

B.E./B.TECH. Degree Examination, December 2020

Fourth Semester

**AE16402 Mechanics of Machines**

(Regulation 2016)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions

**PART A - (8 X 2 = 16 marks)**

1. The relation between the number of pairs ( $p$ ) forming a kinematic chain and the number of links ( $l$ ) is
  - (a)  $l = 2p - 2$
  - (b)  $l = 2p - 3$
  - (c)  $l = 2p - 4$
  - (d)  $l = 2p - 5$
2. If the module of a gear be  $m$ , the number of teeth  $T$  and pitch circle diameter  $D$ , then
  - (a)  $m = D/T$
  - (b)  $D = T/m$
  - (c)  $m = D/2T$
  - (d) none of these
3. When the belt is stationary, it is subjected to some tension, known as initial tension. The value of this tension is equal to the
  - (a) tension in the tight side of the belt
  - (b) tension in the slack side of the belt
  - (c) sum of the tensions in the tight side and slack side of the belt
  - (d) average tension of the tight side and slack side of the belt
4. The partial balancing means
  - (a) balancing partially the revolving masses
  - (b) balancing partially the reciprocating masses
  - (c) best balancing of engines
  - (d) all of the above.
5. Differentiate between a machine and a structure.
6. How to evaluate the mating of two gears?
7. Which of the two assumptions viz., uniform intensity of pressure, uniform rate of wear-would you make use of in designing friction clutch and why?
8. Why balancing of rotating parts is necessary for high speed engines?

**PART B - (4 X16 = 64 marks)**

09. (a) In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise, while the link CD = 80 mm oscillates about D, BC and AD are of equal length. Find the angular velocity of the link CD when angle BAD =  $60^\circ$ . (16)

**(OR)**

- (b) A cam is to give the following motion to a knife-edged follower : (16)  
 1. Outstroke during  $60^\circ$  of cam rotation; 2. Dwell for the next  $30^\circ$  of cam rotation; 3. Return stroke during next  $60^\circ$  of cam rotation, and 4. Dwell for the remaining  $210^\circ$  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 the axis of the follower passes through the axis of the cam shaft.

10. (a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with  $20^\circ$  pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. (16)

**(OR)**

- (b) In an epicyclic gear train an arm carries two gears A and B having 40 and 60 teeth. (16)  
 (i) If arm rotates at 200 rpm in clockwise direction about the centre of gear A which is fixed what will be the speed of gear B.  
 (ii) If the gear A instead of being fixed makes 300 rpm in the anticlockwise direction, what will be the speed of gear B.

11. (a) A single plate clutch effective on both sides is required to transmit 25kw at 3000 rpm. Determine the outer and inner radius of frictional surface, if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not exceeding  $0.1 \text{ N/mm}^2$ . Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. (16)

**(OR)**

- (b) A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. ( 16 )  
The angle of the groove is  $30^\circ$ . The cross-sectional area of each belt is  $750 \text{ mm}^2$  and co-efficient of friction between the belt and pulley surface is 0.12. The density of the belt material is  $1.2 \text{ Mg/m}^3$  and the maximum safe stress in the material is 7 MPa. Calculate the power that can be transmitted between pulleys 300 mm diameter rotating at 1500 rpm. Find also the shaft speed in rpm at which the power transmitted would be maximum.
12. (a) A vertical petrol engine 100 mm diameter and 120 mm stroke has a connecting rod ( 16 )  
250 mm long. The mass of the piston is 1.1 kg. The speed is 2000 rpm. On the expansion stroke with a crank  $20^\circ$  from top dead centre, the gas pressure is  $700 \text{ kN/m}^2$ . Determine:
- (i) Net force on the piston,
  - (ii) Resultant load on the gudgeon pin,
  - (iii) Thrust on the cylinder walls,
- (OR)**
- (b) Four masses  $m_1$ ,  $m_2$ ,  $m_3$  and  $m_4$  are 200 kg, 300 kg, 240 kg and 260 kg respectively. ( 16 )  
The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are  $45^\circ$ ,  $75^\circ$  and  $135^\circ$ . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.