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

5TH SEM. / MECH./DIP. IN MECH./MECH(MAINT.)/MECH.(PROD.)/ MECH(SAND.)/MECH(IND.INT.)/2023(W)NEW

Th- 2 Design of Machine Elements

Time- 3 Hrs

Full Marks: 80

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

2 x 10

1. Answer **All** questions
   a. Define Factor of safety for ductile material.
   b. Define toughness and stiffness.
   c. What is key and key-way?
   d. What is spring rate and pitch?
   e. What is the difference between shaft and axle?
   f. What is caulking and Fullering?
   g. Define Rankine Theory.
   h. What are modes of failure of Riveted Joint?
   i. Define angle of twist.
   j. What is muff coupling?

6 x 5

2. Answer **Any Six** Questions
   a. What are the effects of key way in a shaft?
   b. Explain spring constant, spring index, Free length, solid length & pitch.
   c. What is shaft? State its function & list the properties of shaft material.
   d. Design the rectangular key for a shaft of 50mm diameter. The shearing and crushing stresses for the key material are 42MPa and 70 MPa respectively.
   e. Explain the mechanical properties of the material.
   f. Write a short note on Surge Spring.
   g. What are the requirements of good shaft coupling?

3. A solid shaft is transmitting 1MW at 240 r.p.m. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60 MPa. 10

4. Describe with the help of neat sketch, the types of various shaft coupling mentioning the uses of each type. 10

5. Determine the rivet diameter, rivet pitch, strap thickness & efficiency of a single riveted double strap butt joint. Here two plates of 10mm thickness each are to be joined. Take the working stress in tension & shearing as $80N/m^2$& 60 N/m^2 respectively. 10

6. Design completely a rectangular sunk key considering its failure against shear and crushing. 10

7. Derive the expression for stresses in helical spring of circular wire. 10

5TH SEM./ DIP. IN MECH./ MECH(MAINT)/ MECH(PROD)/ MECH(SAND)/ MECHANICAL/ MECH(IND. INT) / 2022(W)

Th2 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 is meant by Spring Rate and Pitch?
   b. Define the term: Factor of Safety.
   c. What is Modulus of Rigidity?
   d. What are the different types of keys?
   e. What is rivet? State its uses.
   f. Define welding and types of welding process.
   g. What is the pressure vessel?
   h. What is spring? Classify spring into its various types.
   i. State the formula for stress in helical spring of a circular wire.
   j. State four general considerations in Machine design.

2. Answer **Any Six** Questions 6 x 5
   a. What is the function of shaft coupling? Describe requirements of a good shaft coupling.
   b. Explain the failures of a riveted joint.
   c. Describe the mechanical properties of the material.
   d. Two plates of 10mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter, rivet pitch, strap thickness of the joint. Take the working stresses intension and shearing as 8MPa and 60MPa respectively.
   e. A line shaft rotating at 200 rpm is to transmit 20kW. The shaft may be assumed to be made of mild steel with an allowable shear stress of 42MPa. Determine the diameter of the shaft neglecting the bending moment on the shaft.
   f. Briefly explain the advantages and disadvantages of Welded Joints over Riveted Joints.
   g. State the application of Saddle keys, Tangent keys, Round keys, Splines keys and Woodruff keys with neat sketches.

5TH SEM/MECH/MECH(MAIN.)/MECH.(PROD.)/MECH(IND.INT)/ MECH(SAND)/ 2020(W)NEW
Th-2 Design of Machine Elements

Time- 3 Hrs

Full Marks: 80

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

2 x 10

1. Answer All questions
   a. Define factor of safety
   b. State function of shaft.
   c. What is a key? State its function.
   d. What are the materials used for helical spring?
   e. What is modulus of rigidity?
   f. What is surge in springs?
   g. What is the difference between toughness and stiffness?
   h. What are the different types of shaft couplings?
   i. Define Diagonal pitch.
   j. What is welded joint? Write two application of welded joint.

6 x 5

2. Answer Any Six Questions
   a. What are the advantages of welded joint over riveted joints?
   b. Explain mechanical properties of the material.
   c. Draw stress-strain diagram for mild-steel. Explain various points.
   d. Explain the failures of a riveted joint.
   e. 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 the maximum stress does not exceed 56mpa. Consider the joint first under static loading and then under fatigue loading.
   f. How are the keys classified? Draw neat sketches of different types of keys and state their applications.
   g. A line shaft rotating at 200r.p.m is to transmit 20kW. The shaft may be assumed to be made of mild steel with an allowable shear stress of 42mPa. Determine the diameter of the shaft, neglecting the bending moment on the shaft.

3. Design a clamp coupling to transmit 30kW at 100r.p.m The allowable shear stress for the shaft and key is 40mPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70mPa. The co-efficient of friction between the muff and the shaft surface may be taken as 0.3. 10

4. Describe the Design procedure in details. 10

5. 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. 10

6. Two plates of 10mm 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 80mPa and 60mPa respectively. 10

7. Design the rectangular key for a shaft of 50mm diameter. The shearing and crushing stresses for the key material are 42mPa and 70mPa. 10