15AU43

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
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) Kinematic link   ii) Kinematic pair   iii) Structure
      iv) Degree of freedom.   **(08 Marks)**
   b. Sketch and explain Elliptical Trammel.   **(08 Marks)**

OR

2 a. Sketch and explain Ratchet and Pawl mechanism.   **(08 Marks)**
   b. Determine the mobility of the mechanism given below.

Fig.Q.2(b)(i)   Fig.Q.2(b)(ii)   **(08 Marks)**

Module-2

3 A four bar mechanism ABCD is made up of four links, pin jointed at the 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 a uniform speed of 100rpm clockwise determine.
   i)   Angular velocity of the links BC and CD.
   ii)   Angular acceleration of the links CD and CB.   **(16 Marks)**

OR

4 Locate all the Instantaneous centers for the Toggle mechanism shown in Fig.Q.4.

Fig.Q.4

DA = 180mm
CB = 240mm
AB = 360mm
BD = 540mm
                                                                             (16 Marks)

Module-3

5 a. Using complex algebra derive expression for velocity and acceleration of the piston, angular
      acceleration of connecting rod of a reciprocating engine mechanism.   **(08 Marks)**
   b. If the crank and connecting rod are 150mm and 600mm long respectively and the crank
      rotation at a speed of 100rpm, determine:
      i)   Velocity and Acceleration of piston
      ii)   Angular velocity and angular acceleration of connecting rod.
      The angle which the crank makes with the inner dead centre is 30°   **(08 Marks)**

OR

6 a. Illustrate use of Klen's construction for velocity diagram for slider crank mechanism.
   (08 Marks)

   b. In a reciprocating engine, the length of crank is 250mm and length of connecting rod is 1000mm. The crank rotates at an uniform speed of 300rpm in clockwise direction and the crank is inclined at 30° with inner dead centre. The centre of gravity of the connecting rod is 400mm away from the crank end. By Klen's construction, determine:
   i) Velocity and acceleration of piston
   ii) Angular velocity and angular acceleration of connecting rod
   iii) Velocity and acceleration at the centre of gravity of the connecting rod.   **(08 Marks)**

Module-4

7 a. Define the following:
   i) Module   ii) Diametral pitch   iii) Backlach   iv) Contact ratio.   **(08 Marks)**
   b. Derive an expression for arc of contact for two meshing spur gears having involute profile.
   (08 Marks)

OR

8 a. Sketch and explain i) Simple gear train   ii) Compound gear train.   **(06 Marks)**
   b. An epicyclic gear train shown in Fig.Q.8(b). The number of teeth on wheel A, B and C are 48, 24 and 50 respectively. if the arm rotates at 400rpm clockwise, find:
   i) Speed of wheel 'C' when A is fixed.
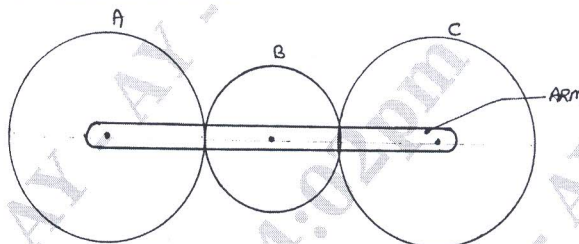   ii) Speed of wheel 'A' when C is fixed.   **(10 Marks)**

Fig.Q.8(b)

Module-5

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

OR

10 A cam rotating clockwise at uniform speed of 300rpm operates a reciprocating follower through a roller 1.5cm diameter. The follower motion defined below.
   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 cam profile when follower axis is offset to right by 1cm.   **(16 Marks)**

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