Roll No. ....   Total No. of Pages : 03

Total No. of Questions : 09

B.Tech (AE) (Sem.–5)
AUTOMOTIVE DESIGN-1
Subject Code : AE-301
Paper ID : [A0713]

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTION TO CANDIDATES :
1. **SECTION-A is COMPULSORY.**
2. **Attempt any FOUR questions from SECTION-B.**
3. **Attempt any TWO questions from SECTION-C.**

SECTION-A   **(10 × 2 = 20 Marks)**

1. (a) What is a brittle material? Give its examples.

   (b) What are upper and lower deviations?

   (c) What is a cone clutch?

   (d) Explain maximum shear theory of failure.

   (e) Sketch parallel and transverse welds.

   (f) What are the advantages of a flange coupling?

   (g) Explain crushing failure of plate or rivet.

   (h) What is caulking and fullering? Differentiate between the two.

   (i) Draw and label stress-strain curve for a ductile material,

   (j) Explain what collar friction torque is and how it can be reduced?

SECTION-B   **(4 × 5 = 20 Marks)**

2. What are the basic requirements for design of machine element?

3. A journal of nominal or basic size of 75 mm runs in a bearing with close running fit. Find the limits of shaft and bearing. What is the maximum and minimum clearance?

4. A cast iron bracket fixed to steel structure by means of four bolts is shown in Fig 2. Determine the size of bolts if maximum permissible tensile stress in bolt is 50N/mm². Given that P= 25kN, l_1 50mm, l_2= 200mm, 1= 400mm

Fig
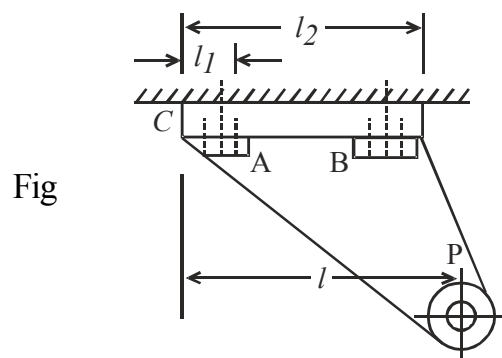
5. It is required to design a muff coupling to connect two shafts transmitting 30 kW at 110 rpm. The permissible shear and crushing stress for the shaft and key material are 40 MPa and 70 MPa respectively. The material of muff is cast iron with permissible shear stress of 18 MPa. Assume that the maximum torque transmitted is 25 percent greater than mean torque.

6. State maximum shear stress theory of failure.

SECTION-C   **(2 × 10 = 20 Marks)**

7. Two plates each 15mm thick and carrying an axial load of 175kN are connected by means of double strap butt joint as shown in figure below. Assume that rivets in double shear are 1.875 times stronger than in single shear. The permissible stresses for rivets and plates in tension, shear and compression are 80, 60, and 120 MPa respectively. Calculate

   (i) Diameter of rivets

   (ii) Width of the plate.

   (iii) Efficiency of joint.

15 ⌐   ⌐15
P = 175 kN ←   → P = 175 kN

                        A B C

W

                        A B C
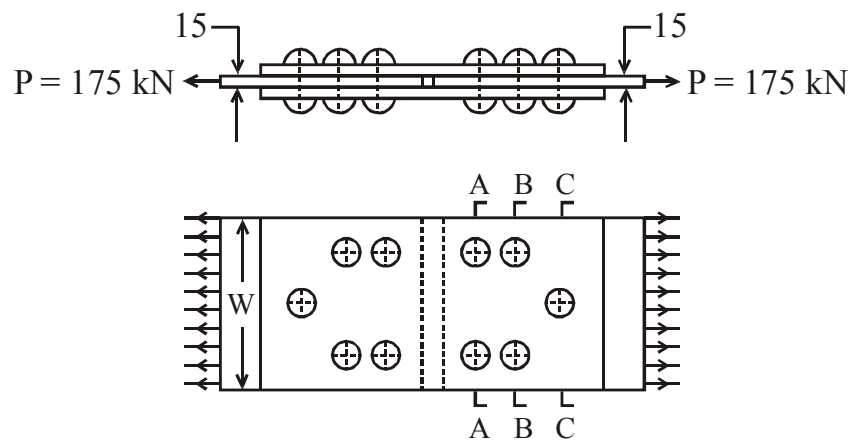
8. A multiple disk clutch, steel on bronze is to transmit 4kW at 750 r.p.m.
    The inner radius of contact is 40 mm and the outer radius is 70 mm. The
    clutch operates in oil with an expected coefficient of friction 0.10 and the
    average allowable pressure for operation is 350 kN/m^2.

    (a) How many total disks of steel and bronze are required?

    (b) What is average pressure?

    (c) What axial force is required?

9. The lead screw of a lathe has single start ISO metric trapezoidal threads
    of 52 mm nominal diameter and 8mm pitch. The screw is required to
    exert an axial force of 2kN in order to drive tool carriage during turning
    operation. The thrust is carried on a collar of 100mm outer diameter and
    60mm inner diameter. The values of coefficient of friction at the screw
    threads and the collar are 0.15 and 0.12 respectively. The lead screw
    rotates at 30rpm. Calculate

    (i) The power required to drive the lead screw.

    (ii) Calculate induced stresses in screw and nut.

    (iii) Efficiency of the screw.