EX/PROD/T/315/2019

B.PRODUCTION ENGINEERING EXAMINATION, 2019

(3rd Year, 1st Semester)

DESIGN OF ENGINEERING SYSTEM-I

Time: 3rs. **Full marks: 100**

(Attempt any one from (a),(b) and (c) in Question-1)

1. (a) **What factors** a design engineer should consider while **designing product**? (10)
   (b) Explain the importance of **ergomomics** and **aesthetics** in product design. (10)
   (c) How **design engineer** plays an important role in keeping the **cost of the product as low? (10)**

(Attempt any one from (a),(b) and (c) in Question-2.)

2. (a) **Derive** an expression with **neat sketches** for the **maximum load** in a bolt when a bracket with circular base is bolted to a wall by means of **4-bolts**. (10)

   (b) **Describe** with neat **sketches** the procedure for designing a **Lozenge joint/ Economical joint**. (10)

   (c) What is an **eccentric loaded welded joint**? **Discuss** the procedure for Designing such a joint. (10)

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(Attempt any one from (a) and (b) in Question-3.)

3. (a) **Design** and **draw a Proctective** type of cast iron flange coupling for a steel Shaft transmitting **15kW at 200rpm** and having an allowable shear stress(τs)= **40N/mm^2.** The working stress in the bolts should not exceed(τb)=**30N/mm^2**. Assume that the same material is used for shaft and key and the crushing stress is twice the value of its shear stress. The maximum torque is **25%** more than the full load torque. Given (τ)**cast iron=14N/mm^2.** (20+10=30)

(b) A solid transmission shaft is supported by two bearings placed **1000mm** apart. A pulley **ϕ600mm** is mounted at a distance of **300mm** to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of **2250N**. Another pulley **ϕ400mm** is placed **200mm** to the left of right hand bearing and it driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is **180°** and **μ=0.24**.

Given : **σb=63N/mm^2,(τ)shaft = 42N/mm^2,**

Draw: (i) **space diagrams; (ii) torque diagram; (iii) vertical and horizontal load load diagrams; (iv) B.M.Ds (v) resultant B.M.D.;**

design the transmission shaft. (15+ 5X3=30)

(Attempt 50marks from (a),(b),(c) and (d) in Question-4.)

4. (a) Design a cotter joint to connect two steel rods of equal diameter. Each rod Is subjected to an axial tensile force of **55kN. Design the joint** and **draw the diamensional sketches.** (18+12=30)

(b) An offset bracket cross-section **250mm^2**, having arm of I-cross-section is fixed to a vertical steel column by means of 4-standard bolts as shown in **FIGURE-1.** an inclined pull of **10kN** is acting on the bracket at an angle of 60° to the vertical. Given: **σt = 100N/mm^2, τ=60N/mm^2;** dimension of the arms cross-section: **width:thickness= 3:1; bolt distance=175mm.**

For coarse series(dc in mm):	**6.466**	**8.160**	**9.858**	**11.545**
Designation :	**M8**	**M10**	**M14**	**M16**

Draw the **view at sectionAA** and **calculates:**

(i) **the size of the fixing bolits;**

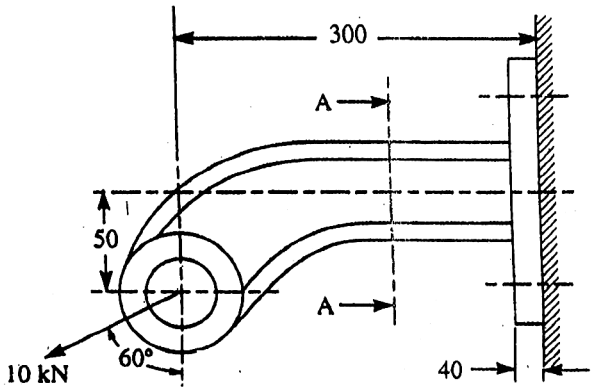
(ii) **size of the bracket.** (5+7+8=20)

(c) An eccentrically loaded lap riveted joint is to be designed for a steel bracket as shown in **FIGURE-2**. The bracket plate is **25mm thick**, load on the bracket **P=50kN** load arm **e= 400mm**, rivets spacing **C= 100mm**, all the rivets are to be of same size. Given permissible shear stress(τ)=**65N/mm^2**, crushing stress (σc)= **120N/mm^2.**

Draw the **force diagram** and **determine** the **size of the rivets** to be used for the joint. (8+12=20)

(d) (i) A welded connection, as shown in **FIGURE-3**, is subjected to an eccentric load of **7.5kN**. The permissible shear stress for the weld is **100N/mm^2**. Assume static condition. Determine the **size of the welds**. (15)

(iii)A plate, **75mm wide** and **10mm thick**, is joined with another steel plate by means of **single transverse** and **double parallel fillet** welds, as shown in **FIGURE-4**. The joint is subjected to a **maximum tensile force of 55kN**. The **permissible tensile** and **shear stresses** in the weld material are **70** and **50N/mm^2,** respectively. **Determine** the **required length** of each parallel fillet weld. (15)



All dimensions in mm.

FIGURE- 1.

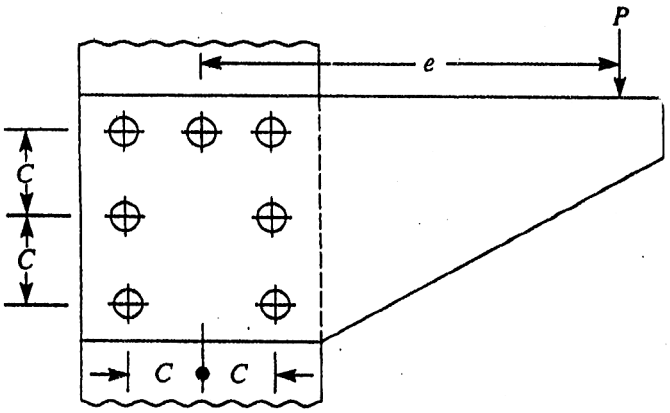


FIGURE- 2.

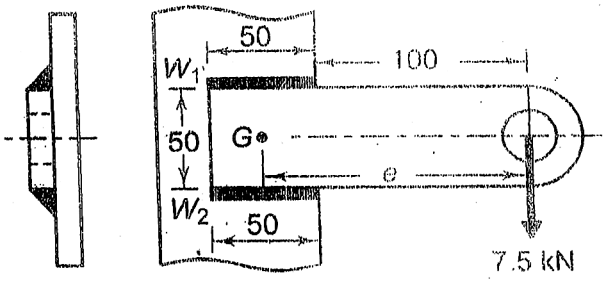


FIGURE- 3.

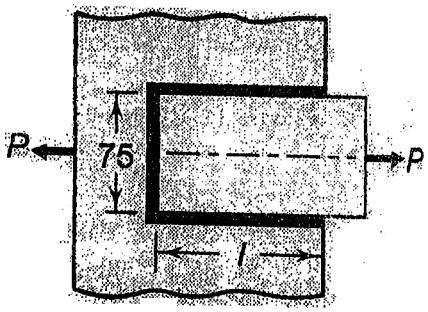


FIGURE- 4.