B.E. Third Semester (Mechanical Engineering / Power Engineering (New)) (C.B.S)

Kinematics of Machine

P. Pages : 3 **NKT/KS/17/7228/7253**

Time : Three Hours * 0 2 9 1 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Illustrate your answers whenever necessary with the help of neat sketches.
9. Required Half Imperial Drawing Sheet.

1. a) Answer **any three.** **9**

i) Define mechanism. Draw neat Kinematic sketch of mechanism used in wiper of a bus.
ii) Define lower pair. Draw neat sketch of a lower pair with two degree of freedom.
iii) Draw neat kinematic sketch of a mechanism used in a foot pedal pump used by roadside puncher repairer.
iv) Define machine. List atleast eight machines which are available around us.

b) What is inversion of a mechanism? Crank slotted lever mechanism is an inversion of single slider crank mechanism. Determine quick return ratio it crank length in 200 mm and connecting rod in 500 mm. **5**

OR

2. a) Define coupler curve. Draw neat sketch of any one straight line mechanism. **4**

b) Minimum three Links are required to form a mechanism, true or false? Explain. **2**

c) Determine mobility by identifying number of Links, types of links, number of pairs, types of pairs. **8**

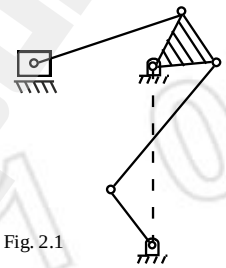


Fig. 2.1

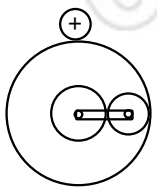


Fig. 2.2

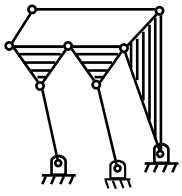


Fig. 2.3

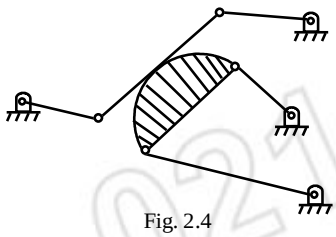


Fig. 2.4

3. For the mechanism shown in fig 3 determine the acceleration of point D. Also determine angular velocities of links AB & O_4BC & CD. **14**

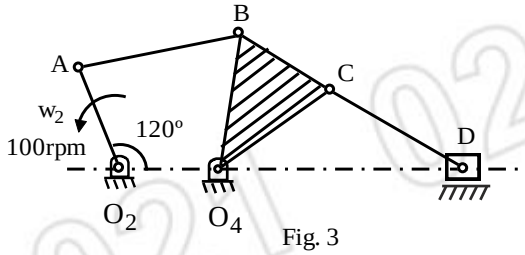


Fig. 3

$O_2O_4 - 50\,mm,\ O_2A - 60mm, AB - 120mm, O_4B - 100mm$

$BC - 80\,mm,\ O_4C - 120\,mm, CD - 150mm$

$\angle O_4O_2A - 120^o,\ N_2 - 100\,rpm$ counter clock wise.

OR

4. Define instantaneous centre. For the slider crank mechanism shown determine velocity of slider. **8**

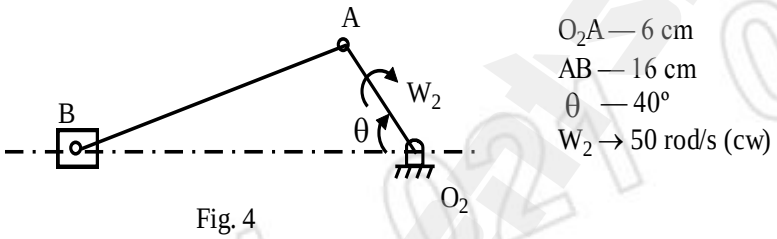


Fig. 4

b) What is Coriolis component of acceleration? Determine the relation for magnitude of Coriolis component. How directions are obtained? Explain atleast one situation in which Coriolis component exists. **6**

5. a) How the cams are classified. Explain in details. **4**

b) The reciprocating radial roller follower of a plate cam is to rise 50 mm with SHM in 150° of cam rotation & return with SHM in 150° with dwell of 30° in between rise and return and at the end of return. If the roller radius is 10mm and the prime circle radius is 50 mm construct the displacement diagram, the pitch curve and the cam profile for the clockwise cam rotation. **9**

