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(Pages : 3)

Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2013

ME 09 505—MECHANICS OF MACHINERY

Time : Three Hours

Maximum : 70 Marks

Part A

Answer **all** *questions.*

Each question carries 2 *marks.*

1. What do you mean by degree of freedom of a mechanism ?
2. What do you understand by the terms cam and follower ? Name the essential members of a cam mechanism.
3. Define the following terms :
   (a) Length of path of contact.
   (b) Arc of contact.
4. What do you mean by the term train value ? How it is related to velocity ratio ?
5. Define the terms related to synthesis of mechanism :
   (a) Transmission angle.
   (b) Function generator.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

Each question carries 5 *marks.*

1. State and prove the Arnold Kennedy theorem.
2. What are straight line motion mechanisms ? Name the different types of mechanisms used for straight line motion.
3. What you mean by the pressure angle of a cam ? Discuss its importance in cam design.
4. What are the functions of a differential gear in an automobile ? Explain the working of a differential gear with a neat sketch.
5. Name the different types of gear train and give the examples where each of them is used.
6. Prove that for a constrained motion, the minimum number of binary links in a mechanism is four.

(4 × 5 = 20 marks)

Turn over

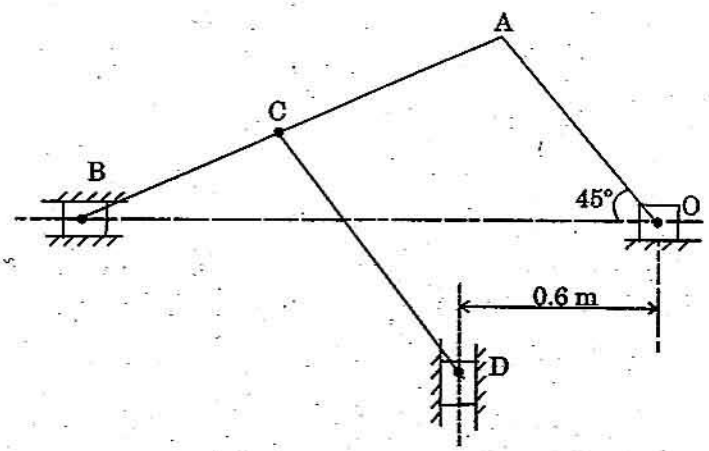
Part C

Answer **all** *questions.*
Each question carries 10 *marks.*

1. In a four-bar mechanism PQRS, the link PS is fixed. The length of the links are PQ = 25 mm, OR = 85 mm, RS = 50 mm and PS = 80 mm. The crank PQ rotates at 10 rad/s clockwise. Sketch the mechanism and draw the velocity and acceleration diagram when the link PQ makes 600 with link PS. Find the angular velocity and angular acceleration of links OR and RS.

Or

2. The lengths of various links of a mechanism as shown in Figure are OA = 0.3 m ; AB = 1m ; CD = 0.8 m ; and AC = CB. Determine, for the given configuration, velocity of slider D if he crank OA rotates at 60 r.p.m. in the clockwise direction. Also find the angular velocity of the link CD. Use instantaneous centre method.



3. Draw the profile of the cam when the roller follower moves with cycloidal motion during outstroke and return stroke, as given below :

   (a) Outstroke with maximum displacement of 40 mm during 180° of cam rotation.

   (b) Return stroke for the next 150° of cam rotation.

   (c) Dwell for the remaining 30° of cam rotation.

   The minimum radius of the cam is 15 mm and the roller diameter of the follower is 10 mm. The axis of the roller is offset by 10 mm towards right from the axis of cam.

Or

4. The following data is related to a symmetrical circular arc cam operating a flat faced follower :

   Least radius of cam of the cam = 27.5 mm ; total lift = 12.5 mm ; angle of lift = 55° ; nose radius = 3 mm ; speed of cam = 600 rpm. Find :

   (a) Distance between cam centre and nose centres ;

   (b) Radius of circular flank ; and

   (c) Angle of contact on the circular flank.

5. Two mating spur gear with module pitch of 6.5 mm have 19 and 47 teeth of 20° pressure angle, and 6.5 mm addendum. Determine the number of pairs of teeth in contact and the angle turned through by the larger wheel for one pair of teeth in contact. Determine also the sliding velocity at the instant : (i) engagement commences ; (ii) the engagement terminates ; and (iii) at the pitch point. When the pitch line velocity is 1.2 m/s.

Or

6. In a reverted epicyclic gear train the arm A carries two gears B and C and compound gear D–E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth ion gears B, C and D are 75,30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm a makes 100 r.p.m. clockwise.

7. Design a slider crack mechanism so that displacement of the slider is proportional to cube of the crank rotation in the interval of $30° \leq \theta \leq 100°$. Assume initial distance of the slider equal to 15 cm and the final distance to be 10 cm.

Or

8. Determine the Chebysheve spacing for function $y = 3x^3 - 2x$ for $0 \leq x \leq 1$ and specify three precision points. Also find θ_j and Φ_j $(j = 1, 2, 3)$ $20° \leq \theta \leq 80°$ and $60° \leq \Phi \leq 190°$.

(4 × 10 = 40 marks)