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

Kinematics of Machines

P. Pages : 4 **NJR/KS/18/4368/4393**

Time : Three Hours * 0 1 4 7 * 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. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Retain the construction lines.

1. a) Define & give at least one example **4**

i) Link ii) Mechanism

iii) Machine iv) Structure

b) What is inversion? Draw neat sketch of hand pump mechanism & prove t is an inversion of single slider crank mechanism. **4**

c) With the help of neat sketch explain the working of Geneva wheel with example. **3**

d) Draw neat sketch of class I four bar mechanism. Assume your own dimensions. Identify which link rotates through 360º. **3**

OR

2. a) State & explain the working of any exact straight line mechanism. **6**

b) Calculate the degree of freedom of the following linkages. **2x4=8**

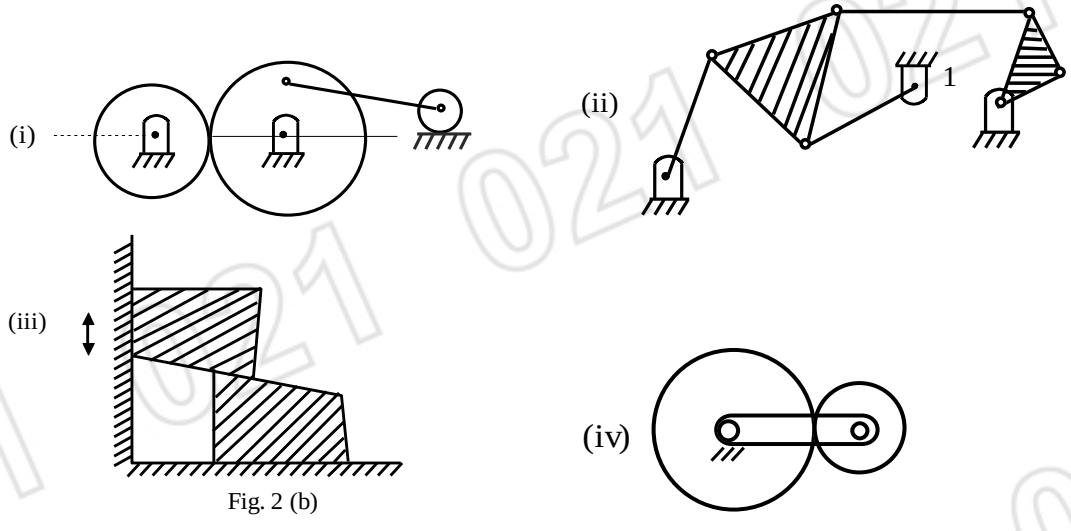

Fig. 2 (b)

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3. In the mechanism shown in fig 3, the slider C is moving to the right with a velocity of 1m/s & an acceleration of 2.5 m/s^2. **13**

The dimensions of various links are AB = 3m inclined at 45º with the vertical & BC = 1.5 m inclined at 45º with the horizontal. Determine: 1. The acceleration of the point B, & 2. The angular acceleration of the links AB & BC.

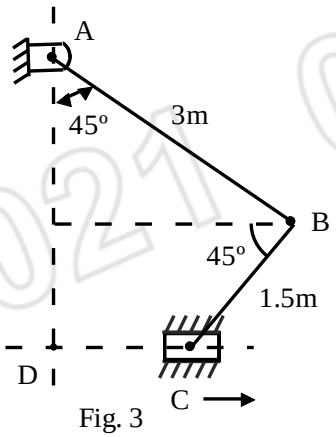

Fig. 3

OR

4. a) Define instantaneous center. State & prove Kennedy's theorem. **4**

b) Locate all the instantaneous centres of the slider crank mechanism as shown in figure 4. (b). The lengths of crank OB & connecting rod AB are 100mm & 400mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: 1. velocity of slider A, & 2. Angular velocity of connecting rod AB. **9**

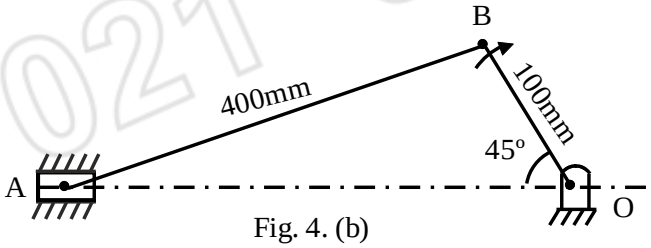

Fig. 4. (b)

5. a) What are the different types of followers. **3**

b) Differentiate between cam mechanism & linkage mechanism. **3**

c) Define following terms for cam & follower mechanism drawing neat sketch. **7**

i) Base circle

ii) Pitch circle

iii) Pressure angle

iv) Angle of ascent

v) Lift

vi) Angle of descent

vii) Pitch point.

