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17ME42

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms:
i) Link ii) Kinematic pair iii) Kinematic chain iv) Machine v) Structure vi) Constrained motion vii) Mechanism viii) Inversion ix) Degree of freedom x) Grashof's law. **(10 Marks)**

b. With neat sketch, explain crank and slotted lever quick return motion mechanism. **(10 Marks)**

OR

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

b. Explain with neat sketches:
i) Ratchet mechanism
ii) Geneva wheel **(10 Marks)**

Module-2

3 a. A four bar chain ABCD has a fixed link AD = 1m. The driving crank AB = 0.3m. The follower link CD = 0.6m and the connecting link BC = 1.2m. The crank AB rotates at a speed of 300rpm clockwise with an angular acceleration of 200 rad/sec^2 in anti-clock wise direction. When the angle made by the crank with the fixed link is 135° in anti-clockwise direction. Determine:
i) Angular velocity of link BC and CD
ii) Acceleration of B and C. **(12 Marks)**

b. Explain and derive an expression for Coriolis component of acceleration. **(08 Marks)**

OR

4 a. Sketch and explain Klein's construction for single slider-crank mechanism. **(10 Marks)**

b. In a pin jointed 4-bar mechanism as shown in Fig.Q.4(b), AB = 150mm, BC = CD = 180mm and AD = 300mm. The angle of BAD = 60°. The crank AB rotates uniformly at 100rpm. Locate all the instantaneous center and find the angular velocity of the link BC. **(10 Marks)**

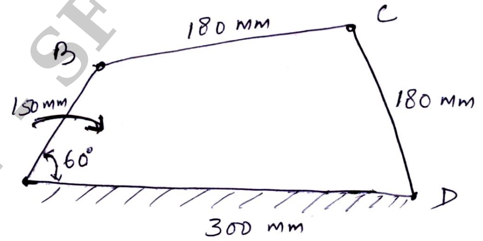

Fig.Q.4(b)

Module-3

5 For an inclined slider crank mechanism of crank length of 50mm, crank angle of 30° and connecting rod length 150mm, determine the velocity and acceleration of the slider using complex algebra method. Take the constant speed of the crank as 2100 rpm in clockwise direction. **(20 Marks)**

OR

6 a. Derive an expression for the Freudensteins equation of four bar mechanism. **(12 Marks)**
b. Explain the function generation, path generation and motion generation. **(08 Marks)**

Module-4

7 a. State and prove law of gearing. **(06 Marks)**
b. Derive an expression for path of contact. **(06 Marks)**
c. A pair of spur gears has 16 teeth and 18 teeth, a module 12.5mm, an addendum 12.5mm and a pressure angle 14.5°. Prove that the gears have interference. Determine the minimum number of teeth and the velocity ratio to avoid interference. **(08 Marks)**

OR

8 a. Explain epicyclic gear train with neat figure. **(08 Marks)**
b. An epicyclic gear train consists of a sun wheel (S), a stationary internal gear (E) and the three identical planet wheel (P) carried on a star shaped planet carrier (C). The sizes of different toothed wheels are such that the planet carrier C rotates at 1/5 of the speed of the sun wheel. The minimum number of teeth on any wheel is 100N-m. Determine:
i) Number of teeth on different wheels of train.
ii) Torque necessary to keep the internal gear stationary. **(12 Marks)**

Module-5

9 Draw the profile of a cam operating a roller follower with the following data:
Minimum radius of the 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 deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150rpm. Calculate the maximum velocity and acceleration of the follower during descent period. **(20 Marks)**

OR

10 a. Derive an expression for displacement, velocity and acceleration when the flat face of the follower contact with the straight flank of the tangent cam. **(08 Marks)**
b. A symmetrical circular arc cam operating a flat faced follower has the following particulars. Least radius of the cam = 30mm, lift = 20mm, angle of lift = 75°, nose radius = 5mm, speed = 600rpm. Find:
i) The principal dimensions of cam.
ii) The acceleration of the follower at the beginning of lift, at the end of contact with the circular flank, at the beginning of contact with nose and at the apex of nose. **(12 Marks)**

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