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Fourth Semester B.E. Degree Examination, Jan./Feb. 2021 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. Define the following terms:
 - i) Kinematic link
 - ii) Kinematic chain
 - iii) Kinematic pair
 - iv) Degree of freedom
 - v) Inversion. (10 Marks)
- b. Explain with a neat sketch:
 - i) Toggle Mechanism
 - ii) Ratchet and Pawl mechanism. (10 Marks)

OR

- 2 a. Explain with a neat sketch, the working of Elliptical Trammel. (10 Marks)
- b. Explain with a neat sketch, crank and slotted lever Quick return motion mechanism. (10 Marks)

Module-2

- 3 In the four bar mechanism shown in Fig.Q.3(a) the lengths of various links are $AB = 190\text{mm}$, $BC = CD = 280\text{mm}$, $AD = 500\text{mm}$, $\angle BAD = 55^\circ$. The crank AB rotates at 10 rad/s in clockwise direction. Determine:
 - i) Acceleration of links BC and CD
 - ii) Angular Acceleration of BC and CD . (20 Marks)

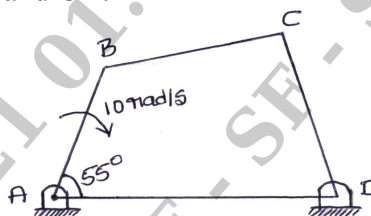


Fig.Q.3

OR

- 4 a. State and Prove Kennedy theorem. (08 Marks)
- b. Fig.Q.4(b) shows a six link mechanism. The dimensions of the links are $OA = 100\text{mm}$, $AB = 580\text{mm}$, $BC = 300\text{mm}$, $QC = 100\text{mm}$, $CD = 350\text{mm}$. The crank OA rotates clockwise at 150rpm . For the position when crank OA makes an angle of 30° with the horizontal. Determine:
 - i) Linear velocities of the pivot points B , C , D
 - ii) Angular velocities of the links AB , BC and CD . (12 Marks)

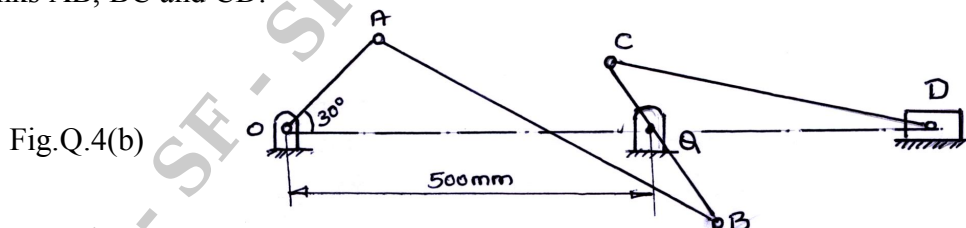


Fig.Q.4(b)

Module-3

- 5 a. Explain the importance of loop closure equation with an example. (08 Marks)
- b. For the mechanism shown in Fig.Q.5(b) includes a crank of 50mm length and the connecting rod of 200mm length. The crank speed is constant at 300rpm. Determine the angular velocity and angular acceleration of the connecting rod by using complex algebra method, when the crank angle is 30° . (12 Marks)

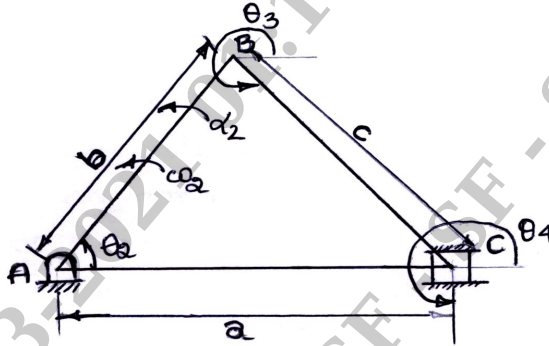


Fig.Q.5(b)

OR

- 6 a. Using complex algebra method derive the expression for velocity and acceleration of the piston in slider crank mechanism. (14 Marks)
- b. Derive Freudensteins equation for a four bar linkage. (06 Marks)

Module-4

- 7 A cam with a minimum radius of 25mm is to be designed for a knife edge follower with the following data:
- To raise the follower through 35mm during 60° rotation of the cam.
 - Dwell for next 40° of cam rotation
 - Descending of the follower during the next 90° of cam rotation.
 - Dwell during the rest of the cam rotation.
- Draw the profile of the cam if the ascending and descending of the cam is with simple harmonic motion and line of stroke of the follower is offset 10mm from the axis of the cam shaft. What is the maximum velocity and acceleration of the follower during ascent and the descent if the cam rotates at 150rpm? (20 Marks)

OR

- 8 Draw the profile of a cam operating roller follower and with following data:
- Minimum radius of the cam = 40mm
 - Lift = 37.5mm
 - Roller diameter = 20mm
 - Line of stroke passes through the axis of the cam.
- The cam lifts the follower for 60° with uniform Acceleration and retardation motion followed by a dwell period of 30° . Then the follower lowers down during 60° of the cam rotation with uniform acceleration and retardation motion followed by a dwell period. Calculate the maximum velocity and acceleration of the follower during the descent period if the cam rotates at 120rpm. (20 Marks)

Module-5

- 9 a. State and prove Law of Gearing. (08 Marks)
- b. A pinion of 20° involute teeth rotating at 275rpm meshes with a gear and provides a gear ratio of 1.8. The number of teeth on the pinion is 20 and module is 8mm. If the interference is just avoided. Determine:
- Addenda on the wheel and the pinion
 - Path of contact
 - Maximum velocity of sliding on both sides of the pitch point. (12 Marks)

OR

- 10 An epicyclic gear train is shown in Fig.Q.10. The number of teeth on A and B are 80 and 200. Determine the speed of the arm "a".
- If A rotates at 100rpm clockwise and B at 50 rpm counter clockwise.
 - If A rotates at 100rpm clockwise and B is stationary. (20 Marks)

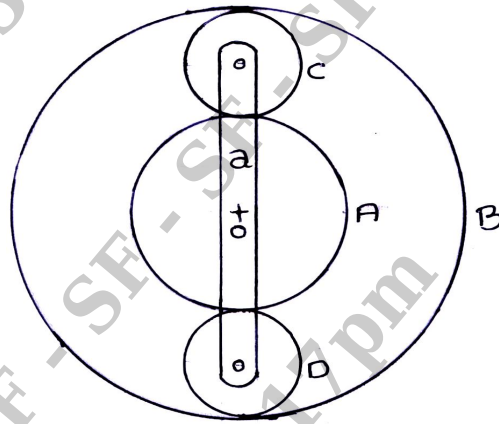


Fig.Q.10