OR

6. Construct the profile of a cam to suit the following specifications: **13**
Least radius of cam = 40 mm;
Diameter of roller = 20mm;
Angle of lift = 120º;
Angle of follwer = 150º;
Lift of the following = 40mm;
Number of dwells are two of equal interval between rise and return.

During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration & deceleration. The speed of the cam shaft is uniform and 60 rad/s counter clockwise. Also determine the value of acceleration during return.

7. a) State law of gearing & explain it. **4**

b) Define following with respect to gears **4**

i) Backlash ii) Circular pitch
iii) Module iv) Pressure angle.

c) The no. of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20º involute profile & the module is 6mm. If the arc of contact is 1.75 times the circular pitch. Find the addendum. **5**

OR

8. a) Centre distance between two meshing spiral gears in 200mm. The gear ratio is 2 & the angle between shafts is 75º. If the driven gear has angle of helix 35º, determine for 12mm normal circular pitch: **4**

i) No. of teeth on each wheel
ii) Exact centre distance.

b) An epicyclic train of gears is arranged as shown in fig. 8. (b). How many revolutions does the arm, to which the pinions B is attached, make: **10**

1. When A makes 1 revolution clockwise & D makes half revolution anticlockwise &
2. When A makes one revolutions clockwise & D is stationary?

The no. of teeth on the gears A & D are 40 & 90 respectively. Determine No of teeth on gear B.

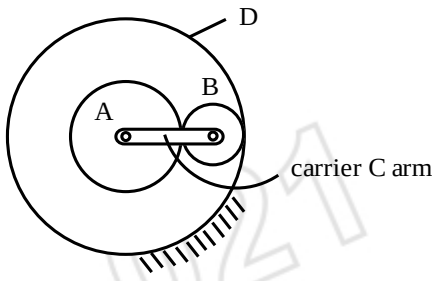

Fig. 8 (b)

9. a) Write the name of different types of methods available for synthesis of mechanism by using graphical method. **3**

b) Derive Freudenstein's equation for analytical synthesis of a four bar linkage. **10**

OR

10. Design a four bar crank rocker mechanism for wiper in which the rocker of length 80mm oscillates by 100º with a time ratio of 1.15. Also determine minimum and maximum transmission angles. Show the mechanism in toggle position. **13**

11. a) State the laws of friction. **3**

b) Discuss the friction circle. **4**

c) The inner & outer radii of a single plate clutch are 40mm & 80mm respectively. Determine the maximum, minimum & the average pressure when the axial force is 3kN. **7**

OR

12. a) With neat sketch explain working of Rope Brake Dynamometer. **5**

b) The simple band brake, as shown in fig. is applied to a shaft carrying a flywheel of mass 400kg. The radius of gyration of flywheel is 450mm & runs at 300 rpm. If the coefficient of friction is 0.2 & the brake drum diameters is 240mm, find: **9**

1. The torque applied due to a hand load of 100N.
2. The no. of twins of the flywheel before it is brought to rest.
3. The time required to bring it to rest, from the moment of applications of the brake.

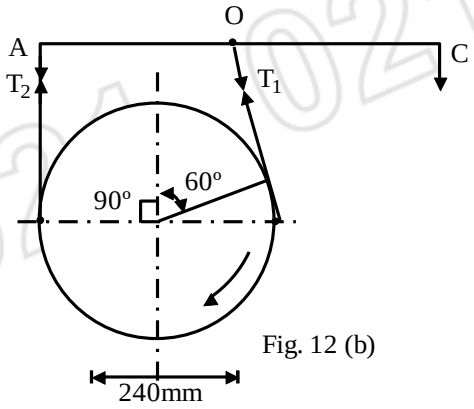

Fig. 12 (b)

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