

**SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR**

**ROLL NO:**

--	--	--	--	--	--	--	--	--	--	--	--	--

Total number of pages: [2]

Total number of questions: 06

**B. Tech. -ME/ 5<sup>th</sup> Sem**

**Design of Machine Elements - I**

**Subject Code: BTME-502A**

Paper ID: .....

Time allowed: 3 Hrs

Max Marks: 60

**Important Instructions:**

- All questions are compulsory
- Design Data book is allowed in the examination.

**PART A (2×10)**

Q. 1. Answer in brief:

- (a) What is Endurance Limit?
- (b) What do you mean by Ergonomic and Aesthetics in design?
- (c) What is the purpose of keys?
- (d) What do you mean by critical speed of shaft??
- (e) What is caulking & fullering in riveted joint?
- (f) Classify the pipe joints.
- (g) What are splines? What is their use?
- (h) Differentiate between flexible and rigid coupling?
- (i) Why levers are usually tapered?
- (j) Show the distribution of stresses in pipes with the help of neat sketch.

**PART B (5×8)**

Q. 2. It is required to design a Knuckle joint to connect two circular rods subjected to an axial tensile force of 30 kN. Design the joint if the permissible stresses are:

$$\sigma_t = 55 \text{ MPa}; \tau = 40 \text{ MPa and } \sigma_c = 70 \text{ MPa}$$

OR

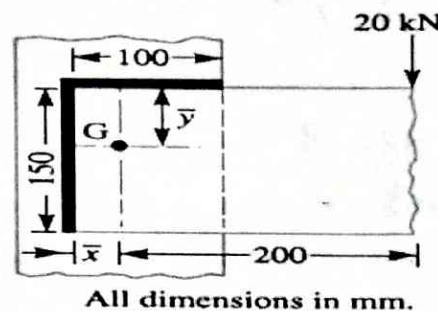
Explain the factors to be considered for selection of material for design of components.

CO1

Q. 3. A steam boiler is to be designed for a working pressure of  $2.5 \text{ N/mm}^2$  with its inside diameter 1.7 m. Give the design calculations for the longitudinal and circumferential joints for the following working stresses for steel plates and rivets : In tension = 75 MPa ; In shear = 60 MPa; In crushing = 120 MPa.

OR

A bracket, as shown in Figure 1, carries a load of 20 kN. Find the size of the weld if the allowable shear stress is not to exceed 90 MPa.



CO2

- Q. 4. Design a shaft to transmit power from an electric motor to a lathe through a pulley by means of a belt drive. The pulley weighs 200 N is overhung from the shaft, the distance of the centre of pulley from the centre of bearing being 300 mm. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 125 r.p.m. Take coefficient of friction between the belt and the pulley 0.25.

OR

A shaft is transmitting 100 kW at 180 rpm. If the allowable shear stress in the material is 60 MPa. Find the suitable diameter for the shaft. The shaft is not to twist more than  $1^\circ$  in a length of 3 m. Take  $C = 85 \text{ GPa}$ .

CO3

- Q. 5. Design a clamp coupling to transmit 30 kW at 110 r.p.m. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3.

OR

Design a square flanged pipe joint for pipes of internal diameter 50 mm subjected to an internal fluid pressure of 7 N/mm<sup>2</sup>. The maximum tensile stress in the pipe material is not to exceed 21 MPa and in the bolts 28 MPa.

CO4

- Q. 6. Explain the detailed procedure for designing a foot lever.

OR

A lever safety valve is 70 mm in diameter and is to be designed for a boiler to blow-off at pressure of 1 N/mm<sup>2</sup> gauge. Design a suitable mild steel lever of rectangular cross-section using the following permissible stresses : Tensile stress = 70 MPa; Shear stress = 50 MPa; Bearing pressure intensity = 25 N/mm<sup>2</sup>.

The pin is also made of mild steel. The distance from the fulcrum to the weight of the lever is 880 mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 80 mm.

CO5