5TH SEM. /MECH./MECH(SAND.)/MECH(IND.INT.)/ 2024(S)

Th-2 Design of Machine Elements

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1 & 2
Figures in the right hand margin indicates marks
DATA BOOKS ALLOWED

1. Answer **All** questions 2 x 10
   a. What do you mean by ultimate stress?
   b. What is spring rate?
   c. Define Angle of twist.
   d. What is rivet and part of rivet?
   e. Classify keys.
   f. What is rigid coupling? State its types?
   g. Differentiate between shaft and axle.
   h. State the materials used for helical spring.
   i. Define lap joint.
   j. Name the physical properties of metals.

2. Answer **Any Six** Questions 6 x 5
   a. What is the function of shaft coupling? Describe requirements of a good shaft coupling.
   b. Describe any five mechanical properties of the material.
   c. Explain modes of failure of riveted joints.
   d. Draw stress-strain diagram for mild steel. Explain various points.
   e. What are the advantages of welded joints over riveted joints?
   f. Design a rectangular key for a shaft of 50 mm diameter. The shearing and crushing stress for the key material is 42 MPa and 70 MPa.
   g Explain surge in springs.

3 Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter; rivet pitch, strap thickness and efficiency of the joint. Take the working stresses in tension and shearing as 80 MPa and 60 MPa respectively. 10

4 Write down the general procedure in machine design procedure. 10

5 Explain about the following terms used in compression springs 10
(i) Spring Constant (ii) Spring Index (iii) Free Length (iv) Pitch (v) Solid Length.

6 Design a clamp coupling to transmit 30 kW at 100 rpm. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. 10

7 A solid shaft is transmitting 1.5 MW at 300 rpm. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 25%. Assume the allowable shear stress as 80 MPa. 10