Code No: NR310305 **NR**

III B.Tech I Semester Supplementary Examinations, November 2005
DESIGN OF MACHINE ELEMENTS
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) How will you designate
   i. plain carbon steel with 4% carbon and 0.8% manganese,
   ii. Plain carbon steel with a minimum yield strength of 200 N/mm^2 and
   iii. Alloy steel with 0.35-0.45 % carbon and 0.9 - 1.2 % chromium.
   (b) What are the advantages of copper. Discuss important copper alloys? [6+10]

2. (a) Define factor of safety for :
   i. Ductile materials and
   ii. Brittle materials
   (b) Discuss the various stresses and the corresponding deformations that exist in machine components under load. [6+10]

3. (a) Define stress concentration factor.
   (b) A hot rolled shaft is subjected to torsional load that varies from 320 Nm clockwise to 120Nm anti-clockwise and an applied bending moment at a critical section varies from 400Nm to 200Nm. The shaft is of uniform cross section. Determine the required shaft diameter. The material has an ultimate strength of 560MPa and yield strength of 420 MPa. Assume factor of safety to be 2. [4+12]

4. (a) Design the procedure for designing a lozenge joint.
   (b) A triple riveted lap joint with zig-zag riveting is to be designed to connect two plates of 6 mm thickness. Determine the diameter of the rivet, pitch of rivets and distance between the rows of the rivets. Indicate how the joint will fail. Also, find the efficiency of the joint. The permissible stresses are 120 MPa in tension, 100 MPa in shear and 150 MPa in crushing. [6+10]

5. (a) What are the assumptions made in the design of a welded joint?
   (b) A plate 120 mm wide and 15 mm thick is joined with another plate by a single transverse weld and a double parallel fillet weld as shown in Figure1. The maximum tensile and shear stresses are 70 MPa and 56 MPa respectively. Find the length of each parallel fillet weld, if the joint is subjected to both static and fatigue loading. Assume a length of 12.5 mm for starting and stopping of weld run. Take stress concentration factor for transverse weld as 1.5 and for parallel fillet welds as 2.5. [6+10]

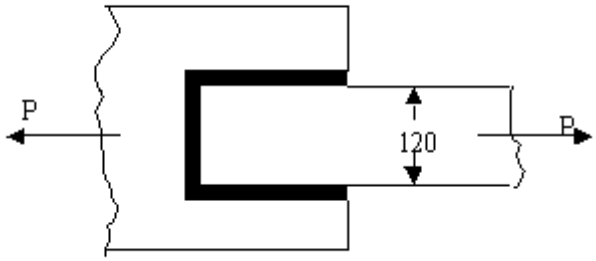

Figure 1:

6. (a) It is required to design a square key for fixing a gear on a shaft of 30 mm diameter; to transmit 20 kW power at 720 RPM. The key is made of 50 C4 steel with f_{yt} =460 Mpa and FOS=3.The yield strength and compressive strength of key material is assumed to be equal. Design the key.

   (b) Design a knuckle joint to withstand a tensile load of 60 kN using steel with the permissible stresses in tension 63 Mpa; in crushing 75 Mpa; in shear 50 Mpa. [6+10]

7. (a) What type of stresses are induced in shafts?

   (b) A solid circular shaft is subjected to a bending moment of 3000N-m and a torque of 10,000N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 700Mpa and a ultimate shear stress of 500Mpa. Assuming a factor of safety as 6, determine the diameter of shaft. [6+10]

8. (a) Describe, with the help of neat sketches, the types of various shaft couplings, mentioning the uses of each type.

   (b) Design a muff coupling to connect two shafts transmitting 40KW at 120rpm. The permissible shear and crushing stress for the shaft ank key material (mild steel) are 30Mpa and 80Mpa respectively. The material of muff is cast Iron with permissible shear stress of 15Mpa. Assume that the maximum torque transmitted is 25 percent greater than mean torque. [6+10]

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