12/22 TE Sem VI (Mech) Dec 2022 RMC Scheme

[Total Marks : 80]

(3 Hours)

N.B.
(1) Question no. 1 is **compulsory**.
(2) Attempt any **three** questions out of remaining **five** questions.
(3) Use of standard data book like PSG, Mahadevan is permitted.
(4) **Figures** to the **right** indicate full **marks**. (20)

1. Attempt any FOUR of the following :
   (a) Explain the safe region and boundary conditions with suitable sketch for the maximum principal stress theory.
   (b) Describe various stresses in a belt with formula and its meaning.
   (c) Compare between rolling contact and sliding contact bearing.
   (d) Give detail classification of coupling.
   (e) Which threads are used in power screw? Give reason for your answer.

2. (a) Design a knuckle joint to connect two rods subjected to a load of 40 KN. The material for rod and knuckle pin can be assumed as 40C8. A suitable factor of safety can be considered if required for designing the joint. (12)
   (b) A helical compression spring is subjected to a load that ranges from 600 N to 1200 N. If the compression in the spring for the maximum load is 30 mm and spring index in 6, design the spring. The yield stress in shear for the spring material is 960MPa, endurance strength on shear as 480MPa and modulus of rigidity as 80×10^3 MPa. (08)

3. (a) Determine the life of a mechanical element subjected to complete reversed bending stress cycle as follows: (12)
   i) ± 300 MPa for 30% of time
   ii) ± 275 MPa for 25% of time
   iii) ± 400 MPa for 10% of time
   iv) ± 325 MPa for 25% of time
   v) 0 MPa for 10% of time
   The material has ultimate tensile strength of 1200MPa. The operating temperature is 400°C and fatigue stress factor = 0.7.
   (b) Explain the terms: coefficient of speed fluctuation and coefficient of steadiness. (08)

4. (a) A welded joint as shown in Fig. 1, is subjected to an eccentric load of 60 KN in the plane of the welds. Determine the size of the welds, if the permissible shear stress for the weld is 100 N/mm². Assume static conditions. (10)
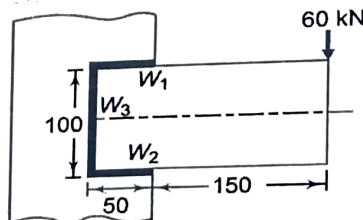

Figure 1 – Q 4 (a)

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(b) Explain with a suitable sketch the working of a single plate clutch. (10)

5. (a) Determine the suitable diameter for the solid shaft, if it is supported by two bearings (10) placed 1m apart. A 300 mm diameter pulley is mounted at a distance of 250 mm to the right of left hand bearing and this drives a pulley directly below it with the belt. Another pulley 400 mm diameter is placed 350 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulley is 180° & $\mu = 0.3$. The shaft transmits 10KW at 1440 rpm and weight of pulley A is 250N and that of B is 500 N. Assume that the torque of one pulley is equal to that of the other pulley.

(b) A hydrodynamically lubricated full journal bearing is used to support a radial load (10) of 15 KN. The speed of journal is 1500 r.p.m. and l/d ratio is 1. If the permissible bearing pressure is 1.5 N/mm², determine the following:
   i)   length and diameter of bearing
   ii)   minimum oil film thickness
   iii)   coefficient of friction
   iv)   oil flow rate
   v)   temperature rise.

6. (a) Select a suitable deep groove ball bearing for the shaft diameter of 60 mm and (10) reliability of 98 %. The shaft rotates at 1440 r.p.m. and the bearing carries a radial load of 2500 N and an axial load of 1200N. Expected life of braring is 25000 hours and consider a load factor of 1.2.

(b) Explain the various design considerations for casting with suitable sketches (10) wherever applicable.

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