Total No. of Questions—12] [Total No. of Printed Pages—7

[3762]-26

S.E. (Mechanical) (II Sem.) EXAMINATION, 2010

THEORY OF MACHINES AND MECHANISMS–I

(2003 COURSE)

Time : Four Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

Unit I

1. (*a*) Define the following terms : [4]

(*i*) Structure

(*ii*) Mechanism

(*iii*) Kinematic pair

(*iv*) Constrained motion.

(*b*) Explain inversions of four bar chain and give their practical applications. [8]

(*c*) Determine degree of freedom for the following mechanisms : [4]

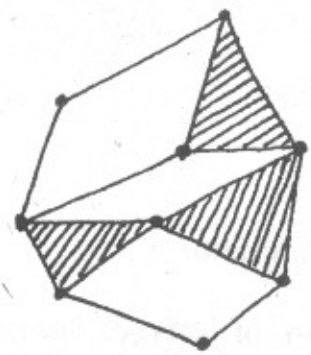

Fig. 1

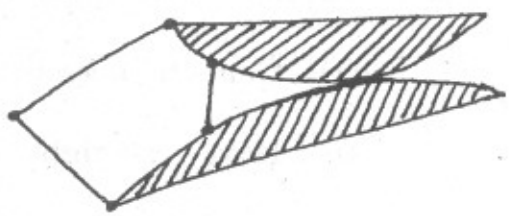

Fig. 2

P.T.O.

Or

2. (*a*) Discuss the following : [8]

(*i*) Classification of kinematic pair

(*ii*) Kutzbach criteria

(*iii*) Grashoff's law

(*iv*) Classification of links.

(*b*) Explain the inversion of double slider crank chain with suitable sketches. [8]

Unit II

3. (*a*) Explain "Davis steering gear mechanism" and "Achermann steering gear mechanism" in detail. [8]

(*b*) Explain construction of Hooke's Joint and derive equation for angular velocity ratio for single Hooke's joint. [6]

(*c*) Differentiate between single and double Hooke's joint. [2]

Or

4. (*a*) Explain with neat sketch :

(*i*) Geneva mechanism. [6]

(*ii*) Hart's straight line mechanism. [4]

(*b*) State and prove the condition of correct steering for a four-wheeled vehicle. [6]

Unit III

5. (*a*) Explain Freudenstein's theorem in instantaneous centre. [4]

(*b*) Fig. 3 shows a crank OA 110 mm long rotating clockwise about 'O' at 160 r.p.m. AB is connecting rod 440 mm long. A point 'C' on AB is 165 mm from 'A', the rod CE 385 mm long is attached. The rod CE slides in a slot in a trunnion at D. The end E is connected by a link EF 330 mm long to the horizontally moving slides 'F' for the mechanism shown in the figure. Determine the velocity of slider 'F' using instantaneous centre method. [14]

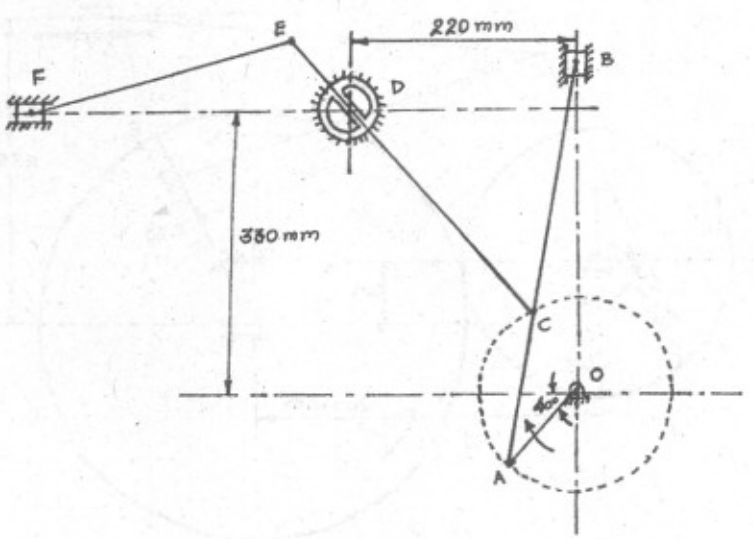

Fig. 3

Or

6. (*a*) Explain Aronhold-Kannedy's theorem. [3]

(*b*) In the mechanism shown in Fig. 4, the crank O_1A and O_2B are 100 mm and 50 mm respectively. The diameters of wheels with centres O_1 and O_2 are 260 mm and 150 mm respectively. BC = AC = 200 mm. CD = 250 mm. The wheel roll on each other. The crank O_1A rotates at 120 r.p.m.

