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18ME44

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
Kinematics of Machines

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain with neat sketches types of kinematic pairs. **(12 Marks)**

b. State the Grashoff's law. For a four bar mechanism of link length 3cm, 12cm, 8cm and 10cm, check whether it satisfies Grashoff's law. From these links draw a crank rocker mechanism, showing fixed link, crank and rocker. **(08 Marks)**

OR

2 a. Draw a neat sketch of Peaucelliar straight line mechanism. Explain with proof how the tracing point describes a straight line path. **(10 Marks)**

b. Explain with neat sketch:
i) Ratchet and Pawl mechanism
ii) Toggle mechanism. **(10 Marks)**

Module-2

3 In a slider crank mechanism, crank rotates at 180rpm. Length of the crack OA is 500mm, connecting rod AB is 1500mm. When the crank is turned by 45° from IDC, find:
i) Angular velocity and angular acceleration of connecting rod AB.
ii) Velocity and acceleration of slider B. **(20 Marks)**

OR

4 a. State and prove Kennedy's theorem. **(08 Marks)**

b. In a 4 bar mechanism ABCD, link AD is fixed. Length of the links AB = 20cm, BC = 30cm, CD = 32cm, AD = 60cm. Crank AB rotates at 300rpm in anticlockwise direction. When the crank AB rotates at 60°, locate all instantaneous centers and find the angular velocity of link BC. **(12 Marks)**

Module-3

5 In a slider crank mechanism, the crank radius is 100mm and length of connecting rod is 500mm. The crank rotates at 15rad/s in anticlockwise direction and angular acceleration is 115 rad/sec^2. Find the acceleration of piston and the angular acceleration of connecting rod when the crank is at 60° from inner dead centre, by complex algebra analysis. **(20 Marks)**

OR

6 a. Explain function generation. **(06 Marks)**

b. Design a four bar mechanism if the motion of the input and output links are governed by a function $y = x^{1.5}$ and x varies from 1 to 4. Assume θ to vary from 30° to 120° and ϕ from 60° to 130°. The length of the fixed link is 30mm. **(14 Marks)**

Module-4

7 a. How the cams are classified? Explain in detail. **(08 Marks)**

b. What are the different types of motion with which follower can more? Explain with displacement, velocity and acceleration diagram. Also mention the equation to find maximum velocity and acceleration in each case. **(12 Marks)**

OR

8 Draw the profile of a cam operating a roller reciprocating follower with the following data: Minimum radius of cam = 25mm, lift = 30mm, roller diameter = 15mm. The cam lifts the follower for 120° with SHM followed by a dwell period of 30°. Then the follower lowers down during 150° of the cam rotation with uniform acceleration and retardation motion followed by a dwell period. If the cam rotates at a uniform speed of 150rpm, calculate the maximum velocity and acceleration during the descent period. **(20 Marks)**

Module-5

9 a. Derive an expression for the length of path of contact in a pair of spur gears. **(08 Marks)**

b. A pair of involute spur gears with 16° pressure angle and pitch of module 6mm is in mesh. The number of teeth on pinion is 16 and its rotational speed is 240rpm. When the gear ratio is 1.75, find inorder to avoid the interference:

i) Addenda on the gear and pinion
ii) Length of path of contact
iii) Maximum velocity of sliding of teeth on either side of the pitch point. **(12 Marks)**

OR

10 a. What do you understand by 'gear train'? Discuss various types of gear trains. **(10 Marks)**

b. In an epicyclic gear train, an arm carriers two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300rpm in the clockwise direction, what will be the speed of gear B? **(10 Marks)**

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