Code No: R31035 **R10** **Set No: 1**

III B.Tech. I Semester Supplementary Examinations, May 2013

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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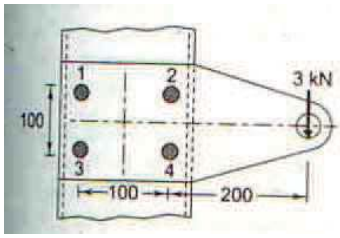
1. (a) What are the steps involved in design of machine elements? Why does the tensile strength of cast iron decrease as the thickness of part increases?
   (b)The stresses induced at a critical point in a machine component made of steel45C8 (S_{yt} =380 N/mm^2 are as follows. σ_x= 100 N/mm^2, σy= 40N/mm^2 τ_{xy} = 80 N/mm^2. Calculate the factor of safety by the maximum shear stress theory.

2. (a) Write soderberg's equation and state its application to different type of loadings.
   (b) A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4P. The span of the beam is 500 mm and its cross section is circular with a diameter of 60 mm, taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3. Calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9.

3. (a) Enumerate the different types of riveted joints and rivets.
   (b) A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 499 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint. If the above joint is subjected to a load such that the factor of safety is 4, find out the actual stresses developed in the plates and the rivets.

4. (a) How is locking of threads obtained in split nut?
   (b) A steel plate subjected to a force of 3 kN and fixed to a vertical channel by means of four identical bolts as shown in fig. The bolts are made of plain carbon steel 45 C8 (S_{yt} = 380 N/mm^2) and the factor of safety is 2. Determine the diameter of the shank.



5. (a)What are the applications of a cotter joint?
   (b) Design a knuckle joint to connect two mild steel bars under a tensile load of 25 KN. The allowable stresses are 65 MPa in tension. 50 MPa in shear and 83 MPa in crushing. Assume suitable data, if required.
6. A mild steel shaft transmits 20 kW at 200 rpm. It carries a central load of 900N and is simply supported between the bearings 2.5 meters apart. Determine the size of the shaft; if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56 MPa.What size of the shaft will be required, if it is subjected to gradually applied loads?

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7. (a) What is coupling? Give at least three practical applications of coupling?
   (b) Design a muff coupling to connect two shafts transmitting 40 kW at 120 rpm. The permissible shear and crushing stress for the shaft and key material (mild steel) are 30 MPa and 80 MPa respectively. The material of the muff is cast iron with permissible shear stress of 15 MPa. Assume that the maximum torque transmitted is 25 percent greater than the mean torque.

8. (a) What is the function of spring? In which type of spring the behaviour is nonlinear.

   (b) Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 KN / mm^2. Take Wahl's factor K = (4C-1/4C-4) +0.615/C where C = spring index.

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Code No: R31035 **R10** **Set No: 2**

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DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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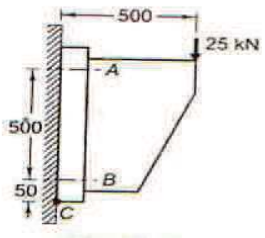
1. (a) Where do you use maximum shear stress theory of failure? How will you find out allowable stress for brittle parts using factor of safety?
   (b) The stresses induced at a critical point in a machine component made of steel45C8 (S_{yt} =380N/mm^2 are as follows. σ_x= 100N/mm^2, σy= 40N/mm^2 τ_{xy} = 80 N/mm^2 calculate the factor of safety by the maximum normal stress theory.

2. (a) What is meant by stress concentration? How do you take it in to consideration in case of a component subjected to dynamic loading?
   (b) A bar of steel has an ultimate tensile strength of 700 MPa, a yield point stress of 400 MPa and fully corrected endurance limit (S_e) of 220 MPa. The bar is subjected to a mean bending stress of 600 MPa and stress amplitude of 80 MPa. Superimposed on it is a mean torsional stress and torsional stress amplitude of 70 and 35 MPa respectively. Find the factor of safety.

3. (a) What is the difference between caulking and fullering? Explain with the help of neat sketches?
   (b)Determine the length of the weld run for a plate of size 120 mm wide and 15 mm thick to be welded to another plate by means of
      1. A single transverse weld and
      2. Double parallel fillet welds when the joint is subjected to variable loads.

4. (a) What are the two methods to make bolt of uniform strength?
   (b) A wall bracket is attached to a wall by means of four identical bolts, two at A and two at B as shown in fig. Assuming that the bracket is held against the wall and prevented from tipping about point C by all four bolts and using an allowable tensile stress in the bolts as 35 N/mm^2. Determine the size of the bolts on the basis of Maximum principal stress theory.



5. (a) How are the keys clssified ? Draw neat sketches of different types of keys and state their applications?
   (b) Two mild steel rods 40 mm diameter are to be connected by a cotter joint. The thickness of the cotter is 12 mm. Calculate the dimensions of the joint,if the maximum permissible stresses are 46 MPa in tension,35 MPa in shear and 70MPa in crushing.

