2124
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 Section. All questions carry equal marks.

x-x-x

1. a) What are the various phases of the Design Process.

   b) What is meant by the term Mechanical Advantage in the case of Levers.

   c) What are permanent joints. Give their examples.

   d) What is Coupling. Where do you use it.

   e) Why are square threads preferable to V-threads for power transmission.

Section – A (10 marks each)

2. (a) A plate **100 mm** wide and **10 mm** thick is to be welded with another plate by means of transverse welds at the ends. If the plates are subjected to a load of **70 kN**, find the size of the weld for static as well as fatigue load. The permissible tensile stress should not exceed 70 **MPa.**

   (b) Sketch and discuss the various types of Welded Joints used in pressure vessels. What are the considerations involved. (5,5)

3. Design a Foot Brake Lever from the data given as:

   Length of the lever from the centre of gravity of the spindle to the point of application of load

   = 1 metre

   Maximum load on the Foot Plate = **800 N**

   Overhang from the nearest bearing = **100 mm**

   Permissible tensile and shear stress = **70 MPa.**

4. It is required to design a Knuckle Joint to connect two circular rods subjected to an axial tensile force of **50 kN**. The rods are co-axial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. Assume the working stresses for both the pin and rod material as **80 N/mm²** in tension, **40 N/mm²** in shear and **80 N/mm²** in crushing

Section – B (10 marks each)

5. Design and make a neat, dimensioned sketch of a muff coupling (sleeve coupling) which is used to connect two steel shafts transmitting **25 kW** power at **360 rpm**. The shafts and keys are made of plain carbon steel 30C8 (yield stress: **400 MPa**). The sleeve is made of grey cast iron FG200 (ultimate stress: **200 MPa**). The factor of safety for the shaft and key is 4. For the sleeve, the factor of safety is **6** based on ultimate strength. For Shaft and Key, the allowable tensile stress and compressive stress can be taken as **100 Mpa** and allowable shear stress can be taken as **50 Mpa**. For Sleeve, the allowable shear stress can be taken as **16.67 MPa**.

6. Design an oval flanged joint for a pipe of **60 mm** bore. It is subjected to a fluid pressure of **10 MPa**. The allowable strength of the pipe and flange is **20 N/mm²** and that for the bolt is **60 N/mm²**. Assume width of packing as **15 mm**. Also, sketch the oval flanged pipe joint.

7. (a) Find the diameter of a solid steel shaft to transmit **20 kW** at **200 r.p.m.** The ultimate shear stress for the steel may be taken as **360 MPa** and a factor of safety as **8**. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is **0.5**.

(b) Show that if the Power Screw is to be Self-Locking, its efficiency can never be more than **50 %**.

(6,4)

x-x-x