ELIZADE UNIVERSITY, ILARA-MOKIN
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
FIRST SEMESTER 2020/2021 EXAMINATIONS

HOD'S SIGNATURE

Course Title: STRENGTH OF MATERIALS II
Course Code: CVE 311/MEE 309
Instruction: Attempt **ANY FOUR** questions **Time allowed:** 3 hours. **Units:** 3

Question 1 (15 marks)

Explain the following

a) Section Modulus and Moment of Resistance **(3 marks)**
b) Bending Stress and Shearing Stress **(3 marks)**
c) Second Moment of Area and Radius of Curvature **(3 marks)**
d) Slope and Deflection in beams **(3 marks)**
e) Bending Moment and Shearing Force **(3 marks)**

Question 2 (15 marks)

a) A circular bar is subjected to an axial pull of 180 kN. If the maximum intensity of shear stress is not exceeding 65 N/mm^2, determine the diameter of the bar. **(5 marks)**

b) A beam in Fig. 2b is a rolled steel of an unsymmetrical I-section. If the maximum bending stress in the beam section is not to exceed 40 MPa, find the maximum uniformly distributed load (UDL) that the beam can carry over a simply supported span of 5 m. **(10 marks)**

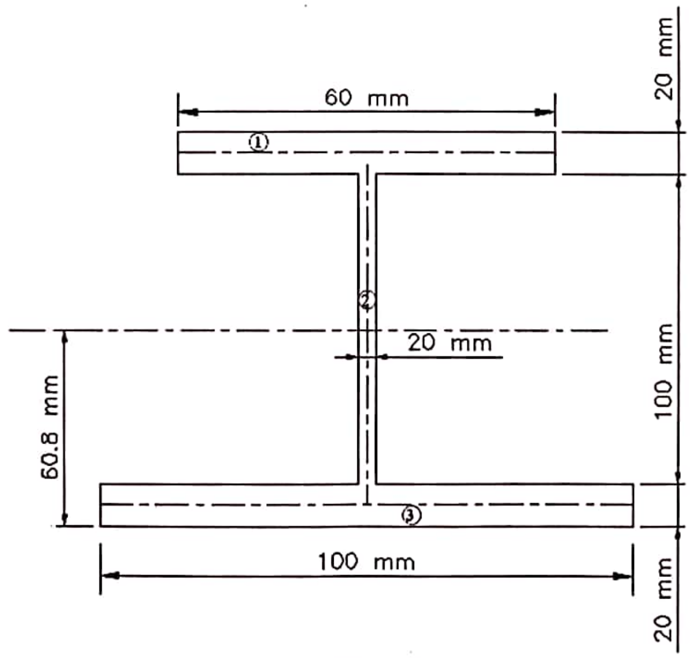

Fig. 2b

Question 3 (15 marks)

a) Find the elongation of the bar shown in Figure 3a, when it is subjected to an axial tensile of 300 kN. Take modulus of elasticity for the bar material as 200 GPa.

(5 marks)

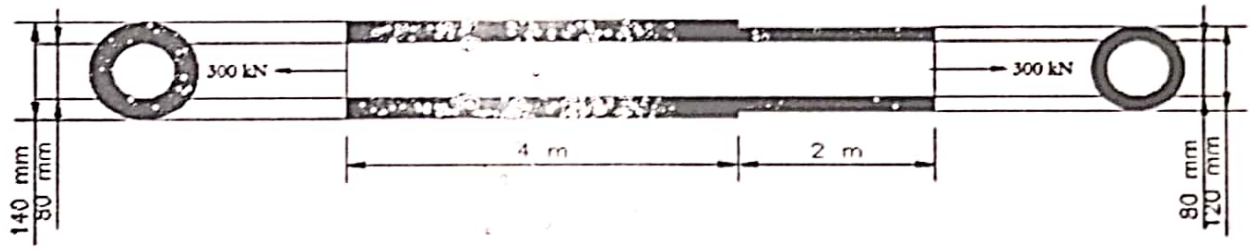

Fig. 3a

b) A floor carrying a load of 6 $kN.m^2$ is supported on a timber joist of 100 mm X 200 mm over a span of 4 m. Calculate the spacing of joists if the bending stress is not to exceed 10 N/mm^2.

(5 marks)

c) A beam of triangular cross section having base width of 100 mm and height of 150 mm is subjected to a shear force of 13.5 kN. Find the value of maximum shear stress and sketch the shear stress distribution along the depth of beam. **(5 marks)**

Question 4 (15 marks)

a) Show that the moment of inertia I_{xx} of a rectangular section is $\frac{bd^3}{12}$ **(10 marks)**

b) A simply supported beam 3 m long is carrying a point load at its centre. If the slope at the end of the beam is not to exceed 1°, find the deflection at the centre of the beam. **(5 marks)**

Question 5 (15 marks)

a) Show that the maximum shearing stress τ_{max} of a rectangular section is 1.5 τ_{avg}. **(7 marks)**

b) A cantilever beam with a point load 'W' at the free end has its maximum slope 'i' and deflection 'y' equation as $\frac{Wl^2}{2EI}$ and $-\frac{Wl^3}{3EI}$. Derive these equations. Take $EI\frac{d^2y}{dx^2} = M$

(8 marks)

Question 6 (15 marks)

a) A cantilever beam is 5 m long and has a load of 50 kN/m accros its span. The deflection at the free end is 3 mm downwards. The modulus of elasticity is 205 GPa. The beam has a solid rectangular section with a depth 3 times the width. (D=3B). Determine (i) the flexural stiffness (ii) the dimensions of the section. **(6 marks)**

b) For a beam under bending, show that $\sigma/E = y/R$

(9 marks)