

B.E./B.Tech SEMESTER ARREAR EXAMINATIONS, APRIL/MAY 2012

6

MECHANICAL ENGINEERING

3rd SEMESTER – (R-2008)

ME 9203 – KINEMATICS OF MACHINES

Time : 3 Hrs

Max.marks: 100

- Instructions :
1. Answer ALL the questions.
 2. Write brief procedure for graphical constructions.
 3. Sketches should be drawn neatly.
 4. Answers without units and with wrong units will carry less marks.
 5. Symbols used should be explained at least once in each solution.
 6. Answers without writing the relevant equations and equations without substituting the data will carry ZERO marks.

PART A — (10 × 2 = 20 marks)

1. State the Kutzbach criterion.
2. Define Mobility.
3. Define trace point with respect to cams?
4. Sketch a conjugate cam and mark the salient parts.
5. State any two advantages and disadvantages of involute gear tooth profile.
6. Define Coriolis component of acceleration and sketch its direction
7. Write the properties of instantaneous centres
8. Define Cone of friction
9. A body weighs 200 N is placed on a rough horizontal plane. If the coefficient of friction between the body and the horizontal plane is 0.3, determine the horizontal force required to just slide the body on the plane.
10. (i) A gear box in auto mobile utilizes ----- gear train
(ii) In determining the minimum no of teeth on a pinion, the major consideration is to avoid ----

PART B — (5 × 16 = 80 marks)

11. (a) For the kinematic linkages shown in fig 11(a), calculate the following: (i) the no. of binary links, the no. of ternary links, the no. of total links, (ii) the no. of loops (iii) the no. of pairs (iv) the no. of degrees of freedom. (6 marks)

(b) Define inversions of a mechanism and Explain the inversions of double slider crank chain with neat sketches (10 marks)

12. (a) The fig 12 (a) shows a toggle mechanism in which link D is constrained to move in horizontal direction. For the given configuration, findout (1) velocities of points B and D and (2) angular velocities of links AB, BC and BD. The crank OA rotates at 60 rpm in anticlockwise direction. (16 marks)

(OR)

12. (b) The link AB of a four bar mechanism as shown in fig 12(b) revolves uniformly at 120 rpm in clockwise direction. Find the angular acceleration of links BC and CD. The dimensions of various links are as given below:

AB = 40 mm, BC = 100 mm, CD = 80 mm, AD = 60 mm and $\angle DAB = 90^\circ$.

(16 marks)

13. (a) A came rotating clockwise at a uniform speed of 1000 rpm is required to give a roller follower the motion as follows: Follower to move outwards through 50 mm during 120° of cam rotation, to dwell for next 60° of cam rotation, to return to its starting position during next 90° of cam rotation and to dwell for the rest of the cam rotation. The minimum radius of the cam is 50 mm and the dia of roller is 10 mm. The line of stroke of follower is offset by 20 mm from the axis of the cam shaft. If the displacement takes place with uniform and equal acceleration and retardation on both outward and inward strokes, draw the profile of the cam and find the maximum velocity and acceleration during out stroke and return stroke. (16 marks)

(OR)

(b) (i) Classify the followers with neat sketches based on surface of contact, motion and path. (12 marks)

(ii) What is tangent cam and state its applications (4 marks)

14. (a) A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm are in mesh. The smaller gear rotates at 1000 rpm, determine (i) sliding velocities at engagement and disengagement of pair of a teeth and (ii) contact ratio. (16 marks)

(OR)

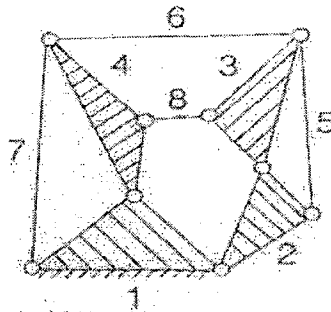
(b) Fig 14(b) shows a compound gear in which an input torque of 150 N.m is given to shaft B at 1000 rpm. The sun and planet gears are all of the same diameter and pitch. What will be the speed and the torque at the output shaft C assuming an efficiency of 97%. Also find the torque required to hold the annulus A1 stationary.

(16 marks)

15. (a) The mean diameter of a Whitworth bolt having V threads is 25 mm. The pitch of the thread is 5 mm and the angle of V is 55° . The bolt is tightened by screwing a nut whose mean radius of bearing surface is 25 mm. If the coefficient of friction for nut and bolt is 0.1 and for nut and bearing surface is 0.16, find the force required at the end of a spanner 0.5 m long when the load on the bolt is 8 kN. (16 marks)

(OR)

- (b) In a thrust bearing the external and internal radii of the contact surfaces are 210 mm and 160 mm respectively. The total axial load is 60 kN and coefficient of friction = 0.05. The shaft is rotating at 380 rpm. Intensity of pressure is not to exceed 350 kN/m^2 . Calculate (i) power lost in overcoming the friction and (ii) number of collars required for the thrust bearing. (16 marks)



(a)

Fig 11(a)

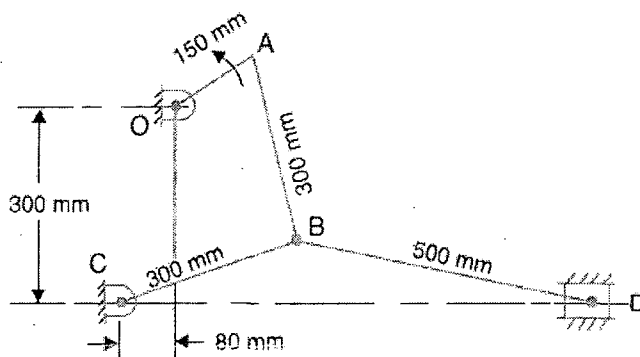
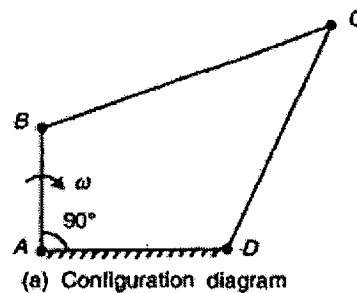


Fig 12(a)



(a) Configuration diagram

Fig 12(b)

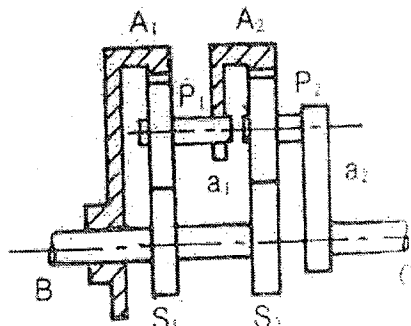


Fig 14(b)