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

Kinematics of Machine

Paper – II

P. Pages : 4 **TKN/KS/16/7316/7341**

Time : Three Hours * 1 0 9 8 * 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. Required Half Imperial Drawing Sheets.

1. a) Define **3**

i) Link

ii) Mechanism

iii) Machine

b) Define Grubbler's criteria for planer mechanism. **3**

c) Calculate the degree of freedom of the linkages. **8**

i)

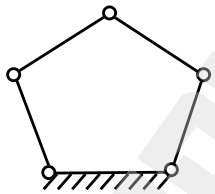

Fig. 1

ii)

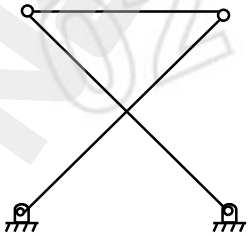

Fig. 2

iii)

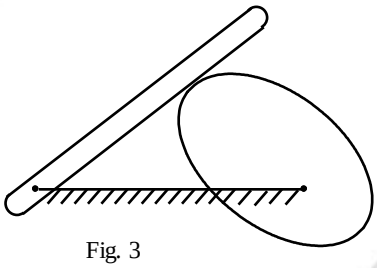

Fig. 3

iv)

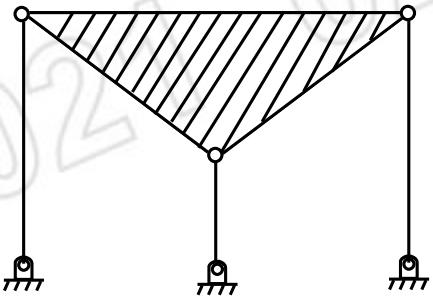

Fig. 4

OR

2. a) Define & Explain with example. **4**

i) Inversion of Mechanism.

ii) Degrees of freedom of mechanism.

b) State & Explain Grashof's law. **4**

c) Differentiate between machine & structure. **2**

d) Discuss exact straight line mechanism. Draw neat sketch of any one exact straight line mechanism. **4**

3. The Crank of slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm & the connecting rod is 600 mm long. **13**
Determine :

i) Linear velocity & acceleration of midpoint of connecting rod.

ii) Angular velocity & acceleration of midpoint of connecting rod at the crank angle of 45º from inner dead centre.

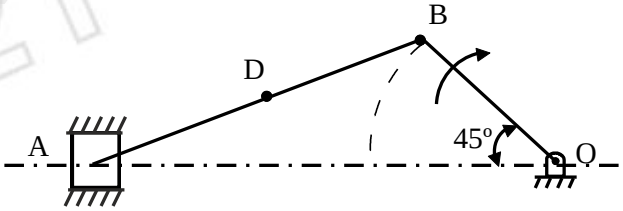

Fig. 5

OR

4. a) State & prove Kennedy's theorem as applicable to instantaneous centres of rotation of three bodies. **4**

b) In a pin jointed four bar mechanism as shown in fig. AB = 300 mm; BC = CD = 360mm & AD = 600 mm. The angle BAD is 60º. The Crank rotates uniformly 100 rpm ^{cw}. Locate all instantaneous centre & find angular velocity of link BC. **9**

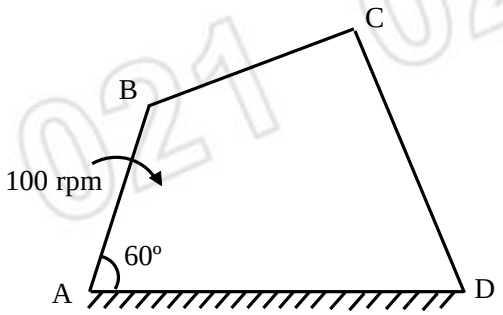

Fig. 6

5. a) What is Cam? State different types of cams & followers. **4**

b) Define the following terms for cam & follower mechanism. **9**

i) Base circle. ii) Pitch circle.
iii) Pressure angle. iv) Lift
v) Angle of ascent. vi) Angle of descent.
vii) Pitch point. viii) Pitch curve
ix) Prime circle.

OR

6. Draw the profile of cam operating a roller reciprocating follower with the following data. Minimum radius of cam = 30 mm; lift of follower = 40 mm; Roller diameter = 15 mm; The line of stroke of follower passes from cam axis. The cam lifts the follower for 120º with S.H.M. followed by dwell period 40º. The follower moves down during 60º of cam return with uniform velocity followed by a dwell period. **13**
If the cam rotates at uniform speed of 200 rpm in clockwise direction.
Find the maximum velocity & acceleration.

7. a) Give comparison between spur gear & helical gear. **4**

b) The pressure angle of two gears in mesh 20º & have a module of 10 mm. The number of teeth on pinion are 24 & on gear 60. The addendum of pinion & gear is same & equal to one module. **10**
Determine :
i) The number of pairs of teeth in contact.
ii) The angle of action of pinion & gear.
iii) The ratio of sliding to rolling velocity at pitch point.

OR

8. a) Define the following gear terminologies **5**

i) Circular Pitch ii) Module
iii) Gear ratio iv) Pressure angle
v) Path of approach.

b) In an epicyclic gear train, an arm carries two gears 1 & 2 having 40 & 50 teeth respectively. The arm rotates at 160 rpm CCW about the centre of gear 1. which is fixed. Determine the speed of the gear 2. **9**

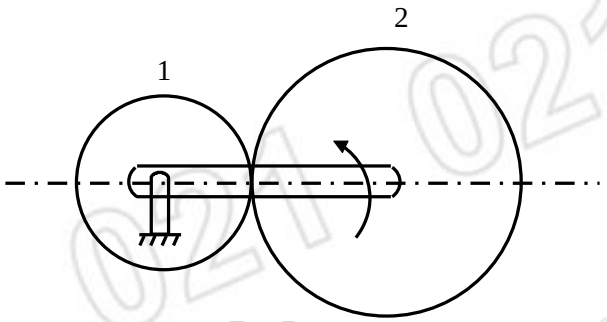

Fig. 7

9. a) What is Kinematic synthesis? What are the different methods of synthesis? **4**

b) Derive Freudenstein's equation for a four bar linkage design. **9**

OR

10. a) Design a slider crank mechanism for following requirements **9**
Stroke length – 100 mm
Off set – 20 mm
Determine, the length of Crank, connecting rod and time ratio.

b) What is transmission angle in mechanism? How it is related to mechanical advantage of the mechanisms? Explain. **4**

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

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

c) With neat sketch explain working of Rope Brake Dynamometer. **6**

OR

12. a) Define Clutch, Brake & Dynamometer with their applications. **6**

b) A single dry plate clutch transmits 15 KW at 1800 rpm. The axial pressure is limited to 0.8×10^5 N/m^2. For coefficient of friction 0.3. **7**
Determine :

i) Mean radius & face width of the friction line assuming ratio of mean radius to face width as 4.

ii) External & internal radii of clutch plate.

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