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

PAPER ID : 2101 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) THEORY EXAMINATION 2011-12

MACHINE DESIGN—I

Time : 2 Hours *Total Marks : 50*

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

(ii) Assume any missing data suitably.

(iii) Use of design data book is permitted.

1. Attempt any **four** parts of the following : **(3.5×4=14)**

(a) What is preferred numbers ? How will you find the numbers belonging to R10 series ?

(b) Discuss the distortion energy theory of material failure. What are its key advantages ?

(c) Discuss the factors that govern the selection of material in machine design.

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

(e) Discuss the advantages of standards in machine design.

(f) Designate the following materials :

(i) Grey cast iron with ultimate tensile strength of 300 N/mm^2.

(ii) Plain carbon steel with 0.4% carbon and 0.8% manganese.

(iii) Alloy steel having carbon 0.35% to 0.45%, chromium 0.90% to 1.20%.

2. Attempt any **two** parts of the following : **(6×2=12)**

(a) A cantilever beam is subjected a bending load of 6 kN at its free end. If the length of cantilever beam is 350 mm and yield stress for the beam material is 350 MPa. Determine the dimension of the most economical cross section between a circular cross section of diameter d and a rectangular cross section of size h × t. Take factor of safety as 3.

(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 double riveted lap joint is made out of 16 mm thick plate, find the maximum force per pitch length which will rupture the joint assuming the following ultimate stresses : σ_t = 400 MPa, σ_s = 320 MPa and σ_c = 640 MPa. What would be the actual stresses developed in the joint if a factor of safety 4 is used ?

3. Attempt any **two** parts of the following : **(6×2=12)**

(a) 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.

(b) Design a flange type coupling to transmit 25 kW at 150 rpm. The allowable shear stresses for shaft, bolt and key are 42 MPa. Assume maximum torque to be 25% greater than the full load torque. Find the maximum bearing stress between the bolt and the flange.

(c) Give the classification of keys. Also, explain the effect of key way on the strength of the shaft.

4. Attempt any **one** part of the following : **(12×1=12)**

(a) A triple start square threaded screw is used to raise a load of 50 kN. The screw has a nominal diameter of 50 mm

and pitch is 8 mm. Height of the nut is 40 mm and coefficient of friction between screw and nut is 0.25. Assuming no collar friction find the maximum stress induced in the screw and nut thread and the bearing pressure between screw and nut.

(b) The blow off pressure for a safety valve is 1.5 MPa with the maximum lift of the valve as 14 mm. The valve diameter 75 mm is loaded with spring index of 5.5 and an initial compression of 40 mm. Maximum permissible shear stress for the spring material is 500 MPa and G = 80 GPa. Design the spring.