Exam.Code:0941
Sub. Code: 33862

2076

B.E. (Mechanical Engineering)

Fifth Semester

MEC-501: Design of Machine Elements - I

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.***

x-x-x

Q1. (a) Define notch sensitivity and stress concentration. 2*5=10

(b) What do you understand by torsional rigidity and lateral rigidity?

(c) Why are stresses in welded joints so difficult to obtain?

(d) What is bolt of uniform strength?

(e) List few advantages of threaded joints.

Part A

Q2. (a) A thin wall cylindrical pressure vessel of mean diameter of 60 mm is subjected to internal pressure varying from 0 to 40 MPa. Find the required thickness of the pressure vessel based on yield point of 400 MPa, endurance limit of 22 MPa, and a factor of safety of 3. Use Soderberg criterion of failure. 5

(b) A triple riveted lap joint is to be made between 7 mm plates. If the safe working stresses in tension, shear and crushing are 84 MPa, 60 MPa and 120 MPa respectively, calculate the rivet diameter, rivet pitch and distance between rows of rivets for the joint. Zig-zag riveting is to be used. 5

Q3. Design a cotter joint for socket and spigot type to sustain an axial load of 125 kN. The material selected for the joint has the following design stresses: Allowable stresses in tension = 100 MPa, allowable stresses in crushing =170 MPa, allowable stresses in shear =75 MPa. 10

Q4. A bell crank lever is to be designed to raise a load of 5 kN at the short arm end. The arm lengths are 150mm & 500mm. The permissible stress for lever & pin material in shear & tension are 60 N/mm² & 90 N/mm² respectively. The bearing pressure on the pin is to be limited to 12 N/mm². Assume the lever cross-section as t x 4t and fulcrum pin length as 1.25d, where d is pin diameter. 10

Part B

Q5. (a) Select a rectangular sunk key to transmit 9 kW at 300 rpm. The yield stress for the steel used is 300 MPa. Take factor of safety as 2.5. 5

(b) Design a muff coupling to connect two shafts transmitting 25 kW of power at 360 rpm. The shafts and key are made of material having allowable shear and crushing stress as 40 MPa and 80 MPa respectively. The sleeve is made of grey cast iron having ultimate strength of 200 N/mm². Take factor of safety for sleeve as 6. 5

Q6. (a) A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10000 N-m. The shaft is made of 45 C8 steel having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft. 5

(b) Explain in detail the condition for self locking of a power screw. 5

Q7. Design an oval flanged pipe joint for pipe having internal diameter 45 mm. It is subjected to an internal fluid pressure of 7.5 N/mm^2. The maximum tensile stress in the pipe material is not to exceed 25 MPa and in bolts 55 MPa. 10

x-x-x