17MT45

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Theory of Machines

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a.   Define the following:
         (i)   Kinematic pair   (ii) Degree of freedom
         (iii) Structure   (iv) Mechanism   **(08 Marks)**
    b.   With a neat sketch, explain inversions of Double Slider Crank Chain.   **(12 Marks)**

OR

2   a.   With a neat sketch, explain the Geneva wheel mechanism.   **(10 Marks)**
    b.   Explain briefly the Ackerman steering gear.   **(10 Marks)**

Module-2

3   a.   Define the following:
         (i) Pitch circle   (ii) Addendum   (iii) Module   (iv) Circular pitch.
                                                                                           (04 Marks)
    b.   Explain Law of Gearing.   **(06 Marks)**
    c.   A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute
         with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of
         contact, arc of contact and the contact ratio.   **(10 Marks)**

OR

4   a.   Define Gear train. Explain the types of Gear trains.   **(08 Marks)**
    b.   An Epicyclic train of gears is arranged as shown in Fig. Q4 (b). How many revolutions does
         the arm, to which the pinions B and C are attached make.
         (i)   When A makes one revolution clockwise and D makes half a revolution anticlockwise.
         (ii)   When A makes one revolution clockwise & D is stationary.
         The number of teeth on the gears A and D are 40 and 90 respectively.   **(12 Marks)**
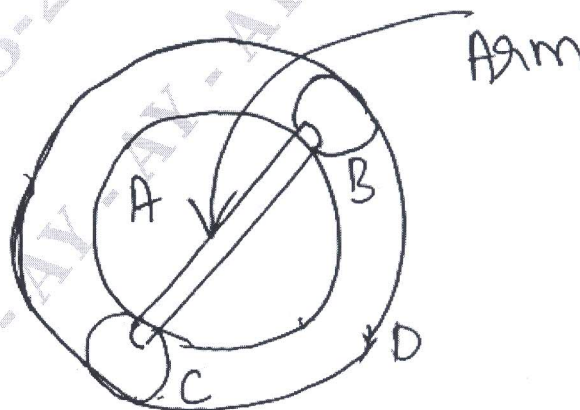

Fig. Q4 (b)

Module-3

5   a.   Define Cam. Explain the classification of followers.   (06 Marks)
     b.   A Cam is to be designed for a knife edge follower with the following data :
          (i)   Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
          (ii) Dwell for the next 30°.
          (iii) During the next 60° of cam rotation the follower returns to its original position with
                simple harmonic motion.
          (iv) Dwell during the remaining 180°.
          Draw the profile of the Cam when, the line of stroke of the passes through the axis of the
          cam shaft. The radius of the base circle of the cam is 40 mm.
          Determine the max velocity and max acceleration of the follower during ascent and descent
          if the cam rotates at 240 rpm.   (14 Marks)

OR

6   A cam drives a Flat reciprocating follower in the following manner:
     During first 120° rotation of the cam, follower moves outward through a distance of 20 mm
     with simple harmonic motion. The follower dwells during next 30° of cam rotation. During
     next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The
     follower dwells for the next 90°of cam rotation. The minimum radius of the cam is 25 mm.
     Draw the cam profile.   (20 Marks)

Module-4

7   a.   Explain the necessity of balancing.   (05 Marks)
     b.   A shaft carries 4 masses in parallel planes A, B, C and D in this order along its length. The
          masses at B and C are 18 kg and 12.5 kg respectively and each has an eccentricity of 60 mm.
          The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B
          and C is 100° and that between the masses at B and A is 190°, both being measured in the
          same direction. The axial distance between the planes A and B is 100 mm and that between
          B and C is 200 mm. If the shaft is in complete dynamic balance. Determine
          (i)   The magnitude of the masses at A and D.
          (ii) The distance between planes A and D.
          (iii) The angular position of the mass at D.   (15 Marks)

OR

8   a.   Explain the materials used for manufacturing of belts.   (05 Marks)
     b.   Explain the types of Flat Belt drives.   (05 Marks)
     c.   A pulley is driven by a Flat Belt, the angle of lap being 120°. The belt is 100 mm wide by
          6 mm thick and density 1000 kg/m^3. If the coefficient of friction is 0.3 and the maximum
          stress in the belt is not to be exceeding 2 MPa. Find the greatest power which the belt can
          transmit and the corresponding speed of the belt.   (10 Marks)

Module-5

9   a.   Define : (i) Gyroscope   (ii) Gyroscopic couple.   (04 Marks)
     b.   A uniform disc of 150 mm diameter has a mass of 5 kg. It is mounted centrally in bearings
          which maintain its axle in a horizontal plane. The disc spins about its axle with a constant
          speed of 1000 rpm. While the axis processes uniformly about the vertical at 60 rpm. If the
          distance between the bearings is   100 mm. Find the resultant reaction at each bearing due
          to the mass and gyroscopic effects.   (16 Marks)

OR

10   a.   Explain the classification of governors.   (08 Marks)
     b.   A porter governor has all four arms 250 mm long. The upper arm are attached on the axis of
          rotation and the lower arms are attached to the sleeve at a distance of 30 mm from the axis.
          The mass of each ball is 5 kg and the sleeve has a mass of 50 kg. The extreme radii of
          rotation are 150 mm and 200 mm. Determine the range of speed of the governor.   (12 Marks)