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6. A machine shaft supported on bearings having their centres 750 mm apart,transmitted 185 KW at 600 rpm. A gear of 200 mm and 20^0 tooth profile is located 250 mm to right of left hand bearing and a 450 mm diamter pulley is mounted at 200 mm to right of right hand bearing. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180^0 angle of contact. The pulley weighs 1000 N and tension ratio is 3. Find the diameter of the shaf, if the allowable shear stress of the material is 63 MPa.

7. (a) What is the difference between rigd and flexible couplings?
   (b) Design a sleeve used for connecting two shafts rotating at 300 rpm to transmit 20 KW.The shafts are connected to the sleeve by keys. Take S_s = 40 MN/m^2

8. The free end of a torsional spring deflects through 90^0 when subjected to a torque 4 N-m. The spring index is 6. Determine the coil wire diameter and number of turns with the following data.

   Modulus of rigidity = 80 GPa
   Modulus of elasticity = 200 GPa
   Allowable stress = 500 MPa.

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Code No: R31035 **R10** **Set No: 3**

III B.Tech. I Semester Supplementary Examinations, May 2013

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

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1. (a) Distinguish between unilateral Tolerance and Bilateral tolerance? Which tolerance is preferred and Why?
   (b) The principal stresses induced at a point in a machine component made of steel 50 C4 (S_{yt} =460 N/mm^2 are as follows. σ_1= 200N/mm^2, σ_2= 150N/mm^2 σ_3 = 0. calculate the factor of safety by the maximum shear stress theory.
2. (a) What information do you obtain from Goodman's line?
   (b) A 25 mm diameter shaft is made of forged steel 30 C8 (S_{ut} = 600 N/mm^2). There is a step in the shaft and the theoretical stress concentration factor at the step is 2.1. The notch sensitivity factor is 0.84. Determine the endurance limit of the shaft if it is subjected to a reversed bending moment.
3. (a) What is an eccentric riveted joint? Explain the method adopted for designing such a joint?
   (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 KN-m. The allowable shear stress in the weld is 70 MPa.
4. (a) What are the methods of preventing loosening of threads between the nut and the screw?
   (b) The effective diameter of the cylinder is 400 mm. The maximum pressure of steam acting on the cylinder cover is 1.12 N/mm^2. Find the number and size of studs required to fix the cover. Draw a neat proportional sketch for the elevation of the cylinder cover.
5. (a) What is the effect of keyway cut in to the shaft?
   (b) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.
6. (a) Explain under what circumstances are hollow shafts are preferred over solid shafts.
   (b) A propeller shaft is required to transmit 45 KW power at 500 rpm. It is a hollow shaft, having inside diameter 0.6 times of outside diameter. It is made of plain carbon steel and the permissible shear stress is 84 N/mm^2. Calculate the inside and outside diameters of the shaft.
7. A marine type flange coupling is used to transmit 3.75 MW at 250 rpm. The allowable shear stress in the shaft and bolts may be taken as 50 MPa. Determine the shaft diameter and the diameter of the bolts.
8. Design and draw a valve spring of a petrol engine for the following operating conditions:

Spring load when the valve is open	=	400 N
Spring load when the valve is closed	=	250 N
Maximum inside diameter of spring	=	25 mm
Length of spring when valve is open	=	40 mm
Length of spring when valve is closed	=	50 mm
Maximum permissible shear stress	=	400 MPa.

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Code No: R31035 **R10** **Set No: 4**

III B.Tech. I Semester Supplementary Examinations, May 2013

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) What do you understand by preferred numbers? Explain in detail.
   (b)The load on a bolt consists of an axial pull of 20 KN together with a transverse shear force of 5 KN. Find the diameter of bolt required according to Maximum distortion energy theory.

2. (a)Explain the terms 1) Stress Concentration factor 2) Notch sensitivity
   (b)A leaf spring in an automobile is subjected to cyclic stresses. The average stress = 150 MPa, Variable stress = 500 MPa, Ultimate stress = 630 MPa, Yield stress = 350 MPa, and endurance limit = 150 MPa.Estimate under what factor of safety the spring is working by Goodman's and Soderberg's formula.

3. (a) What are the assumptions made in the design of welded joints
   (b) Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet pitch, strap thickness and efficiency of the joint. Take the working stresses in tension and shearing as 80 MPa and 60 Mpa respectively.

4. (a) What are the methods to make bolts and screws?
   (b) Find the size of 14 bolts required for a C.I steam engine cylinder head. The diameter of the cylinder is 400 mm and the steam pressure is 0.12 N/mm^2. Take the permissible tensile stress is 35 MPa.

5. (a) What is cotter joint? Explain with the help of a neat sketch, how a cotter joint is made?
   (b) A 20 KW, 960 rpm motor has a mild steel shaft of 40 mm diameter and the extension being 75 mm. The permissible shear and crushing stresses for the mild steel key are 50 MPa and 120 MPa. Design the keyway in the motor shaft extension.

6. (a) What are the materials for making transmission shaft?
   (b) A rotating shaft, 40 mm in diameter, is made of steel F_eE580 (S_{yt} = 580 N/mm^2). It is subjected to a steady torsional moment of 250 Nm. Calculate the factor of safety available is based on 1) Maximum principal stress theory; and
   2) Maximum shear stress theory

7. Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90 KW at 250 rpm. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not tom exceed 1^0 in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa.

8. A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4KN 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.

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