B. Tech.

(SEM. VI) EXAMINATION, 2006-07

MACHINE DESIGN

Time : 3 Hours] [Total Marks : 100

Note : (1) Answer the following questions.
   (2) Assume suitable data, if missing in the problem.

1 Answer any two of the following : 10×2=20
   a. Discuss briefly the general considerations in designing a machine component.
   b. How do you identify the need of a product? How do you formulate the design concepts? Count with a suitable example.
   c. How do you identify the human and aesthetic aspects in the design of a product? Explain with suitable example.

2 Answer any two of the following : 10×2=20
   a. Differentiate between ‘strength design’ and stiffness design.
      A mild steel bracket shown in Fig.1 is subjected to a pull of 6 kN acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find

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the cross sectional dimension of the bracket, if
the permissible stress in the material of the
bracket is limited to 50 MPa.

![Diagram of bracket]

**Fig. 1**

b. How do you prevent stress concentration?
How is it considered in the design of machine
components under the variable loading? A flat
plate of width 60 mm has a central hole of 10
mm diameter. This plate is subjected to an axial
load of 10 kN (tensile). Determine the thickness
of plate. Take $f_{yp} = 300$ MPa, factor of
safety = 2.5 and $K_t = 2.55$

c. A hot rolled steel shaft is subjected to a
tensional load that varies from $-100$ Nm to
$+400$ Nm. Determine the diameter of rod using
a factor of safety 1.75 for the maternal of rod,
take $f_{yp} = 315$ MN/m$^2$; $F_{ut} = 490$ MN/m$^2$
$f_c = 82$ MPa (in shear)

3 Attempt any **two** of the following : 10×2=20
a. Enumerate the most commonly used engineering
materials and state at least one important property
and one application of each.
b. Why are metals in their pure form unsuitable for industrial use? State the alloying elements added to steel to get alloy steels and the effect they produce. Give at least one example of each.

c. Write notes on any two of the following:
   1. Powdered materials
   2. Composite materials
   3. Ceramics.

4 Attempt any two of the following:  

   a. A pulley of 0.9 m diameter revolving at 250 rpm is to transmit 10 kW. Find the width of the leather belt if the maximum tension is not to exceed 145 N in 10 mm width. The tension in the tight side is twice that in the slack side. Determine the diameter of the shaft and the dimension of the various parts of the pulley, assuming it to have six arms. Maximum shear stress is not to exceed 63 MPa.

   b. How do you classify the joints in engineering? A double riveted lap joint is to be made between 9.5 mm plates. If the safe working stresses are $f_l = 80$ N/mm$^2$, $F_S = 60$ N/mm$^2$ and $f_c = 1.5$ ft. Calculate the rivet pitch and distance between rows of rivets for the joint. State how the joint will fail.

   c. How are the keys classified? Draw neat sketches of different types of keys and state their applications.
5. Attempt any two of the following:

a. What are the important points to be considered while designing a pressure vessel?

   A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of $5 \text{N/mm}^2$. Calculate the tangential and radial stress at the inner, middle and outer surface.

b. Explain the procedure for design of a circular flanged pipe joint.

   A cast iron pipe is to deliver water at the rate of 125 m$^3$/min. with a velocity of 0.6 m/sm. The maximum pressure in the pipe is 1N/mm$^2$. The allowable stresses in the cast iron is 20 N/mm$^2$. Determine the pipe diameter and the wall thickness. Take corrosion and wear allowance = 9 mm.

c. What are the advantages of computer aided design over the conventional design? Discuss various functions of computer in the design of machine components.