CBCS SCHEME

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18AU43

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 :
i) Kinematic link ii) Kinematic pair iii) Kinematic chain iv) Mechanism iv) Inversions. **(10 Marks)**

b. Explain with a neat sketch, crank and slotted lever quick return motion mechanism. **(10 Marks)**

OR

2 a. Explain with a neat sketch Pantograph mechanism, state its applications. **(08 Marks)**

b. Explain with a neat sketch Toggle mechanism. **(08 Marks)**

c. Find the degree of freedom for the following mechanism.

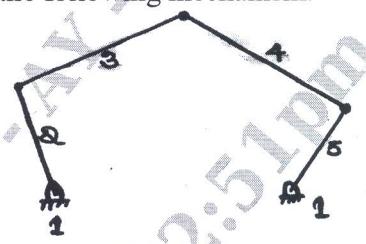


Fig Q2(c) **(04 Marks)**

Module-2

3 a. A 4-brar mechanism ABCD is made up of four links, pin jointed at the ends. AD is a fixed link which is 180mm long. The links AB, BC and CD are 90mm, 120mm and 120mm respectively. At certain instant, the link AB makes at an angle of 60° with the link AD. If the link AB rotates at a uniform speed of 100rpm clockwise (CW) determine,
i) Angular velocity of the links BC and CD
ii) Angular Acceleration of links CD and CB.

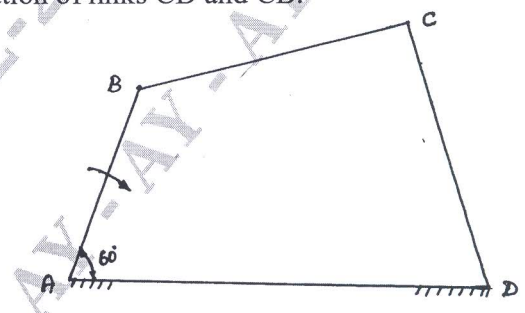


Fig Q3(a) **(10 Marks)**

b. In a slider crank mechanism, the crank DB = 30mm and the connecting rod BC = 120mm. The crank makes an angle of 60° with Inner Dead Centre (IDC) and rotates at uniform speed of 300rpm clockwise (CW) Find,
i) Velocity and piston 'C' and angular velocity of connecting rod BC
ii) Acceleration of piston 'C' and angular acceleration of connecting rod BC. **(10 Marks)**

OR

4 a. The toggle mechanism shown in Fig Q4(a), the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter clockwise direction at a speed of 180rpm, increase at the rate of 50rad/sec^2. The dimensions of the various links are as follows OA = 180mm ; CB = 240mm ; AB = 360mm and BD = 540mm. For the given configuration find,

i) Velocity of slider 'D' and angular velocity of BD

ii) Acceleration of slider 'D' and angular acceleration of 'BD'.

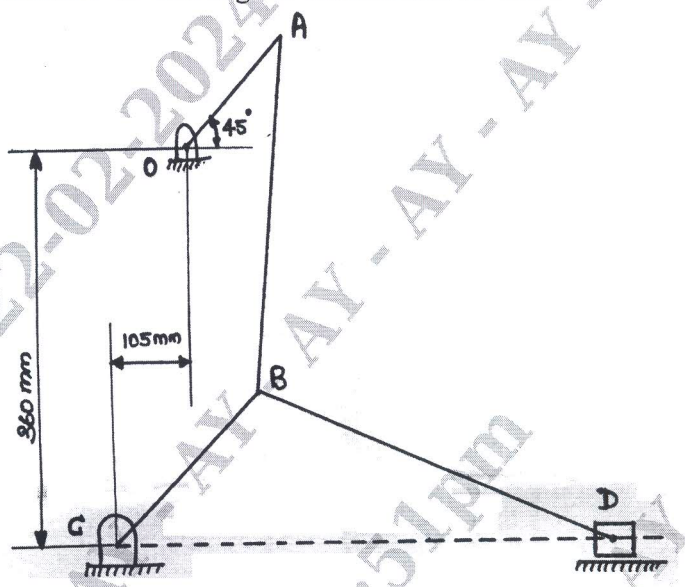
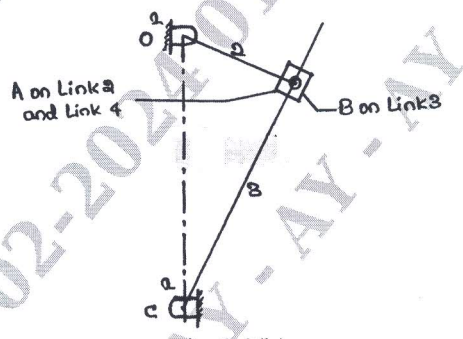


