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Total No. of Pages : 02

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**B.Tech. (ME) (Sem-5)**  
**DESIGN OF MACHINE ELEMENTS-I**

Subject Code : BTME-501

M.Code : 70602

Date of Examination : 16-06-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. Attempt FOUR questions from SECTION-B, Each question carries 10 marks

**SECTION-A**

**1. Answer briefly :**

- a) What is the difference between product design and machine design?
- b) Discuss the importance of safety in machine design.
- c) Define endurance strength.
- d) What is the significance of fatigue strength?
- e) Write the key objectives of concurrent engineering.
- f) What is the role of rivet spacing in joint design?
- g) How does lubrication impact shaft and axle performance?
- h) What is the role of keys in power transmission?
- i) Distinguish between lever and link.
- j) What is the role of gaskets and seals in pipe joint design?

**SECTION-B**

2. Discuss the role of creativity and innovation in the design process for machine elements. How can designers think outside the box to create unique and effective solutions?

3. A low carbon steel plate of 0.7 m width welded to a structure of similar material by means of two parallel fillet welds of 0.112 m length (each) is subjected to an eccentric load of 4000 N, the line of action of which has a distance of 1.5 m from the centre of gravity of the weld group. Design the required thickness of the plate when the allowable stress of the weld metal is 62 MPa and that of the plate is 42 MPa.
4. Define factor of safety and its importance in engineering design. Discuss, how can designers determine the appropriate factor of safety for different loading conditions, such as static, dynamic and impact loads?
5. Determine the diameter of hollow shaft having inside diameter 0.5 times the outside diameter. The permissible shear stress is limited to 200 MPa. The shaft carries a 900 mm diameter cast iron pulley. This pulley is driven by another pulley mounted on the shaft placed below it. The belt ends are parallel and vertical. The ratio of tensions in the belt is 3. The pulley on the hollow shaft weighs 800 N and overhangs the nearest bearing by 250 mm. The pulley is to transmit 35 kW at 400 r.p.m.
6. Design a compression coupling for a shaft to transmit 1300 N-m. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are 4. The permissible tensile stress for the bolt's material is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3.
7. A foot lever is 1 m from the centre of shaft to the point of application of 910 N load. Find: (a) Diameter of the shaft, (b) Dimensions of the key, and (c) Dimensions of rectangular arm of the foot lever at 60 mm from the centre of shaft assuming width of the arm as 3 times thickness. The allowable tensile stress may be taken as 77 MPa and allowable shear stress as 68 MPa.

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**