

CBCS SCHEME

17AU43

Fourth Semester B.E. Degree Examination, Aug./Sept.2020 Kinematics of Machines

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- Define : (i) Link (ii) Kinematic pairs (iii) Kinematic chain (iv) Mechanism (v) Inversions (10 Marks)
 - Sketch and explain crank and slotted lever quick return motion mechanisms. (10 Marks)

OR

- Sketch and explain the working of (i) Pantograph (ii) Ratchet and Pawl mechanism. (10 Marks)
 - Sketch and explain Ackermann Steering Gear Mechanism. (10 Marks)

Module-2

- The Fig.Q3 shows a crank and slotted lever type quick return mechanism. The crank rotates at a uniform speed of 60 rpm clockwise. The line of stroke of the ram is perpendicular to OA. Determine the Velocity and Acceleration of 'D'.

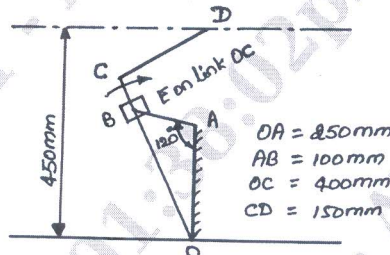


Fig.Q3

(20 Marks)

OR

- State and prove Kennedy's theorem. (06 Marks)
 - The mechanism of a wrapping machine as shown in Fig.Q4(b) has the following dimensions $O_1A = 100\text{mm}$; $AC = 700\text{mm}$; $BC = 200\text{mm}$; $O_3C = 200\text{mm}$; $O_2E = 400\text{mm}$; $O_2D = 200\text{mm}$ and $BD = 150\text{mm}$. The crank O_1A rotates at uniform angular velocity of 100 rad/sec. Locate all instantaneous centres and find velocity of the point 'E' of the bell crank lever by instantaneous centre method.

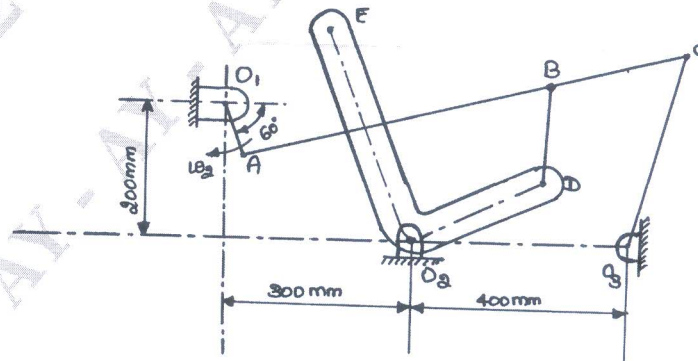


Fig.Q4(b)
1 of 3

(14 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

5 A four bar mechanism is shown in Fig.Q5. Write the loop closure equation and determine an expression for

- The output angle ' ϕ '
- The angular velocity of output link.
- Coupler link position β
- Angular velocity of coupler link
- Angular acceleration of output link
- Angular acceleration of coupler link.

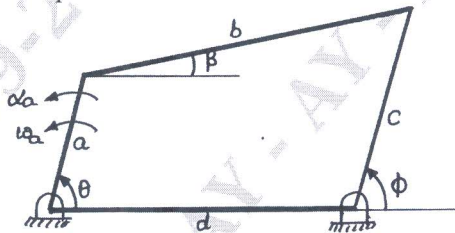


Fig.Q5

(20 Marks)

OR

- Derive an expression for velocity and acceleration of the piston in a reciprocating mechanism by using complex algebra method. (10 Marks)
- Explain Klein's construction for slider crank mechanism. (10 Marks)

Module-4

- Derive an expression for minimum number of teeth necessary for a gear and pinion to avoid interference. (10 Marks)
- An epicyclic gear train as shown in Fig.Q7(b). The wheel 'A' is fixed and the input at the arm 'R' is 3 kW at 600 rpm. Find the speed of wheel 'D' and the torque on it and the torque required to hold the wheel 'A'. Neglect frictional losses.

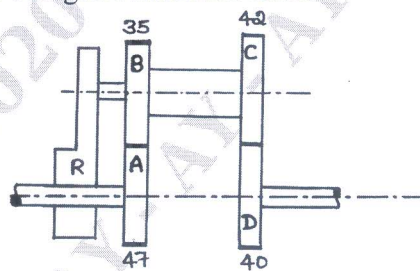


Fig.Q7(b)

(10 Marks)

OR

- Two gear wheel mesh externally and are to give a velocity ratio of 3. The teeth are of involute form of a module 6mm and standard addendum one module. Pressure angle = 18° . Pinion rotates at 90 rpm. Find (i) Number of teeth on each wheel so that interference is just avoided (ii) Length of path of contact (iii) length of arc of contact (iv) Maximum velocity of sliding between teeth (v) Number of pairs of teeth in contact. (12 Marks)
- Sketch and explain the gear trains used in (i) Watches (ii) Automobile gear box. (08 Marks)

Module-5

- 9 a. Explain the following types of cam?
(i) D - R - D cam (ii) D - R - R - D cam (iii) R - R - R cam (06 Marks)
- b. A cam rotates at a uniform speed of 300 rpm clockwise and gives an oscillating follower 75mm long, an angular displacement of 30° in each stroke. The follower is fitted with a roller of 20mm diameter which makes contact with the cam. The outward and inward displacements of the follower each occupying 120° cam rotation and there is no dwell in the lifted position. The follower moves throughout with SHM. The axis of fulcrum is 80mm from the axis of cam and the least distance of roller axis from cam axis is 40mm. (14 Marks)

OR

- 10 a. Define the following term related to cam:
(i) List (ii) Dwell (iii) Pressure angle (iv) Base circle. (04 Marks)
- b. Draw the profile of a cam which will give a lift of 38mm to a follower carrying a roller of 25mm diameter. The axis of the follower is off-set by 18mm to the right of the axis of cam. Ascent of the follower takes place with SHM in 0.05 second followed by a period of rest 0.0125 second. The follower by then descent with UARM during 0.125 second, the acceleration being $3/5$ times retardation. The cam rotates in clockwise direction at a constant speed of 240 rpm and the base circle radius is 50mm. (16 Marks)

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