Fig Q4(a) **(10 Marks)**

b. The Fig Q4(b) shows a quick return mechanism. Link 2 rotates uniformly at 20 rad/sec clockwise direction. Determine the angular acceleration of link 3.



OC = 350mm
OA = 150mm
CB = 250m

Fig Q4(b)

(10 Marks)

Module-3

5 a. In a slider crank mechanism, the crank OA = 300mm and connecting rod AB = 1200mm. The crank OA is tunned 30° from Inner dead centre. Locate all Instantaneous centers. If the crank rotates at 15rad/sec clockwise find : i) Velocity of slider B ii) Angular velocity of connecting rod AB. **(10 Marks)**

b. Determine the velocity and Acceleration of piston by Klein's construction to the following specifications.
Stroke = 300mm ; Ratio of length of connecting rod to crank length = 4 ; Speed of the Engine = 300rpm ; Position of crank = 45° with Inner dead centre. **(10 Marks)**

OR

6 a. Using complex algebra derive expression for velocity and acceleration of the piston, angular acceleration of connecting rod of a reciprocating engine mechanism. **(12 Marks)**

b. Illustrate use of Klein's construction for velocity diagram for slider crank mechanism. **(08 Marks)**

Module-4

7 a. Deduce an expression for minimum numbers of teeth in a gear to avoid interference. **(10 Marks)**

b. Two gear wheels of module pitch 4.5mm have 24 and 33 teeth respectively. Pressure angle = 20° each, wheel has a standard addendum of one module. Find,

i) Length of Arc of contact

ii) Maximum velocity of sliding, if the speed of smaller wheel is 120rpm **(10 Marks)**

OR

8 a. Sketch and explain simple, compound and Epicyclic gear train. **(10 Marks)**

b. In an epicyclic gear train, the internal wheel A and B, the compound wheel C and D rotate independently about the axis 'O'. The wheels E and F rotate on a pin fixed to the arm 'G'. E gears with A and C and F gears with B and D. All the wheels have same pitch and the number of teeth on E and F are 18, C = 28, D = 26.

i) Sketch the arrangement

ii) Find number of teeth on A and B

iii) If arm G makes 150rpm CW and A is fixed, find the speed of B

iv) If the arm G makes 150rpm CW and A makes 15rpm CCW, find the speed of B. **(10 Marks)**

Module-5

9 Draw a full size cam profile which will give lift of 38mm to a follower carrying a roller of 25mm diameter. The axis of the follower is off-set by 18mm Right of the axis of cam. Ascent of the follower takes place with VARM in 120 Degree rotation of cam, and then descent with SHM during next 120 Degree of cam rotation, remaining is Dwell. The cam rotates in anti-clockwise direction at a speed of 240rpm and Base circle radius is 50mm. Find maximum velocity and Acceleration during ascent and Descent. **(20 Marks)**

OR

10 A cam rotates at a uniform speed of 300rpm clockwise and gives an oscillating follower 80mm 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 displacement of the follower each occupying 120 degree cam rotating and there is a dwell of 60 degree in the lifted position and 60 degree after the inward displacement. The follower moves throughout with SHM. The axis of fulcrum is 85mm from the axis of cam and the least distance of roller axis from cam axis is 40mm. **(20 Marks)**

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