CBCS SCHEME

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Kinematics of Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the following :
   i) Mechanism   ii) Kinematic pair   iii) Kinematic link   iv) Kinematic chain. **(08 Marks)**
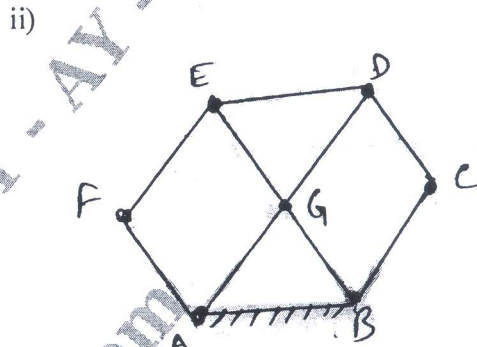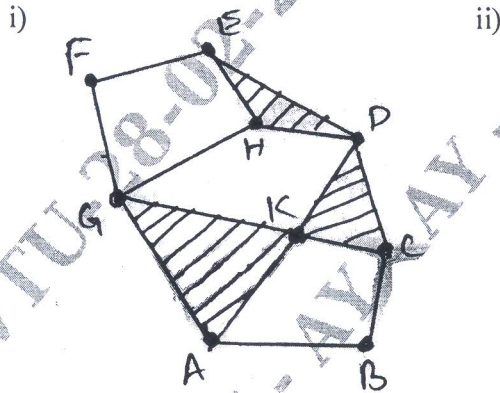   b. Calculate the degrees of freedom
   i)   ii)

Fig Q1(b) **(08 Marks)**

OR

2 a. Describe the working of Whitworth quire return motion mechanism. **(08 Marks)**
   b. Explain the pantograph with suitable figure and derive the expression for the same.
   (08 Marks)

Module-2

3 In a slider crank mechanism, the crank OB = 30mm and the connecting rod BC = 120mm. The crank rotates at the uniform speed of 300rpm clockwise. For the crank position shown in Fig Q3, in which the crank is turned 60°. Find :
   i) Velocity of piston C and angular velocity of connecting rod BC
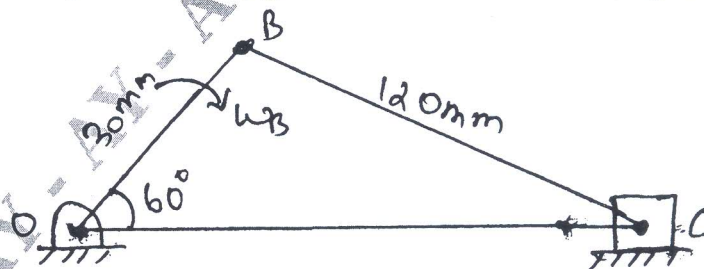   ii) Acceleration of piston C and angular acceleration of connecting rod BC.

Fig Q3 **(16 Marks)**

OR

4 A four bar mechanism ABCD is madeup of four links pin jointed at ends. AD is fixed link which is 180mm long. The links AB, BC and CD are 90mm, 120mm and 120mm long respectively. At certain instant, the link AB makes an angle of 60° with the link AD, if the link AB rotates at uniform speed of 100rpm clockwise. Determine :
   i)   Angular velocity of the links BC and CD
   ii) Angular acceleration of links CD and CB.   **(16 Marks)**

Module-3

5 In a reciprocating engine the length of crank is 25cm and length of connecting rod is 100cm. the crank rotates at an uniform speed of 300rpm. By Klein's construction determine :
   i)   Velocity and acceleration of piston
   ii) Angular velocity and angular acceleration of connecting
   iii) Velocity and acceleration of a point on the connecting rod 40cm from crank end, when the crank is 30° from inner dead center.   **(16 Marks)**

OR

6 a. Determine the velocity and acceleration of a piston by Klein's construction for the following specification stroke = 300mm, Speed of the engine = 300rpm, Ration of length of connecting rod to crank length = 4, Position of crank 45° with inner dead centre. **(08 Marks)**
   b. Derive an expression for slider crank mechanism using Klein's construction.   **(08 Marks)**

Module-4

7 In an epicyclic gear train the internal wheels A, F and the compound wheel C, D rotate about the axis 'O'. The wheels B and E rotate on a pin fixed to the arm L. The wheels have same pitch and the number of teeth on B and E are 18, C = 28, D = 26. If the arm L makes 150rpm clockwise. Find the speed of F when i) Wheel A is fixed   ii) Wheel A makes 15rpm clockwise.   **(16 Marks)**

OR

8 a. Two equal spur gears of 48 teeth mesh together with pitch radii of 100mm and the addendums are 4.25mm. If the pressure angle is 20°. Calculate the length of action and contact ratio.   **(08 Marks)**
   b. Derive an expression for minimum number of teeth on a pinion to avoid interference **(08 Marks)**

Module-5

9 A cam with 3cm as minimum radius is rotating clockwise at a uniform speed of 1200rpm and has to give the motion to the knife edge follower as follows :
   i)   Follower to move outward through 3cm during 120° of cam rotation with SHM
   ii) Dwell for next 60°
   iii) Follower to return to its starting position during the next 90° with UARM
   iv) Dwell for the remaining period
   Draw the cam profile :
      a) Follower axis passes through the cam axis
      b) Follower axis is offset to the left by 1cm.   **(16 Marks)**

OR

10 A cam rotating clockwise at uniform speed of 300rpm operates a reciprocating follower through a roller 2cm in diameter. The follower motion is defined as follows :
   i)   Outward during 150° with UARM
   ii) Dwell for next 30°
   iii) Return during next 120° with SHM
   iv) Dwell for the remaining period, stroke of the follower is 3cm. minimum radius of the cam is 3cm.
   Draw the profile of the cam:
      a) Follower axis passes through the cam axis
      b) Follower axis is offset to the right by 1cm.   (16 Marks)

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