POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION

(MINISTRY OF HIGHER EDUCATION)

MECHANICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION

JUNE 2012 SESSION

JJ310: STRENGTH OF MATERIALS

DATE : 20 November 2012 (Tuesday)

DURATION : 2 HOURS (8.30 AM - 10.30 AM)

This paper consists of **SEVEN (7)** pages including the front page.

Essay (6 questions – answer 4 questions)

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DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only)

ESSAY (100 marks)

INSTRUCTION:

This section consists of **SIX (6)** questions. Answer **FOUR (4)** questions only.

QUESTION 1

a) List **THREE (3)** type of forces. CLO 1 : C1

(3 marks)

b) Define the terms below: CLO 1: C1

i. Hooke's Law
ii. Young's Modulus

(3 marks)

c) A copper wire of 4 meters in length is applied with a force of 10 KN. If the stress in the wire is 60 MPa. Given E_{Copper}=112 GN/ m^2, calculate:

CLO 1 : C3

i. The strain in the wire
ii. The elongation of the wire
iii. The factor of safety, if the ultimate stress is 230 MPa
iv. The diameter of the wire

(16 marks)

QUESTION 2

A parallel composite bar as shown in Figure 2 is made of steel and copper of the same cross sectional area of 500 mm^2 for each bar. The bar is rigidly fixed at both ends. Given

EC_{Copper}=107 GN/ m^2 α_{Copper} =17.5 X $10^{-6/0}$ C A_{Copper} =500 mm^2

E_{Steel}=200 GN/m^2 α_{Steel} =12 X $10^{-6/0}$ C A_{Steel}= 500 mm^2

Calculate:

a) The stress in each bar when a compressive load of 30 kN is applied axially on the composite bar. CLO 1 : C3 (13 marks)

b) The stress developed in each bar when the temperature is increased to 50 ^{0}C. CLO 1 : C3 (5 marks)

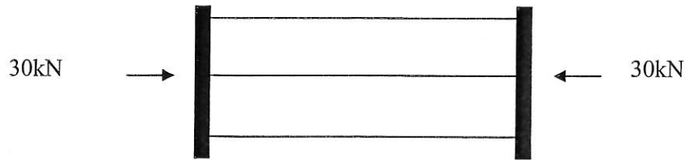


Figure 2

QUESTION 3

Figure 3 shows a simply supported beam carrying a few loads.

a) Calculate the reaction force at point A and B. CLO 1 : C3 (6 marks)

b) Sketch the shear force diagram and the bending moment diagram. CLO 2 : C3 (19 marks)

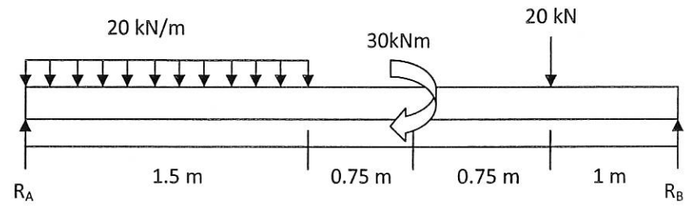


Figure 3

Figure 3

QUESTION 4

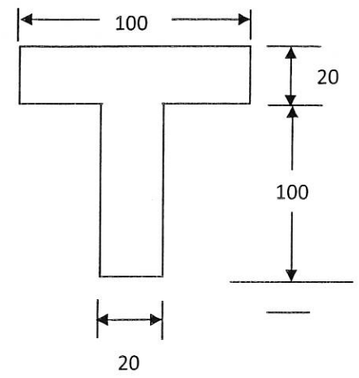
The cross sectional of the beam in Figure 4 below shows a simply supported beam. It carries a uniformly distributed load of 50 kN/m along its 7m length. Determine for the beam: CLO1 : C3

i) The moment of inertia (15 marks)

ii) The maximum bending moment (4 marks)

iii) The maximum tensile stress (3 marks)

iv) The compressive bending stress (3 marks)



All dimensions in mm

Figure 4

QUESTION 5

A beam is subjected to a uniformly distributed load of ~~200~~ 600N/m as shown in Figure 5.

Given E = 20 GPa and I = 15 x 10^{-6} m^4

Using the double integration method, determine,

a) The deflection of the beam at mid length. CLO1:C3 (20 marks)

b) The slope at the end of the beam. CLO1:C3 (5 marks)

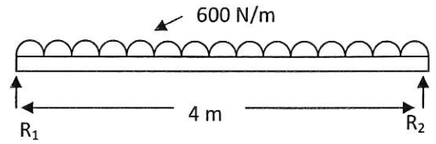


Figure 5

QUESTION 6

a) State the meaning of each term and its unit for the torsional equation.

CLO 1 : C1

(7 marks)

b) A shaft with a diameter of 200 mm and a length of 1 m transmits 50 kW of power at 160rpm rotation. Calculate the maximum shear stresses generatedin the shaft

CLO 1 : C3

(7 marks)

c) A solid steel shaft 5 m long with a load of 80 MPa when twisted through an angle 4^0. Given G = 83 GPa, calculate: CLO 1: C4

i. The shaft diameter

ii. The power that can be transmitted by the shaft at 20 rpm.

(11 marks)