4E4143

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B. Tech. IV Sem. (Main/Back) Exam., June/July-2014
Mechanical Engg.
4ME4 Design of Machine Elements-I
Common with AE & PI

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 24

Instructions to Candidates:-

Attempt any *five questions*, selecting *one question* from *each unit*. All Questions carry *equal* marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1._____   2._____

UNIT-I

Q.1. (a) Discuss factors influencing the selection of materials. [4]

(b) Explain the following:

(i) Standardization

(ii) Inter changeability [6]

(c) A hole is dimensioned as $25^{\pm 0.03}$ mm and the shaft is dimensioned as $25^{+0.00}_{-0.02}$ mm. What type of fit will be established? Determine the hole tolerance, shaft tolerance and the maximum & minimum allowable of the fit. [6]

Q.1. (a) Discuss BIS system of designation plain carbon steel and alloy steel giving suitable examples. [4]

(b) Write note on the following:

(i) Ergonomic Considerations in Design

(ii) Design for Casting

(iii) Hole basis system and shaft basis system of tolerance. [12]

UNIT-II

Q.2. (a) What are the causes of stress concentration? Give suitable diagrams. [6]

(b) Explain the stages of fatigue failure. [4]

(c) Give the design equation to calculate the following dimensions of the knuckle joint subjected to load P.

(i) Pin diameter (d_1)

(ii) Thickness of eye-end (t_1)

(iii) Outer diameter of eye-end (d_2) [6]

OR

Q.2. Design a spigot and socket type cotter joint for axial load of 75kN which alternately changes from tensile to compressive. The allowable stresses for the material used are 50MPa in tensions, 40MPa in shear and 100 MPa in crushing. [16]

UNIT-III

Q.3. One arm of the bell crank lever is 500 mm long and other is 150mm long. A load of 5kN is to be raised acting on a pin at the end of 500 mm arm and the effort is applied at the end of 150mm arm. Lever is made of steel forging, turning at the fulcrum point. For pin and lever the permissible stress is 85 MPa is tension and 70 MPa in shear. Bearing pressure on the pin is not to exceed $10N/mm^2$. Design the lever completely.

[16]

OR

Q.3. A locomotive spring has an overall length of 1.1m and sustains a load of 75kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a Central band of 100mm wide. All leaves are to be stressed to 420N/mm^2 when fully loaded. The ratio of the spring depth to width is to be approximately 2. Take E=210 GPa. & P_b= 10N/mm^2

(a) Determine the width and thickness of leaves.

(b) Determine the Nip

(c) What load is exerted on the band after spring is assembled?

(d) Eye diameter, using bearing consideration only

(e) Maximum deflection. [16]

UNIT-IV

Q.4. A solid steel shaft 1200 mm long is required to transmit 18kw at 600 rpm. A gear 180mm diameter is keyed to the shaft at 300mm to the left of the right hand bearing and driven by another gear from the behind. Another gear of 300 mm dia weighing 500N is mounted on the shaft at 200 mm to the right of the left bearing drives a gear placed directly above it. Pressure angle for both the gear is 20°. The allowable shear stress for shaft material is 70MPa. Determine diameter of the shaft. [16]

OR

Q.4. Design a protected type CI flange coupling to transmit 9kw at 1500rpm. The maximum torque to be transmitted is 20% greater than mean torque. Allowable shear stress for shaft, bolts and keys is 70 MPa and allowable crushing stress for key is 150MPa. The allowable shear stress for CI flange is 15 MPa. [16]

