Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

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S.E. (Prod/Prod SW) (Second Sem.) EXAMINATION, 2010

THEORY OF MACHINES

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from each Section.

(*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*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

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

SECTION I

1. (*a*) Define the following terms :

(*i*) Screw pair

(*ii*) Mechanism

(*iii*) Ternary link

(*iv*) Compound chain. [4]

(*b*) Explain in brief Kutzback criterion for determining DOF of Mechanism. [6]

(*c*) List inversions of four bar chain and explain any *two* with neat sketch. [6]

Or

2. (*a*) Define Kinematic link. Can spring, belt, liquid be treated as links ? Justify your answer. [5]

(*b*) Describe Watt's straight line mechanism. What are the practical uses of straight line mechanism ? [6]

(*c*) Differentiate between Spatial and Planer Mechanism. [5]

3. (*a*) The length of various links of mechanism as shown in Fig. 1 are OA = 0.3 m, AB = 1 m, CD = 0.8 m and AC = CB.

Determine for the given configuration :

(*i*) Velocity of slider B

(*ii*) Velocity of slider D

(*iii*) Angular velocity of CD

(*iv*) Angular velocity of AB.

If OA rotates at 60 rpm clockwise, use instantaneous centre method.

Also find absolute velocity of point C. [12]

Fig. 1

(*b*) In a slider crank mechanism having a stroke length of 30 cm and an obliquity ratio of 4, the crank is rotating uniformly clockwise. The velocity of slider is 6 m/s when the crank has turned 120° from I.D.C. Determine using Klein's construction :

(*i*) Acceleration of slider

(*ii*) Angular velocity and angular acceleration of connecting rod. [6]

Or

4. (*a*) Fig. 2 shows the toggle mechanism in which the crank OA rotates at a uniform speed of 105 rpm in clockwise direction. Determine the velocity and acceleration of slider 'P'.

The lengths of various links are : OA = 8 cm, AB = 18 cm, BC = 24 cm and BP = 28 cm. [14]

Fig. 2

(*b*) Explain different types of ICRs. [4]

5. (*a*) Explain in detail various types of friction. [8]

(*b*) Explain in detail the following :

(*i*) Coulomb's theory of Interlocking

(*ii*) Stick-slip Mechanism of friction. [8]

Or

6. (*a*) Define 'Tribology'. Discuss the different areas covered under 'Tribology'. [5]

(*b*) State the applications where friction and wear are useful. [5]

(*c*) Write short notes on (any *two*) :

(*i*) Two body and three body abrasive wear

(*ii*) Corrosive wear

(*iii*) Surface fatigue wear. [6]

SECTION II

7. (*a*) Define and explain the following terms :

(*i*) Belt-drive

(*ii*) Rope-drive

(*iii*) Chain-drive

(*iv*) Slip and creep of a belt. [6]

(*b*) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the length and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25 ? [10]

Or

8. (*a*) Distinguish between initial tension and centrifugal tension in a belt. [6]

(*b*) An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 meters apart and transmits 4 kW from the smaller pulley that rotates at 300 rpm. Coefficient of friction between the belt and the pulley is 0.3 and the safe working tension is 10 N per mm width. Determine :

(*i*) Minimum width of the belt

(*ii*) Initial belt tension and

(*iii*) Length of the belt required. [10]

9. (*a*) What is the difference between brakes and dynamometers ? [5]

(*b*) A simple-band brake is applied to a rotating drum of diameter 500 mm. The angle of lap of the band on the drum is 270°.

One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 mm from the fulcrum. If the co-efficient of friction is 0.25 and a braking force of

90 N is applied at a distance of 600 mm from the fulcrum, find the braking torque when the drum rotates in the :

(*i*) Anti-clockwise direction and

(*ii*) Clockwise direction. [11]

Fig. 3

Or

10. (*a*) Differentiate between Absorption dynamometer and Transmission dynamometer. [6]

(*b*) Fig. 4 shows a differential band brake of drum diameter 400 mm. The two ends of the band are fixed to the points

on the opposite side of fulcrum of the lever at a distance of 50 mm and 160 mm from the fulcrum as shown in figure. The brake is to sustain a torque of 300 Nm. The coefficient of friction between band and the brake is 0.2.

The angle of contact is 210° and the length of lever from the fulcrum is 600 mm. Determine :

(*i*) The force required at the end of the lever for the clockwise and anticlockwise rotation of the drum.

(*ii*) Value of OB for the brake to be self-locking for clockwise rotation. [10]

Fig. 4

11. (*a*) Explain D'Alembert's principle. [4]

(*b*) Explain the trifilar suspension system. [6]

(*c*) A connecting rod is suspended from a point 25 mm above the small end centre and 650 mm above its C.G. It takes 35 seconds for 20 oscillations. Find dynamically equivalent system of two masses when one mass is located at small end centre. Mass of the connecting rod is 40 kg. [8]

Or

12. (*a*) Explain dynamically equivalent system. [6]

(*b*) With the help of neat Schematic diagram, derive frequency equation of Bifillar Suspension System. [6]

(*c*) A rigid link, 500 mm long has mass 2 kg and radius of gyration 200 mm. Replace this link by dynamically equivalent system of two concentrated masses located at the ends of the link. [6]