9. OLD QUESTION PAPERS

Code No: RT31033 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, Dec/Jan- 2022-23

DESIGN OF MACHINE MEMBERS – I

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

(Data books may be allowed)

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PART –A **(22 Marks)**

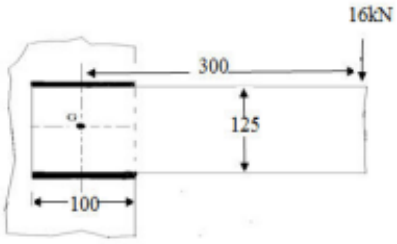
1. a) What is a fit? Write its significance. [3M]
   b) What is notch sensitivity? Explain. [4M]
   c) List advantages of bolted joints over welded joints. [4M]
   d) Write down the advantages and applications of knuckle joint? [4M]
   e) Explain the purpose of shaft couplings. [4M]
   f) Differentiate between helical and leaf springs, [3M]

PART –B **(48 Marks)**

2. a) Explain the steps involved in general machine design process. [8M]
   b) A shaft is designed based on maximum distortion energy theory with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of310MPa. It is subjected to an axial load of 40kN. Determine the maximum torque capacity. Diameter of the shaft is 20 mm. [8M]

3. Determine the diameter of the circular rod made of ductile material with a fatigue strength(complete stress reversal), σ_e=265 MPa and tensile yield strength of 350MPa. The member is subjected to a varying axial load from W_{min}= -300x10^3N to W_{max}=700x10^3N and has a stress concentration factor=1.8. Use factor of safety as 2.0 [16M]

4. A 125 x 95 x10 mm angle is welded to a frame by two 10mm fillet welds, as shown in fig. A load of 16kN is applied normal to the gravity axis at adistance of 300mm from the centre of gravity of welds. Find maximum shear stress in the welds, assuming each weld to be 100mm long parallel to the axis of the angle. All dimensions are in mm. [16M]



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5. a) A shaft and a key are made of the same material and the key width is 1/4 of the shaft diameter. Consider shear only, determine the minimum length of the key in terms of the shaft diameter. The shearing strength of the key material is60% of its crushing strength. Determine the thickness of the key to make the key equally strong in shear and crushing. [12M]

   b) Explain the stresses acting on Keys. [4M]

6. A rigid coupling transmits 40 kW at 150 rpm. The service factor for the application is 1.5 (take design torque as 1.5 times the mean torque). Select the suitable material for the various parts of the coupling. Take the material for shaft as 40C8 (S_{yt}= 380 MPa), material for bolts is 30C8 (400 MPa) and flanges are made up of cast iron FG 150 (S_{ut}=150 MPa). Take factor of safety as 2.5 for all components. [16M]

7. Design a helical spring for a spring loaded safety valve for the following conditions [16M]
   Operating pressure 1N/mm^2
   Maximum pressure when the valve blows off freely=1.075N/mm^2
   Maximum lift of the valve when the pressure is 1.075N/mm^2 =6mm
   Diameter of the valve seat =100mm
   Maximum shear stress =400Mpa
   Modulus of rigidity =86KN/mm^2
   Spring index=5.5

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III B. Tech I Semester Supplementary Examinations, August - 2021

DESIGN OF MACHINE MEMBERS – I

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

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3. Answer any **THREE** Questions from **Part-B**

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PART –A **(22 Marks)**

1. a) Explain about the different types of fits. [3M]
   b) Define the term stress concentration and give the causes of stress concentration. [4M]
   c) Discuss about the bolts of uniform strength. [4M]
   d) How do you design the solid and hollow shafts based on strength and rigidity? [4M]
   e) What are the differences between Rigid couplings and Flexible couplings? [4M]
   f) List the classification of springs. [3M]

PART –B **(48 Marks)**

2. a) Explain briefly about the torsional and bending stresses in the design of machine elements. [8M]
   b) How do you understand failure? Explain the various theories of failure. [8M]

3. a) Explain briefly about Soderberg and Goodman lines with neat sketches. [8M]
   b) A leaf spring in an automobile is subjected to cyclical stresses. The average stress=150MPa, variable stress=50 MPa, Ultimate stress=630 MPa, Yield point stress = 350 MPa and endurance limit=150 MPa. Estimate under what factor of safety the spring is working by Goodman and Soderberg formulae? [8M]

4. a) Explain the design procedure for the eccentrically loaded bolted joint. [6M]
   b) A 65 mm diameter solid shaft is to be welded to a flat plate by a fillet weld around the circumference of the shaft. Determine the size of the weld if the torque on the shaft is 3 kNm and the allowable shear stress in the weld is 70 MPa. [10M]

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5. a) Explain briefly about the design of shafts subjected to combined bending and torsion. [6M]
   b) It is required to design a knuckle joint to connect circular shafts subjected to an axial force of 50 kN. The rods are coaxial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. The allowable tensile, compressive and shear stress in the rod and pin material is limited to 80MPa, 100MPa and 40MPa respectively. [10M]

6. a) Explain the design procedure for flexible coupling. [6M]
   b) Design and draw a muff coupling to transmit 50 HP at 120 rpm. The shaft and key are made of the same material having allowable shear stress of 30 N/mm^2 and compressive stress of 80 N/mm^2. The flange is made, as cast Iron with allowable shear stress is 15 N/mm^2. [10M]

7. a) Explain the design of helical compression springs with a neat sketch. [8M]
   b) A truck spring has 12 number of leaves, two of which are full length leaves. The spring supporters are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 KN with a permissible stress of 280 MPa. 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. [8M]

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III B. Tech I Semester Supplementary Examinations, March – 2021

DESIGN OF MACHINE MEMBERS – I

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

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3. Answer any **THREE** Questions from **Part-B**
(Data books may be allowed)

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PART –A **(22 Marks)**

1. a) Define any four theories of failure. [4M]
   b) Explain Goodman failure theory. [4M]
   c) Distinguish the riveted and the bolted joints. [4M]
   d) Write the applications of spigot and socket joint. [4M]
   e) What is the importance of split muff couplings? [3M]
   f) What are the functions of springs? [3M]

PART –B **(48 Marks)**

2. a) Explain simple stresses. What are the general considerations in the design of machine elements? [8M]
   b) Explain the manufacturing considerations in design. [8M]

3. a) Explain the effect of the following factors on the type of fatigue failure: [6M]
   i) Type of material ii) Surface treatment.
   b) A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 KN and a maximum value of 50 KN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by: Ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. [10M]

4. a) What are the advantages and disadvantages of welded joints? [6M]
   b) Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90MPa, compressive stress 140 MPa and shear stress in the rivet is 56 MPa. [10M]

5. a) Write the design procedure for Jib and Cotter joint for square rods. [6M]
   b) Design a sleeve and cotter joint to resist a tensile load of 60 KN. All parts of the joint are made of the same material with the following allowable stresses: σt= 60 MPa , τ = 70 MPa and σc=125 MPa. [10M]

6. a) Write the differences between the rigid and flexible couplings. [6M]
   b) A mild steel shaft has to transmit 70 kW at 240 rpm. The allowable shear stress in the shaft material is limited to 45MPa. Design a cast iron flange coupling. The shear stress in the coupling bolt is limited to 30MPa. [10M]

7. a) Explain the stresses and deflection in leaf springs with a neat sketch. [8M]
   b) A rail wagon of mass 20 tonnes is moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa. Design the springs for the buffers. [8M]

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