15173

**B. Tech 5th Semester Examination**

**Theory of Textile Machines (NS)**

**TE-311**

Time : 3 Hours                                    Max. Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt Five questions in all, selecting one question from each sections A, B, C and D. Section E is compulsory. Assume missing data suitably, if any.

**SECTION - A**

1. (a) Explain with sketch the instantaneous centre method for determination of velocities of links and mechanisms.

   (b) Name the three inversions of a double slider crank chain and explain any two.

   (c) The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, determine:
   (i)   velocity of piston,
   (ii)  angular velocity of connecting rod,
   (iii) velocity of point E on the connecting rod 1.5 m from the gudgeon pin,
   (iv)  velocities of rubbing at the pins of the crank shaft, crank and crosshead when the diameters of their pins are 50 mm, 60 mm and 30 mm respectively,
   (v)   position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft.
   (4+4+12=20)

2. (a) Sketch and describe the working of two different types of quick return mechanisms. Give examples of their applications. Derive an expression for the ratio of times taken in forward and return stroke for one of these mechanisms.

**[P.T.O.]**

   (b) Explain the phenomena of 'slip' and 'creep' in a belt drive. An open belt drive connects two pulleys 1.2 m and 0.5 m diameter, on parallel shafts 4 metres apart. The mass of the belt is 0.9 kg per metre length and the maximum tension is not to exceed 2000 N. The coefficient of friction is 0.3. The 1.2 m pulley, which is the driver, runs at 200 r.p.m. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 r.p.m. Calculate the torque on each of the two shafts, the power transmitted, and power lost in friction. What is the efficiency of the drive?                                    (8+12=20)

**SECTION - B**

3. (a) What do you understand by the term 'interference' as applied to gears? How it can be avoided? Derive an expression for the minimum number of teeth required on the pinion in order to avoid interference in involute gear teeth when it meshes with wheel.

   (b) Derive an expression showing the effect of altering the centre distance on the velocity ratio for Involute Teeth Gears.

   (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.       (6+6+8=20)

4. (a) What do you understand by "gear train"? Discuss the various types of gear trains.

   (b) Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains ?

   (c) An epicyclic gear consists of three gears A, B and C as shown in Fig. 1. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B and C.                                    (6+6+8=20)
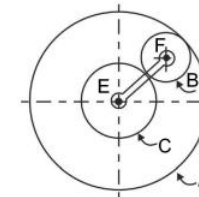


Figure 1

## SECTION - C

5. (a) A cam is to give the following motion to a knife-edged follower:

   (i) Outstroke during 60° of cam rotation;

   (ii) Dwell for the next 30° of cam rotation;

   (iii) Return stroke during next 60° of cam rotation, and

   (iv) Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when (i) the axis of the follower passes through the axis of the cam shaft, and (ii) the axis of the follower is offset by 20 mm from the axis of the cam shaft.

   (b) Define the following terms as applied to cam with a neat sketch:

   (i) Base circle, (ii) Pitch circle, (iii) Pressure angle, and (iv) Stroke of the follower.                                    (12+8=20)

6. (a) Explain clearly the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them.

   (b) Explain: (i) Swaying couple (ii) hammer blow (iii) Variation of Tractive Force with reference to balancing of Reciprocating masses.

   (c) A shaft carries four 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 : 1.The magnitude of the masses at A and D ; 2. the distance between planes A and D; and 3. the angular position of the mass at D.
   (6+6+8=20)

## SECTION - D

7. (a) Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed' in the case of flywheels. Obtain expression for maximum fluctuation of energy, ∆E.

**[P.T.O.]**

   (b) The turning moment diagram for a multicylinder engine has been drawn to a scale of 1 mm = 4500 N-m vertically and 1 mm = 2.4° horizontally. The intercepted areas between output torque curve and mean resistance line taken in order from one end are 342, 23, 245, 303, 115, 232, 227, 164 mm$^2$, when the engine is running at 150 r.p.m. If the mass of the flywheel is 1000 kg and the total fluctuation of speed does not exceed 3% of the mean speed, find the minimum value of the radius of gyration.
   (8+12=20)

8. (a) Write short notes on:

   i) Gear drives in textile machines, ii) Types of Cam followers used in Textile machinery

   (b) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m$^3$ and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account.                                    (10+10=20)

## SECTION - E

9. (i) What is a machine ? Giving example, differentiate between a machine and a structure.

   (ii) Define the term initial tension in a belt drive.

   (iii) Why Offset is provided to a cam follower mechanism ?

   (iv) Write an expression for calculating the linear velocity of the reciprocating roller follower when it has contact with the straight flanks of the tangent cam.

   (v) Define velocity ratio of epicylic gear train.

   (vi) Write the relation between the number of instantaneous centres and the number of links in a mechanism.

   (vii) Define the terms : 1. Lower pair, 2. Higher pair, 3. Kinematic chain, and 4. Inversion

   (viii) Define coriolis component of acceleration.

   (ix) Name various inversions of a slider crank chain.

   (x) Write the equation used to show relation between the number of pairs (p) forming a kinematic chain and the number of links.
   (10×2=20)