

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

Kinematics of Machine

P. Pages : 4

Time : Three Hours



NRT/KS/19/3313/3338

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) Answer **any five**. **10**
- i) Differentiate between machine and structure.
 - ii) Differentiate between lower and higher pair.
 - iii) State the inversion of single slider crank chain.
 - iv) Define kinematic chain.
 - v) Draw neat sketch of hand pump mechanism.
 - vi) Draw neat sketch of Geneva mechanism.
- b) Explain class-I and class-II four bar mechanism with neat sketch. **4**

OR

2. a) Calculate the degree of freedom of the following linkages. **9**
- i)

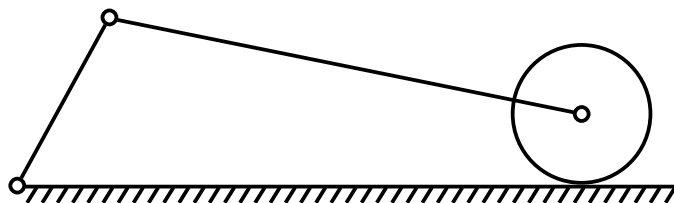


Fig. 2 (i) a

ii)

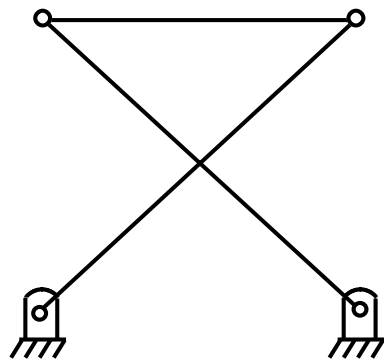


Fig. 2 (ii) b

iii)

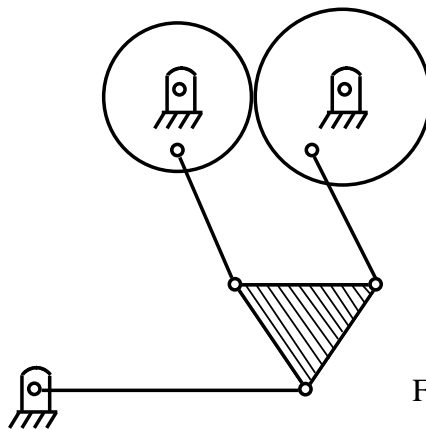


Fig. 2 (iii) c

b) State and explain the working of any exact straight line mechanism.

5

3. The crank of slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine.

13

i) Linear velocity and acceleration of the midpoint of connecting rod.

ii) Angular velocity and angular acceleration of connecting rod at a crank angle of 45° from inner dead centre.

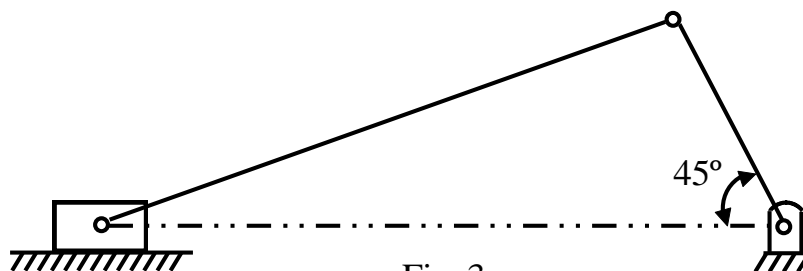
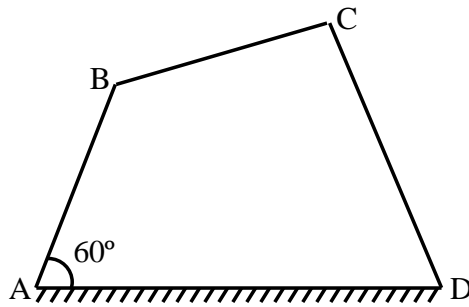


Fig. 3

OR

4. a) Define instantaneous centre. State and prove Kennedy's theorem. 4
- b) The dimension of four bar mechanism fig. 4, is given below. $AB = 300 \text{ mm}$; $BC = CD = 360 \text{ mm}$; The angle $BAD = 60^\circ$ The crank AB rotates uniformly at 100 rpm . Locate all instantaneous centres and find angular velocity of link BC . 9



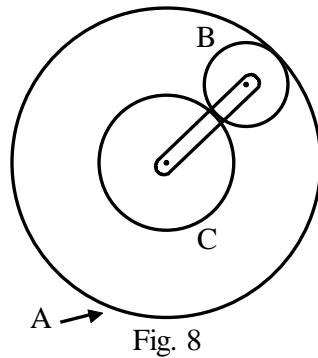
5. a) With the help of neat sketch define the following terms for a cam and follower mechanism. 10
- Base circle.
 - Prime circle.
 - Pitch curve.
 - Pressure angle.
 - Pitch point.
 - Lift.
- b) Explain with neat sketch different type of followers with their applications. 4

OR

6. Draw the profile of cam operating a roller reciprocating follower with the following data: The diameter of cam is 50 mm , roller diameter is 20 mm . The line of stroke of follower passes from cam axis. Rise with SHM for 120° of cam rotation. Dwell 30° and return 60° following SHM. The lift of follower is 50 mm . Determine the velocity and acceleration during rise and return when cam rotates at 400 rpm . 14
7. a) Define the gear terminologies with neat sketch. 6
- b) A pinion having 30 teeth drives a gear of 80 teeth. The Profile of gear is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of Path of contact, are of contact and contact ratio. 7

OR

8. a) An epicyclic gear as in fig 8 consist of three wheels. Wheel A has 72 teeth (internal) and C has 32 teeth (external). The gear B meshes with both gear A and C and it carried on an arm which rotates about the centre at 18 rpm. If gear 'A fixed, Determine the speed of B and C. 10



- b) What are the different types of Gears? Explain any one with neat sketch. 3
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 in which rocker of length 60 mm oscillates by 45° with time ratio 1.25. Also determine minimum and maximum transmission angles. 13
11. a) State the laws of friction. 4
- b) Define clutch, brake and dynamometer with their applications. 4
- c) With neat sketch explain working of Rope brake Dynamometer. 5

OR

12. a) What is transmission angle in mechanism? How it is related to mechanical advantage of the mechanism? Explain. 6
- b) A multiplate clutch has three pairs of contact surfaces. The outer and inner radii at the contact surfaces are 120mm and 60mm respectively. The axial spring force is 1 kN. Assuming uniform wear. Find the power transmitted at 1500 rpm. Take coefficient of friction as 0.35. 7