OR

6. A plate cam with oscillating roller follower that rises through 30° with cycloidal motion in 150° of cam rotation, then dwells for 30°, returns with cycloidal motion in 120° and dwells for 60°. The base circle radius is 50 mm, the roller radius 10mm, the length of the follower is 100 mm and it is pivoted at 125 mm to the left of the cam rotation axis. The cam rotation is clockwise. Construct the displacement diagram and cam profile. **13**

7. a) State and prove law of gearing. Also derive the relation for sliding velocity in case of gears. **5**

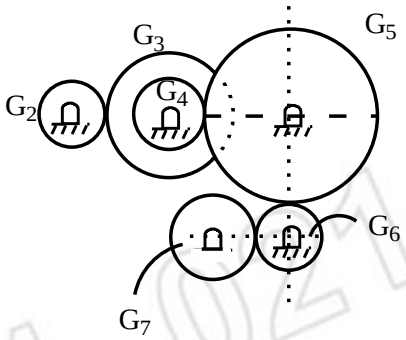
b) A 6mm module, 24 tooth pinion is to drive a 36-tooth gear. The gears are cut on 20° full depth involute system find the addendum, dedendum, clearance, Circular pitch, base pitch tooth thickness, base circle radii, length of paths of approach, and recers and contact ratio. **8**

OR

8. a) A pair of spiral gear has a gear ratio of 2. A normal module of 5 mm, a shaft centre distance of about 250 and angle between axes of rotation 50° with same helix angle for both gears. Find the tooth numbers, the helix angles and the exact centre distance. **5**

b) What are different types of gears? Explain with their applications. **3**

c) Find the speed and direction of gears 5 and 7. Compute the train value (kinematic coefficient) of the train. **5**



Pitch diameters are

D_2 — 175 mm
D_3 — 375 mm
D_4 — 225 mm
D_5 — 750 mm
D_6 — 225 mm
D_7 — 400 mm

9. a) Determine the link lengths of a slider crank linkage to have a stroke of 600 mm and a time ratio of 1:20 **5**

b) The rocker of a crank rocker linkage is to have a length of 500 mm and swing through a total angle of 45º with a time ratio of 1.25. Determine suitable set of dimensions. Also determine maximum and minimum transmission angles. **8**

OR

10 a) Define synthesis of mechanism. What are different types of synthesis? **3**

b) What are the advantages of analytical method of synthesis over graphical? Derive freudensten's equation for analytical synthesis of four bar mechanism. **10**

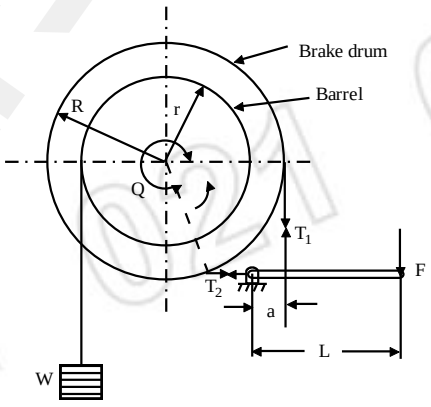
11. a) What are different types of Friction? **3**

b) What is coefficient of friction? Explain what is limiting angle of friction. **4**

c) Explain with neat sketch the working of rope Brake dynamometer. **6**

OR

12. a) A crane is used to support a load of 2.00 tonne on the rope round its barrel of 400 mm diameter (fig 12.1). The brake drum diameter is 600 mm, the angle of contact is 300º and the coefficient of friction between the band and drum is 0.25 what will be the force F required at the end of the lever? Take a = 160 mm and L= 900 mm. **6**



b) A single plate clutch transmits 20 kW at 1000 rpm. The axial pressure is limited to 80 kN/m^2. The mean radius of the plate is 4 times the radial width of the friction surface. If both the sides of the plate are effective and the coefficient of friction is 0.3. Find **7**

i) Inner and outer radii of the plate and the mean radius.
ii) Width of the friction lining

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