

TME-502

1046

Odd Semester Examination 2017-18

B.TECH. (SEMESTER-V)

MACHINE DESIGN-I

Time: 03:00 Hours

Max Marks : 100

Note:- Attempt all questions.

1. Attempt any four questions:

(5x4=20)

- a. How does the high alloy steels and high speed tool steels designated according to the BIS? Explain the order.
- b. A shaft is transmitting 100 KW at 160rpm. Find suitable diameter for the shaft, if the maximum torque transmitted exceeds the mean by 25%. Take maximum allowable shear stress as 70MPa.
- c. A cylindrical shaft made of steel of yield strength 700mPa is subjected to static loads consisting of bending moment 10KN-m and torsional moment of 30KN-m. Determine diameter of shaft using any two different theories of failure. Take F.O.S=2 and $E=210\text{GPa}$.
- d. What do you mean by stress concentration? Discuss the methods of stress concentration?
- e. Derive Soderberg's equation and state equation and state its application to different types of loadings.

2. Attempt any four questions:

(5x4=20)

- a. Discuss the strength of transverse and parallel fillet welded joints.
- b. A plate 100mm wide and 12.5mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50KN. Find the length of the weld so that maximum stress does not exceed 56mPa. Consider the joint first under static loading and then under fatigue loading.
- c. Discuss the stresses in screwed fastening due to static loading.

- d. Design the rectangular key for a shaft of 50mm diameter. The shearing and crushing stresses for the key material are 42MPa and 70MPa.
- e. Describe the types of various shaft and couplings mentioning the uses of each type.

3. Attempt **any two** questions: (10x2=20)

- a. A screw jack is to lift a load of 80KN through a height of 400mm. The strength of screw material in tension and compression is 200MPa and in shear 120MPa. The material for nut is phosphor-bronze for which the elastic limit may be taken as 100MPa in tension, 90MPa in compression and 80MPa in shear. The bearing pressure between the nut and the screw is not to exceed 18N/mm^2 . Design the screw jack.
- b. The lead screw of a lathe has Acme threads of 50mm outside diameter and 8mm pitch. The screw must exert an axial pressure of 2500N in order to drive the tool carriage. The thrust is carried on a collar 110mm outside diameter and 55mm inside diameter and the lead screw rotates at 30rpm. Determine (a) the power required to drive the screw and (b) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar.
- c. During the design of power screw, what types of stress is to be considered to maintain a power screw having adequate strength to withstand axial load and the applied torque? Explain.

4. Attempt **any two** questions: (10x2=20)

- a. A helical spring is made from a wire of 6mm diameter and has outside diameter of 75mm. If the permissible shear stress is 350MPa and modulus of rigidity 84KN/mm^2 . Find the axial load which the spring can carry and the deflection per active turn. Assume first neglecting the effect of curvature and then consider the effect of curvature.
- b. A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05m apart and the central band is 85mm wide. The central load is to be 5.4KN with a permissible stress of 280MPa. Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring.
- c. What do you mean by nipping? Also derive the expression for determining the stress and deflection in full length and graduated leaves.

5. Attempt **any two** questions:

(10x2=20)

- a. With the help of flowchart, explain the engineering design process. Also compare the engineering design process and their scientific method and discuss their consequences.
- b. What do you mean by need analysis? Explain the need based development with appropriate examples.
- c. Explain the term Brain storming with some live case studies. Also discuss the technology based developments.

-----x-----