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17AU43

Fourth Semester B.E. Degree Examination, July/August 2021
Kinematics of Machines

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Define with suitable examples:
   i)   Higher pair
   ii) Kinematic chain
   iii) Mechanism.   (06 Marks)
   b. Explain with the help of neat sketches:
   i)   Four bar mechanism
   ii) Parallel crank mechanism
   iii) Elliptical trammel.   (14 Marks)

2 a. Explain the Whitworth quick return motion mechanism, with neat sketch.   (08 Marks)
   b. Explain the pantograph mechanism, with neat sketch, state its applications. (06 Marks)
   c. Explain Peaucellier's exact straight line mechanism, with a line diagram. (06 Marks)

3 In the mechanism shown in Fig.Q.3 crank 2 rotates at 3000rpm. Find the acceleration of the
   point 'C' in magnitude, direction and sense. Also find angular acceleration of link 3.
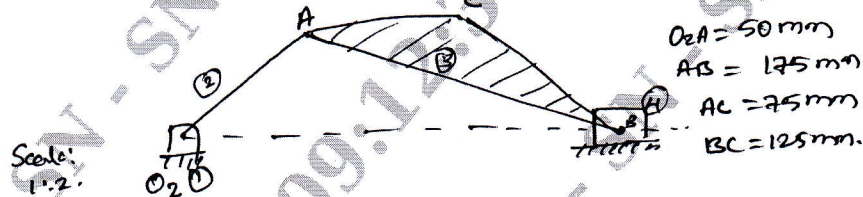   (20 Marks)

$O_2A = 50\,mm$
$AB = 175\,mm$
$AC = 75\,mm$
$BC = 125\,mm$.

Scale: 1:2.

Fig.Q.3

4 In a slider crank mechanism shown in Fig.Q.4. Crank OA = 300mm and connecting rod
   AB = 1200mm. Crank OA is turned 30° from IDC. Locate all the instantaneous centers. If
   the crank rotates at 15rad/sec. Clockwise find: i) Velocity of slider B   ii) Angular velocity
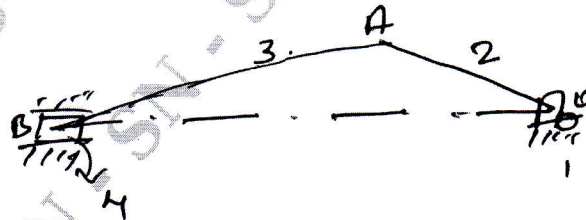   of connecting rod AB.   (20 Marks)

Fig.Q.4

5 Determine the velocity and acceleration of the piston by Klein's construction to the
   following specifications:
   Stroke = 300mm, Ratio of length of CR to CC = 4, (connecting rod to crank length), speed
   of engine = 300rpm, position of crank = 45° with IDC.   (20 Marks)

6   In a reciprocating engine length of crank is 250mm and length of connecting rod is 1000mm. The crank rotates at a uniform speed of 300rpm CW. Crank is at 30° from IDC. Determine:
  i)   Velocity of piston and angular velocity of connecting rod.
  ii) Acceleration of piston and angular acceleration of connecting rod by complex algebra method from 1st principle.   **(20 Marks)**

7 a. What is interference in involute gears? Derive an expression for the length of arc of contact in a pair of meshed spur gear.   **(10 Marks)**
   b. Two gears in mesh have a module of 8mm and pressure angle of 20°. The larger gear has 57 teeth while the pinion has 23 teeth. If the addendum on pinion and gear wheel are equal to one module, find: i) Number of pairs of teeth in contact   ii) Angle of action of pinion and gear wheel.   **(10 Marks)**

8   A fixed annular gear A and a smaller concentric rotating gear 'B' are connected by a compound gear C-D. Gear 'C' mesh with gear A and D with B. The compound gears revolved in a pin to the arm R, which revolves about the axis A and B. $N_A = 150$, $= Z_A$, $Z_B = 40$, $Z_D = 100$. Determine Z_C. If gears A and C have twice the module of gears B and D. How many revolutions will B make for one complete revolution of arm R.   **(20 Marks)**

9   A cam rotating clockwise at uniform speed of 300rpm operates a reciprocating follower through a roller 1.5cm diameter. The follower motion is defined as below.
  i)   Outward during 150° with UARM
  ii) Dwell for next 30°
  iii) Return during next 120° with SHM
  iv) Dwell for remaining period.
  Stroke of follower is 3cm, minimum radius of cam is 3cm. Draw cam profile when follower axis is offset to right by 1cm.   **(20 Marks)**

10   A push rod operated by a cam is to rise and fall with SHM along an inclined straight path. The least radius of cam is 50mm and push rod is fitted at its lower end with a roller of 30mm diameter. When it its lowest position, the roller centre is vertically above the cam axis. The maximum displacement of roller is 50mm in a direction inclined 30° to the right of vertical. The cam rotates at 100rpm in a clockwise direction. The time of lift is 0.15 second and time of fall is 0.1 second with rest period of 0.05 second at the upper position. Draw the cam profile.   **(20 Marks)**

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