Hall Ticket No | | | | | | | | | | | Question Paper Code: AME012

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech V Semester End Examinations (Regular) - November, 2018

Regulation: IARE – R16

DESIGN OF MACHINE MEMBERS

Time: 3 Hours **(ME)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain the basic procedure of machine design. **[7M]**
   (b) Discuss the various mechanical properties of engineering materials. **[7M]**

2. (a) Discuss the various methods for the reduction of the stress concentration. **[7M]**
   (b) A forged steel bar,50 mm in diameter, is subjected to a reversed bending stress of 250 N/mm^2.The bar is made of steel 40C8(s_{ut} =600 N/mm^2).Calculate the life of the bar for a reliability of 90%. Take k_a=0.55, k_b=0.85, k_c=0.897. **[7M]**

UNIT – II

3. (a) Explain basic types of screw fastening. **[7M]**
   (b) A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25mm and 75 mm respectively. If the ultimate stresses are 400 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. **[7M]**

4. (a) List out Advantages and Disadvantages of Welded Joints over Riveted Joints **[7M]**
   (b) A steel plate, 100 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Figure 1. The strength of the welded joint should be equal to the strength of the plates to be joined. The permissible tensile and shear stresses for the weld material and the plates are 70 and 50 N/mm^2 respectively. Find the length of each parallel fillet weld. Assume the tensile force acting on the plates as static. **[7M]**

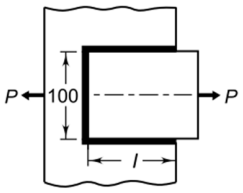

Figure 1

UNIT – III

5. (a) Explain the different types of keys with neat sketches. **[7M]**

   (b) Design the rectangular key for a shaft of 50 mm diameter. The shearing and Crushing stresses for the key material are 42 MPa and 70 MPa. **[7M]**

6. (a) What is Knuckle joint? Write the design procedure for the Knuckle joint. **[7M]**

   (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 :σ_t = 60 MPa ; τ = 70 MPa ; and σ = 125 MPa **[7M]**

UNIT – IV

7. (a) A shaft transmitting a maximum torque of 800 N-m is also subjected to a maximum bending moment of 1050 N-m.The transmission involves moderate shocks.The Permissible shear stress for the shaft material is given as 48 N/mm^2. Determine the diameter of the shaft required for the purpose by using ASME code. **[7M]**

   (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. **[7M]**

8. (a) List out why couplings are used and what are the basic requirements for it. **[7M]**

   (b) Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. **[7M]**

UNIT – V

9. (a) Explain the different types of springs with neat sketches. **[7M]**

   (b) A safety valve of 60 mm diameter is to blow off at a pressure of 1.2 N/mm^2.It is held in its seat by a close coiled helical spring. The maximum lift of the valve is 10 mm. Design a suitable compression spring of spring index 5 and providing an initial compression of 35 mm. The maximum shear stress in the material of the wire is limited to 500 MPa. The modulus of rigidity for the spring material is 80 kN/mm^2. Calculate: **[7M]**

   i.Diameter of the spring wire

   ii.Mean coil diameter

   iii.Number of active turns and

   iv.Pitch of the coil.

   Take Wahl's factor = 4C-1/4C-4+0.615/C, where C is the spring index.

10. (a) Define the terms solid length, spring index, spring rate, free length and pitch of the coil related to helical compression springs. **[7M]**

(b) A helical compression spring of a cam-mechanism is subjected to an initial pre load of 50 N.The maximum operating force during the load cycle is 150 N.The wire diameter is 3 mm, while the mean coil diameter is 18 mm.The spring is made of oil-hardened and tempered valve spring wire of Grade-VW(s_{ut} =1430 N/mm^2).Determine the factor of safety used in the design on the basis of fluctuating stresses. Take s_{se}'=0.22 S_{ut}; S_{sy} = 0.45 S_{ut} **[7M]**

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