Printed Pages—3   **TME502**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4075 | **Roll No.** | | | | | | | | | | |

B. Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2010-11

MACHINE DESIGN—I

Time : 3 Hours   *Total Marks : 100*

Note :— (1) Attempt **all** questions.

　　　　(2) Assume any missing data suitably.

　　　　(3) Use of design data book is permitted.

1. Attempt any **four** parts of the following :   **(5×4=20)**

　(a) List out the factors to be considered for material selection.

　(b) Discuss the effect of silicon, manganese, sulphur and phosphorous on cast iron.

　(c) Write a short note on copper and its alloys.

　(d) What is fatigue failure of a material ? Explain the mechanism of such failures.

　(e) Discuss the need for standardization in machine design.

　(f) Differentiate between clearance fit, interference fit and transition fit.

2. Attempt any **two** parts of the following :   **(10×2=20)**

　(a) Explain various properties of a ductile material with the help of stress-strain curve. What is working stress and how is it calculated from ultimate stress or yield stress ?

(b) Define maximum shear stress theory. A cylindrical shaft made of steel having yield strength 600 MPa is subjected to static load consisting of bending moment 10 kN-m and a torsional moment of 30 kN-m. Assuming a factor of safety of 2, find the required diameter of shaft using maximum shear stress theory. Take $E = 210$ GPa and Poisson's ratio $= 0.25$.

(c) A shaft is subjected to a bending moment varying from -200 N-m to $+500$ N-m and a twisting moment varying from 50 N-m to 175 N-m. If material is 30C8, stress concentration factor is 1.85, notch sensitivity is 0.95 and factor of safety is 1.5, find the diameter of shaft.

3. Attempt any **two** parts of the following.   **(10×2=20)**

(a) Determine the length of weld required to weld two plates of size 120 mm wide and 15 mm thick by means of (a) a single transverse weld and (b) double parallel fillet welds when the joint is subjected to variable loads.

(b) A steam engine cylinder of effective diameter of 300 mm is subjected to a stream pressure of 1.5 N/mm². The cylinder head is connected by means of 8 bolts having yield points stress of 330 MPa and endurance limit of 240 MPa. The bolts are tightened with a preload of 1.5 times that of steam load. A soft copper gasket is used to make the joint leak proof. Assuming a stress concentration factor of 2.8 and a factor of safety of 2, determine the size of bolts.

(c) Why the initial tightening of bolts essential ? How does it improve the fatigue strength of bolted joint ? Also explain the different kinds of induced stresses in bolts.

4. Attempt any **two** parts of the following.   (10×2=20)

(a) A sluice gate weighing 600 kN is raised and lowered by means of two square threaded screws. The coefficient of friction between the thrust collar and screw is 0.003 and that between the screw and nut is 0.05. Design the screw and nut.

(b) Design a closed coil helical compression spring which when put to a load of 400 N may deflect 80 mm. The diameter of each coil is 10 times that of wire of the spring and the maximum shear stress not to exceed 55 MPa. G = 84 GPa. Also find what suddenly applied load will elongate the spring by 30 mm.

(c) A hollow steel shaft required to replace a solid wrought iron shaft of the same diameter. The stress that the steel can bear is 30% more than that of the iron. Find the internal diameter and saving in weight.

5. Attempt any **four** parts of the following :—   (5×4=20)

(a) Explain design by innovation using a suitable example.

(b) What are the role of morphological charts in product development ?

(c) Explain the product consumption cycle and its various stages.

(d) Discuss the key features of divergent phase of product design.

(e) Explain the process of brain storming. What is the role of brain storming in new product development ?

(f) Discuss the timeline of the development of bicycle.