ME-501 **Roll No.** | | | | | | | | | | |

B. Tech.
(SEM V) ODD SEMESTER EXAMINATION 2015-16
MACHINE DESIGN - I

Time: 2 Hours **Maximum Marks: 50**

Notes: ***(i) Attempt all questions.***
(ii) Assume any missing data suitably.
(iii) Use of design data book is permitted.

Q1. Attempt ***any four*** parts of the following. (3X4=12)

(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.

Q2. Attempt ***any two*** parts of the following. (6X2=12)

(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 400 MPa is subjected to static load consisting of bending moment 10 kN-m and a torsional moment of 22 kN-m. Assuming a factor of safety of 2, find the required diameter of shaft using maximum shear stress theory. Take E = 200 GPa and Poisson's ratio = 0.3.
(c) A shaft is subjected to a bending moment varying from -300 N-m to +400 N-m and a twisting moment varying from 75 N-m to 150 N-m. If material is 30C8, stress concentration factor is 1.80, notch sensitivity is 0.90 and factor of safety is 1.5, find the diameter of shaft.

Q3. Attempt ***any two*** parts of the following. (6X2=12)

a) A mild steel shaft transmits 25 kW at 200 rpm. It carries a central load of 1000N and is simply supported between the bearings 3 m apart. Determine the size of the shaft, if it is subjected to gradually applied load. The allowable shear stress is 45 MPa and the maximum tensile and compressive stress is not to exceed 60 MPa.
b) Design a split muff coupling to transmit 50 kW power at 180 rpm. The shafts, keys and the clamping bolts have yield strength of 500 MPa. The yield strength in compression is 1.5 times that in tension. Assuming 8 bolts and factor of safety of 5, design the coupling. The split muff is

made of cast iron and has permissible shear strength of 15 MPa. The coefficient of friction between the shaft and the hub can be taken as 0.3.

c) Explain the effect of keyway on the strength of a shaft. Design the rectangular key for a shaft of 60 mm diameter. The allowable shearing and crushing stress for key material are 40 MPa and 65 MPa respectively.

Q4. Attempt ***any one*** parts of the following. (14X1=14)

a) A steam valve of 250 mm diameter has a pressure of 23 bar acting on it. It is closed by means of a square threaded screw of 45 mm diameter and 6 mm pitch. Determine the torque exerted on the handle of the valve if the coefficient of friction in the thread is 0.15.

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 what suddenly applied load will elongate the spring by 30 mm.