Bachelor of Engineering (Mechanical Engineering) 3rd yr 1st sem Exam 2019 (Old)

3rd Year, 1ST Sem

### Machine Design II

Time:3hrs   （Answer any five from the following）   Full marks: 100

(Assume data if missing)

1. (a) Calculate the self locking condition of simple block brake and differential band brake using free-body diagram of forces.   10

(b) A 450 mm diameter drum has two shoes that subtended angles of 90^0 each. The face width of the shoe is 100mm, and 70kW is being generated. Will the brake overheat and surrounding air is 165 K?   10

2. (a) Derive the expression with sketch for stress and deflection of close coiled helical spring and from that the expression for stiffness of the spring.   10

(b) A railway wagon of mass 20000 kg moving with a velocity of 2 m/s is brought to rest by springs of mean diameter 300 mm. The maximum deflection of the spring is 200 mm. Permissible shear stress is 600 MPa. Find the dimension of each spring.   10

3. (a) An automotive single plate clutch consists of two pairs of contacting surfaces. The outer diameter of the friction disk is 270 mm. The coefficient of friction is 0.3 and the maximum intensity of pressure is 0.3 N/mm^2. The clutch is transmitting a torque of 531 N-m. Assuming uniform wear theory, calculate:

(i) the inner diameter of the friction disk; and

(ii) spring force required to keep the clutch engaged.   10

(b) Show that the energy dissipated during clutching operation is independent of torque and directly proportional to the square of relative velocity of driving and driven shafts. 10

4. A leather open belt drive transmitting 20 kW power. The centre distance between the pulley is twice the diameter of the bigger pulley. The smaller and bigger pulley are rotating 1800 rpm and 600 rpm respectively in clockwise direction. The belt should operate at a velocity of 20 m/s and the stresses in the belt should not exceed 2.5 N/mm^2. The density of leather is 1 gm/cc and the coefficient of friction is 0.35. The thickness of the belt is 6 mm. Calculate:

(i)   the diameter of pulley;

(ii)   the length and width of the belt: and

(iii)   the belt tension   20

[Turn over

5. Cotter joint is used to connect two rods having 50 mm diameter, made of plain carbon steel 40C8 (σ_{yt}=380 n/mm^2). The cotter is made from a steel plate of 12 mm thickness. Calculate the dimensions of the socket end with neat sketch of cotter joint where compressive strength is twice of tensile strength. The factor of safety for the rods, spigot end and socket end is 6 and for cotter is 4.   20

6. (a) A welded connection, as shown in Fig. below is subjected to an eccentric force of 7.5 kN. Determine the size of welds if the permissible shear stress for the weld is 100 N/mm^2. Assume static conditions.
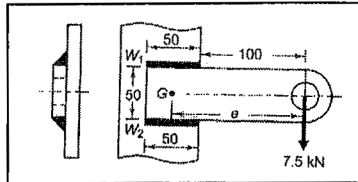
(b) Show by neat sketches the various ways in which a riveted joint may fail.   10+10

7. Write Short notes on (any four)   5×4=20
(a) Bolted joint with eccentric loading
(b) Uniform pressure theory of cone clutch
(c) Clutches with classification
(d) Band and block brake
(e) Different coupling and their uses