Determine :

(*i*) Velocity of the slider D

(*ii*) Angular velocities of links BC and CD

(*iii*) The torque at O_2B when the force required at D is 4 kN. [15]

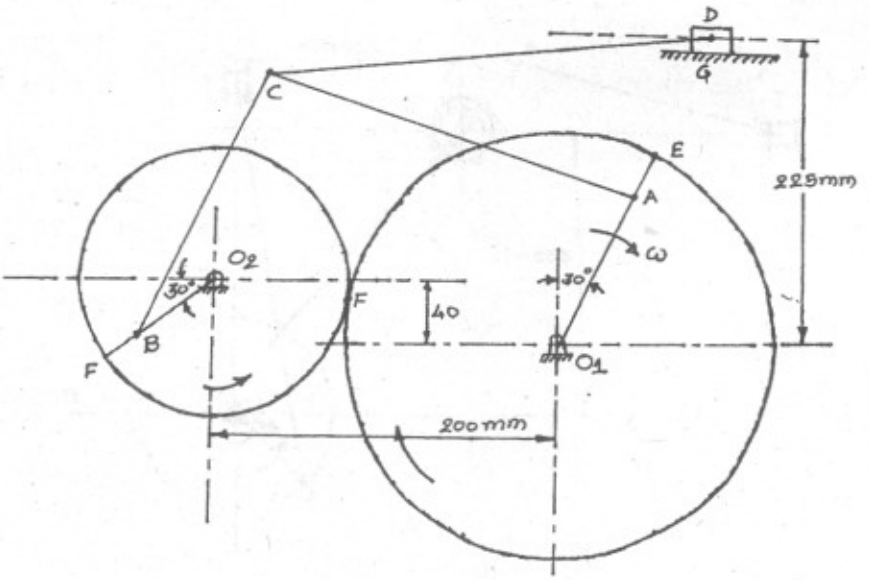

Fig. 4

SECTION II

Unit IV

7. (*a*) Explain Coriolis component of acceleration. [3]

(*b*) Fig. 5 shows a quick return motion mechanism in which the driving crank OA rotates at 120 r.p.m. in a clockwise direction. For the position shown, determine the magnitude and direction of :

(*i*) Acceleration of block D

(*ii*) Angular acceleration of slotted bar QB. [13]

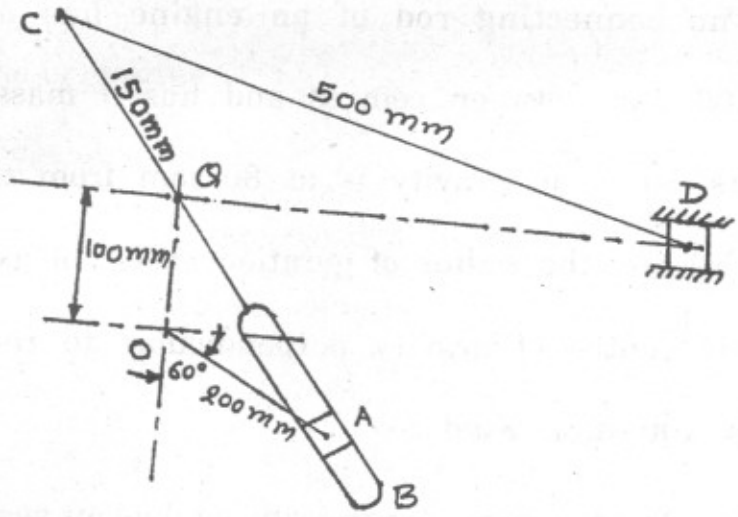

Fig. 5

Or

8. (*a*) Explain Klein's construction for determination of velocity and acceleration of piston of an engine. [6]

(*b*) In a slider mechanism the crank is 200 mm long and connecting rod 750 mm long. Find the velocity and acceleration of piston and connecting rod by velocity polygon method when the slider has moved through 350 mm from top dead centre position. Assume crank rotates at uniform speed of 720 r.p.m. [10]

Unit V

9. (*a*) Explain Trifiller Suspension method. [6]

(*b*) The connecting rod of an engine has a length equal to 200 mm between centres and has a mass equal to 2.5 kg. Its centre of gravity is at 80 mm from the big end (crank pin) and the radius of gyration about an axis passing through the centre of gravity perpendicular to the plane of motion is 100 mm. Find :

(*i*) The two mass dynamically equivalent system when one mass is placed at the small end

(*ii*) Correction couple if masses are placed at the two ends and the angular acceleration of the connecting rod is 100 rad/sec^2 clockwise. [10]

Or

10. (*a*) With the help of neat schematic diagram derive frequency equation of compound pendulum. [8]

(*b*) What do you mean by "correction couple" ? When do we need to consider it ? [4]

(*c*) Write a short note on D' Alembert's principle. [4]

Unit VI

11. (*a*) Explain the following terms : [6]

(*i*) Type synthesis

(*ii*) Number synthesis

(*iii*) Dimensional synthesis

(*b*) Design a four bar mechanism to co-ordinate three positions of the input and output links as follows : [12]

$\theta_1 = 20°, \theta_2 = 35°, \theta_3 = 50°$

$\phi_1 = 35°, \phi_2 = 45°, \phi_3 = 60°.$

Or

12. (*a*) Explain Coupler curve synthesis. [6]

(*b*) Explain overlay method for locating precision position in four bar respectively. [6]

(*c*) Determine the link lengths of the slider crank linkage to have a stroke of 600 mm and time ratio 1 : 20. [6]