain why and how in an automotive transmission the differential allows two wheels to rotate with different angular velocities while the speed of the engine remains the same. (5)

b) Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains? (5)

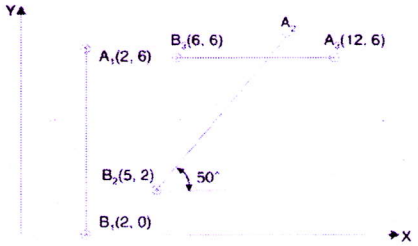
11 a) Explain Freudenstein's method of three-point synthesis of mechanisms. (5)

b) Discuss the method of determining the angles for input and output link in a four-bar mechanism for function generation. (5)

12 Determine the proportions of four bar mechanism, by using three precision points, to generate $y = x^2$, where x varies between 1 and 3. Assume θ_s =30°; $\Delta\theta$ = 90°; φ_s = 70°; $\Delta\varphi$ = 100°. Take length of fixed link AD as 50mm. (10)

13 Design a slider crank mechanism to coordinate three positions of the input crank and the output slider for the following data using graphical method and explain the procedure. θ_{12} = 50°, S_{12} = 30mm, θ_{13} = 90°, S_{13} = 70mm (10)

14 Synthesize a four-bar mechanism to guide a rod AB through three consecutive positions A_1B_1, A_2B_2 and A_3B_3 as shown in figure. (10)



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