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

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Any Missing Data can be suitably assumed.

**Module-1**

- 1 a. With a neat sketch, explain crank and slotted lever mechanism. (10 Marks)
- b. With a neat sketch, explain the working of elliptical trammel. Also derive the relation. (10 Marks)

OR

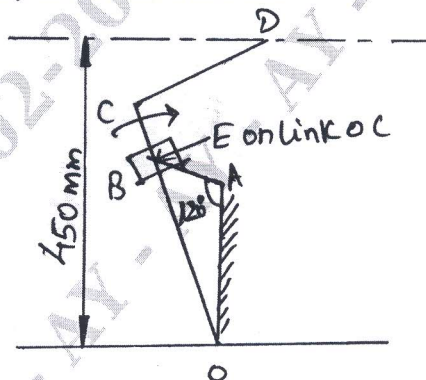
- 2 a. Discuss with neat sketch the working of pantograph and also derive the same. (10 Marks)
- b. With relevant sketch, discuss the working of peaucellier mechanism and discuss the condition of strength line motion using peaucellier mechanism. (10 Marks)

**Module-2**

- 3 A four bar mechanism  $O_1 A B O_2$  is made up of four links, pin jointed at the ends,  $O_1 O_2$  are fixed link which is 120mm long. Link OA, AB,  $O_2 B$  and AC are 45mm, 90mm 60mm and 40mm respectively. Crank  $O_1 A$  rotates at 200rpm and an angular acceleration of  $150 \text{ rad/sec}^2$  at the instant when the crank makes an angle of  $45^\circ$  to the horizontal. Find the acceleration of point B and C and angular velocities and angular acceleration of link 3 and 4. (20 Marks)

OR

- 4 Fig Q4 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



OA = 250mm  
AB = 100mm  
OC = 400mm  
CD = 150mm

Fig Q4

(20 Marks)

**Module-3**

- 5 With relevant proof, Discuss Klein's construction for slider crank mechanism by considering velocity and acceleration diagram. (20 Marks)

OR

- 6 A pin jointed four bar mechanism ABCD is shown in Fig Q6, Link AB = 150mm, BC = 180mm, CD = 180mm, and the fixed link AD = 300mm, Link AB makes  $60^\circ$  with the link AD, and rotates uniformly at 100rpm. Locate all the instantaneous centers and find the angular velocity of link BC and the linear velocity of link CD.

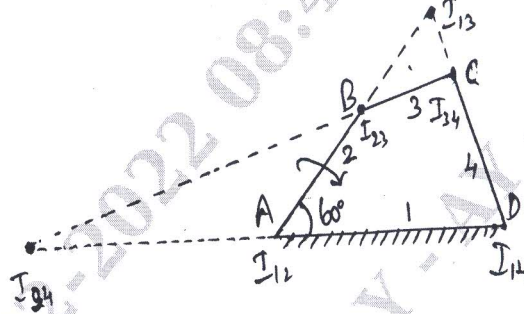


Fig Q6

(20 Marks)

Module-4

- 7 a. Derive an expression for length of path of contact, Length of arc of contact and contact Ratio. (10 Marks)  
 b. Two gear wheels mesh externally and are to give a velocity ratio of 3. The teeth are of involute form of module 6mm and standard addendum one module, Pressure angle =  $18^\circ$ , Pinion rotates at 90rpm. 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 the teeth v) Number of Pairs of teeth in contact. (10 Marks)

OR

- 8 In an epicyclic gear train, the internal wheel A, B and 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 the number of teeth on A and B iii) If the arm G rotates at 150rpm CW and A is fixed, find speed of B iv) If the arm G makes 150rpm CW and wheel A makes 15rpm. CCW, find the speed of B. (20 Marks)

Module-5

- 9 A cam rotating clockwise at uniform speed of 300rpm operating a reciprocating follower through a roller 2cm diameter. The follower motion is defined as below : i) Outward during  $150^\circ$  with UARM ii) Dwell for next  $30^\circ$  iii) Return during next  $120^\circ$  with SHM iv) Dwell for the remaining period, stroke of the follower is 3cm. Minimum radius of the cam is 3cm. Draw the cam profile (i) Follower axis passes through cam axis ii) Follower axis is offset to the right by 1cm. (20 Marks)

OR

- 10 A cam rotates at a uniform speed of 300rpm clockwise and gives an oscillating follower 75mm long, an angular displacement of  $30^\circ$  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  $120^\circ$  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 the cam and the least distance of roller axis from cam axis is 40mm. (20 Marks)

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