Dec.-22-0184

ME-501 (Kinematics of Machines, ME, AE)
B.Tech. 5th (CBCS)

Time : 3 Hours
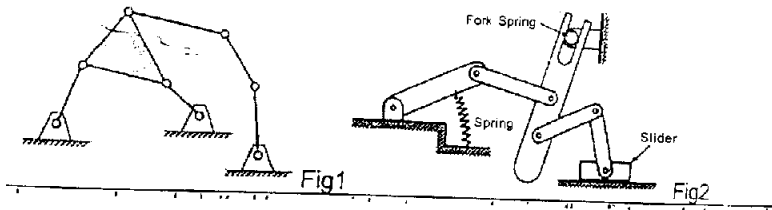
Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five Questions taking one question from each unit. Question no. 9 is compulsory.

Note: Drawing sheet / graph paper is required

UNIT - I

1. (a) Find the DOF of the following figures.   (4)

Fig1   Fig2

(b) In a crank and slotted lever quick return mechanism the distance between the fixed centres is 150 mm and the driving crank is 75 mm long. Determine the ratio of the time taken on cutting and return stroke.   (6)

2. (a) Define Instantaneous Centre. How many IC will be there for eight link mechanism?   (4)

(b) In a pin jointed four bar mechanism ABCD, the lengths of various links are as follows: AB = 25 mm ; BC = 87.5mm; CD = 50 mm and AD = 80 mm. The link AD is fixed and the angle BAD = 135°. If the velocity of B is 1.8 m/s in the clockwise direction, (find 1. Velocity and acceleration of

the midpoint of BC, and) (2. Angular velocity and angular acceleration of link CB and CD).   (6)

UNIT - II

3. The following data are for a disc cam mechanism with roller follower. Minimum radius of the cam = 35, lift of the follower = 40mm, offset of the follower=10mm right, Roller diameter = 15mm, Cam rotation angles are as mentioned below: During ascent 120°, Dwell = 80°, during decent = 80°, and then dwell for the rest of the angle of rotation of cam. Cam rotates in clockwise direction and the follower motion is simple harmonic during both ascent and descent, (i) Draw the displacement diagram of the follower and indicate the relevant data, (ii) Draw the cam profile and indicate the relevant data, (iii) Find out maximum velocity and acceleration of the follower during ascend and descends.   (10)

4. Derive expressions for displacement, velocity and acceleration for a tangent cam operating on a radial-translating roller follower:

(i) When the contact is on straight flank, and

(ii) When the contact is on circular nose.   (10)

UNIT - III

5. (a) What are the types of belt drive? Explain each with neat sketch.   (4)

(b) The power is transmitted from a pulley 1 m diameter running at 200 r.p.m. to a pulley 2.25 m diameter by means of a belt. Find the speed lost by the driven pulley as a result of creep, if the stress on the tight and slack side of the belt is 1.4 MPa and 0.5 MPa respectively. The Young's modulus for the material of the belt is 100 MPa.   (6)

6. (a) What is gear train? Explain each type of gear train. (4)

(b) Two mating involute spur gears of 200 pressure angle have a gear ratio of 2. The number of teeth on the pinion of 20 and its speed is 250 revolution per minute. The module pitch of the teeth is 12mm. If the addendum on each wheel is such that the path of approach and the path of recess on each side are half the maximum possible length each, find i) the addendum for pinion and gear wheel; ii) the length of arc contact; iii) the maximum velocity of sliding during approach and recess. Assume pinion to be driver. (6)

UNIT - IV

7. Synthesize a four bar function generator to solve the equation

$y = \dfrac{1}{x}$; $1 \le x \le 3$; Using chebyshev spacing for three precision points. Given $\varnothing_0 = 30°$; $\Psi_0 = 200°$ and $\Delta\varnothing = \Delta\Psi = 90°$.

(10)

8. (a) Write the classification of Synthesis problems. (4)

(b) Design a four bar mechanism graphically using three position synthesis such that $\theta_{12} = 120°$, $\theta_{13} = 170°$; $\varphi_{12} = 70°$, $\varphi_{13} = 100°$ (6)

Compulsory

9. (a) What is quadratic cycle chain?

(b) Differentiate between sliding and turning pairs.

(c) A sliding link on a Turing pair is 4m in length having a velocity of 10m/s. What will be the coriolis component of acceleration?

(d) Define Creep in belt drive.

(e) If pitch radius of a gear is 30 mm with 4mm module. Find the no. of teeth and circular Pitch.

(f) What is bevel gear?

(g) What is prime circle in a cam profile?

(h) What is tangent cam?

(i) Define Interference in the gear.

(j) What is kennedy theorem of IC centres? (10×2=20)