UNIT-V

Q.5. A bracket is fixed to column by means of five bolts as shown in Figure 1 to carry a load of 15 kN. Calculated diameter of the bolts required if the allowable shear stress for bolt material is 60MPa. [16]
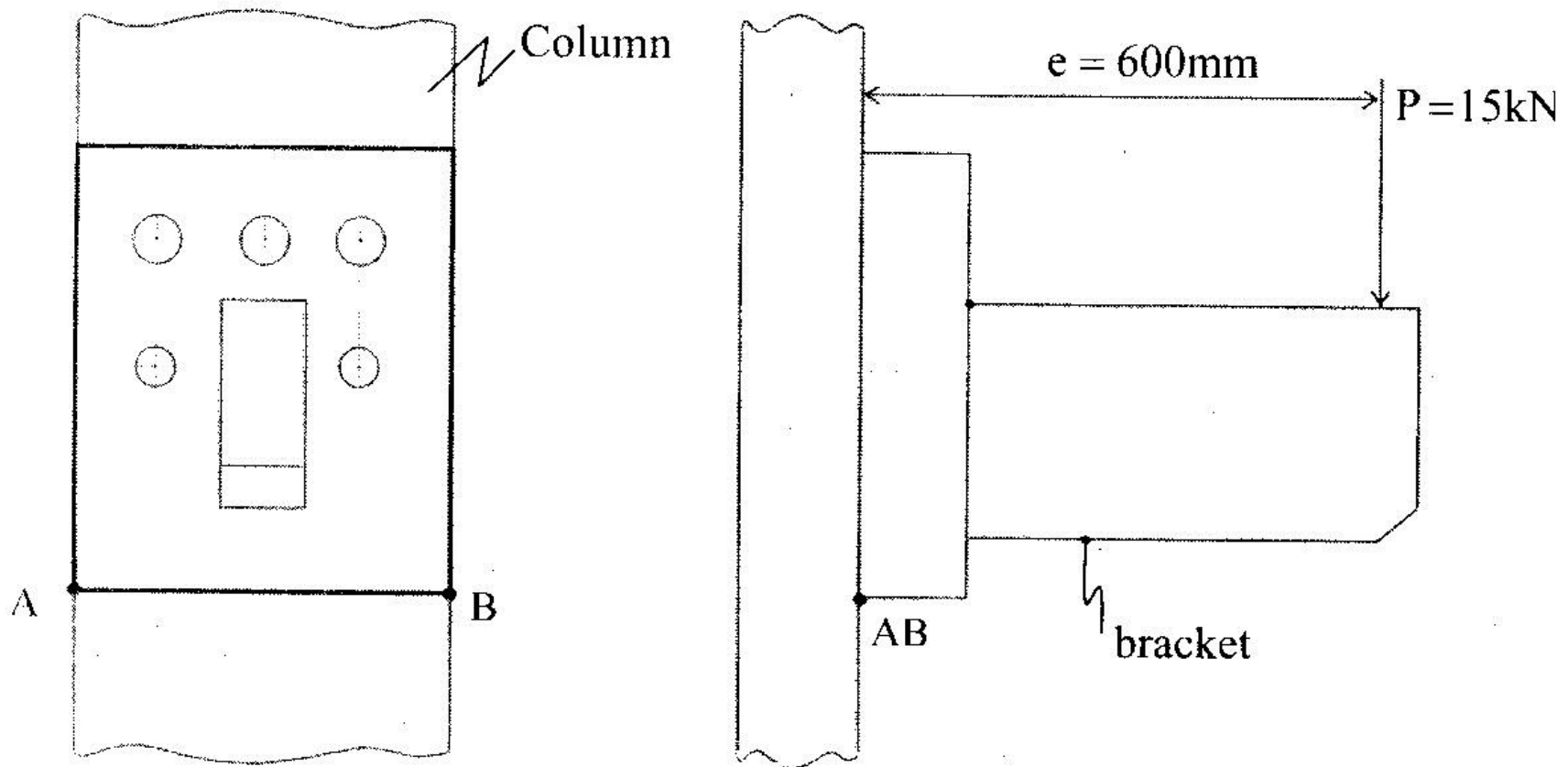

Figure1

OR

Q.5. (a) Name the stresses induced in the Threaded portion engaged with nut, initial tightening. [3]

(b) Why are uniform strength bolts used? Give suitable diagrams of these bolts. [4]

(c) The cylinder head of a steam engine is subjected to a steam pressure of $0.5 N/mm^2$ .It is held in position by means of 12 bolts. The effective diameter of cylinder is 300mm. The stress in the bolt is not to exceed 100MPa. Determine the size of the bolts, considering initial tension for the following cases (a) metal to metal joint (b) a copper gasket (k=0.5). [9]