Register Number: ……………………..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Third Semester

MECHATRONICS ENGINEERING

MCT101: Kinematics of Machinery

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The mechanism called a structure when the number of degrees of freedom is equal to
   a) 3
   b) 1
   c) 2
   d) 0

2. The cam and follower without spring forms a
   a) Lower pair
   b) higher pair
   c) self closed pair
   d) force closed pair

3. A kinematics chain is known as a mechanism when
   a) none of the link is fixed
   b) one of the links is fixed
   c) Two of the links are fixed
   d) all of the links are fixed

4. The coriolis component of acceleration is taken into account for
   a) Slider crank mechanism
   b) Four bar chain mechanism
   c) Quick return motion mechanism
   d) Toggle mechanism

5. For high speed engines, the cam follower should move with
   a) Uniform velocity
   b) Simple harmonic motion
   c) Uniform acceleration and retardation
   d) None of the above

6. Maximum wear occur in case of
   a) Roller follower
   b) Knife edge follower
   c) Flat face follower
   d) Mushroom follower

7. A differential gear in automobile is used to
   a) Reduce speed
   b) Assist in changing speed
   c) Provide jerk free movement of vehicle
   d) Help in turning

8. The type of gear used to connect two parallel co-planar shafts is
   a) bevel gear
   b) Spur gear
   c) Worm gear
   d) Spiral gear

9. The frictional torque transmitted by a cone clutch is same as that of
   a) Flat pivot bearing
   b) Flat collar bearing
   c) Conical pivot bearing
   d) Trapezoidal pivot bearing

10. The power transmitted by the belt is maximum when the maximum tension in the belt is equal to
    a) T_c
    b) $2 T_c$
    c) $3 T_c$
    d) $4 T_c$

PART B (10 x 2 = 20 Marks)

11. Define degree of freedom

12. Write the classification of kinematic pairs

13. What are the types of instantaneous centre?

14. Define kinematic analysis

15. List the terms used in radial cam

16. What is standard cam motion?

17. Define reverted gear train.

18. What are the advantages of involute gear trains?

19. Define friction clutches

20. Differentiate between belt and rope drive

PART C (5 x 14 = 70 Marks)

21. a)   Sketch and explain the various inversions of four bar chain

(OR)

    b)   Sketch single slider crank chain and its various inversions, stating its applications

22. a)   PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm, QR = 175 mm, RS = 112.5 mm and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60º and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.

(OR)

    b)   The angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are: OA = 28 mm ; AB = 44 mm ; BC 49 mm ; and BD = 46 mm. The centre

distance between the centres of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical.(Fig: 1)
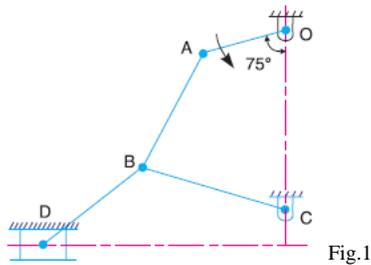

Fig.1

23. a) Draw the profile of a cam operating a knife edge follower from the following data:

   (i) Follower moves outward through a distance of 30mm during 120° of cam rotation.

   (ii) Follower dwells for the next 60° of cam rotation.

   (iii) Follower to return to its initial position during 90° of cam rotation.

   (iv) Follower to dwell for the remaining 90° of cam rotation.

   The cam is rotating clockwise at a uniform speed of 500 rpm. The least radius of the cam is 40mm and the line of stroke of the follower is offset by 15 mm from the axis of the cam and the displacement of the follower is to take place with uniform acceleration and retardation during both outward and return strokes.

(OR)

   b) Construct the profile of a cam to suit the following specifications: Cam shaft diameter = 40 mm ; Least radius of cam = 25 mm ; Diameter of roller = 25 mm; Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm ; Number of pauses are two of equal interval between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of the cam.

24. a) (i) Define the following gear terminology terms: (6)

   (1) module, (2) circular pitch, (3) pressure angle (4) interference

   (5) path of contact (6) contact ratio

   (ii) Drive an expression for the minimum number of teeth on the pinion in order to avoid interference (8)

(OR)

   b) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B? (Fig 2)
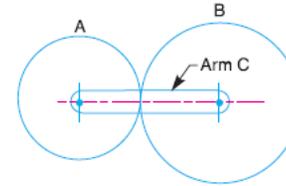

Fig.2

25. a) A shaft which rotates at a constant speed of 160 r.p.m. is connected by belting to a parallel shaft 720 mm apart, which has to run at 60, 80 and 100 r.p.m. The smallest pulley on the driving shaft is 40 mm in radius. Determine the remaining radii of the two stepped pulleys for an open belt. Neglect belt thickness and slip.(fig 3)
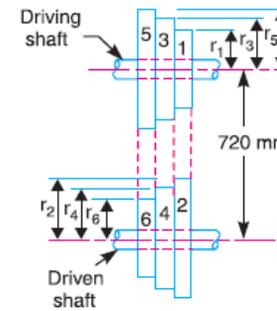

Fig.3

(OR)

   b) (i) Discuss in detail friction in screw threads and self locking (7)

   (ii) Discuss in detail friction in vehicle propulsion and braking (7)

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