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BME-02

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B.Tech. (E.E.)
(SEM-II) EVEN SEMESTER
MAJOR EXAMINATION 2017-2018

FUNDAMENTALS OF MECHANICAL ENGINEERING

Time: 3Hrs. Max. Marks: 50

Note: Attempt all questions. Each question carries equal marks.

Q.1 Attempt any FIVE parts of the following: (5×2=10)

a) Give Kelvin-Planck and Clausius statements of second law of thermodynamics. Justify that violation of Kelvin-Planck statements leads to violation of Clausius statements and vise-versa.

b) Mention the difference between water tube and fire tube boilers.

c) A closed vessel contains 3 kg of CO_2 at pressure 70 kPa and temperature 300K. Heat is supplied to the vessel till the gas attains 140 kPa of pressure. Calculate the (a) final temperature (b) work done on or by the gas (c) change in internal energy.

d) Compare two stroke and four stroke engine on the basis of performance, efficiency and economy of operation?

e) How active sensors & transducers are different from passive one, explain with suitable applications?

f) A sine bar has a length of 250mm. Each roller has a diameter of 20mm. During taper angle measurement of the component the height from the surface plate to the center of roller is 100 mm. calculate the taper angle in degree.

g) Classify the different non-ferrous metals and alloys? Write the composition, properties and applications for an alloy that used to fabricate window frames specifically.

Q.2 Attempt any TWO parts of the following: (2x5=10)

a) What is Hooke's Law? Derive the Generalized Hooke's law and also explain stress-strain diagram for mild steel.

b) A steel wire 2 m long and 3mm in diameter is extended by 0.75 mm due to weight suspended from the wire. If the same weight is suspended from the brass wire 2.5 m long and 2mm in diameter, it is elongated by 4.65mm. Determine the modulus of elasticity of brass if that of steel is 2×10^5MPa.

c) Explain any **two** of the following:

i. Derive an expression for strain energy stored in a body, when the load is applied axially.

ii. Creep and Fatigue failure of materials.

iii. Ductile and Brittle fracture.

Q.3 Attempt any TWO parts of the following: **(2x5=10)**

a) The bar shown in Figure 1is subjected to an axial pull of 150kN. Determine diameter of the middle portion if stress there is limited to 125N/mm^2. Proceed to determine the length of this middle portion if total extension of the bar is specified as 0.15mm. Take modulus of elasticity of bar material is specified as 2×10^5MPa.

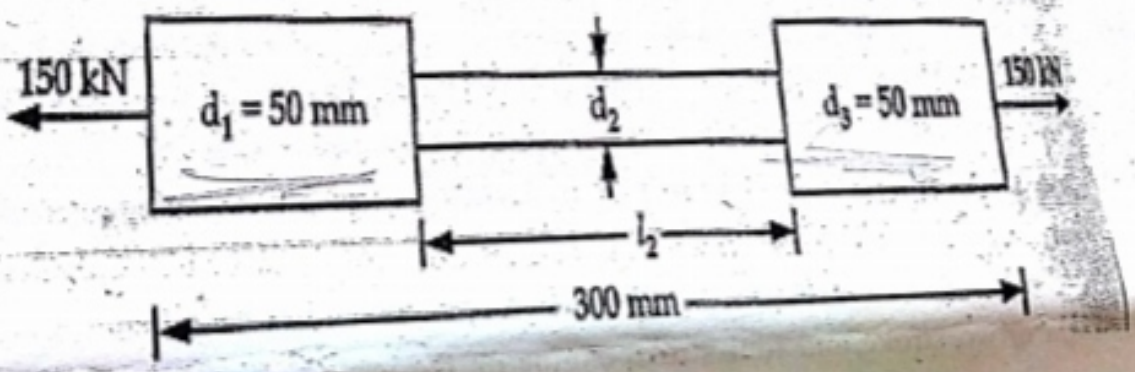

Figure 1

b) If a mild steel material is to be used for an automotive application, how will you measure the hardness of the materials? Explain at least two methods that are widely used with suitable Diagram, formula and related terminology.

c) If E, G and K denotes Young's modulus, modulus of rigidity and Bulk modulus respectively for an elastic material. Find the Poisson's ratio for elastic material when K=E.

Q.4 Attempt any TWO parts of the following:(2x5=10)

a) Calculate the values and draw the diagrams for shear force and bending moment for the following beam shown in Figure 2.

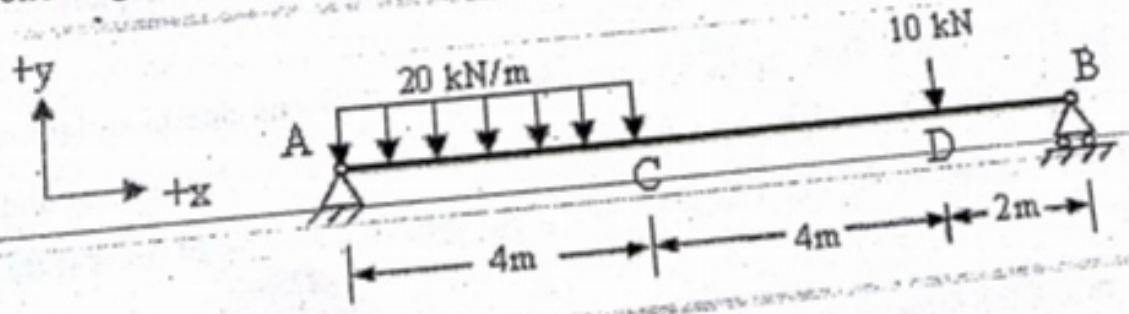

Figure 2

b) Define a beam. Explain the different types of beams in detail with suitable applications.

c) What is the difference in between Sagging and Hogging? Also, explain the different types of supports that used in beams.

Q.5 Attempt any TWO parts of the following: **(2x5=10)**

a) A rolled sheet joint of I – section with dimensions shown in Figure 3. The beam has a span of 10 m and caries uniformly distributed load of intensity 50KN/mrun for the entire span. Make calculations for the stress produced due to bending.

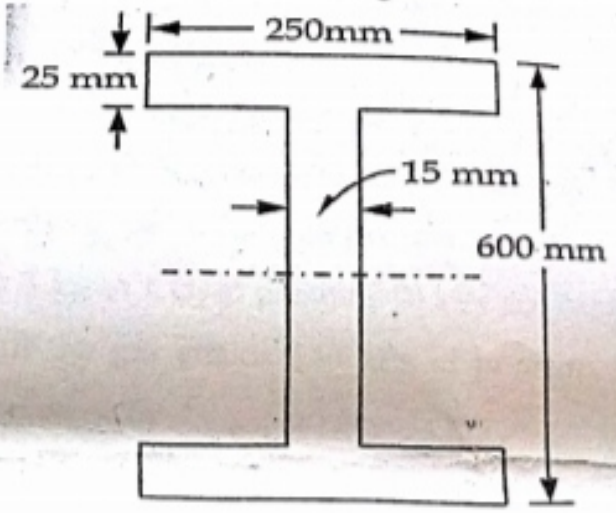

Figure 3

b) A solid shaft is subjected to a maximum torque of 15MN-cm. Determine the diameter of the shaft, if the allowable shear stress and the twist are limited to 1 kN/cm^2 and 1°, respectively 210 cm length of shaft. G=8MN/cm^2.

c) Derive the Bending equation with its all assumptions?