KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (MANUFACTURING ENGINEERING)

EMM 303: SOLID AND STRUCTURAL MECHANICS

DATE: Tuesday, 10th April, 2012 TIME: 2.00 p.m. – 4.00 p.m.

INSTRUCTIONS:

i) This paper contains **FOUR** questions

ii) All questions carry **EQUAL** marks

iii) Attempt **THREE** questions.

Question 1

Fig. Q 1 shows a beam 9m long and simply supported over a span length of 6m. The beam supports a distributed load varying magnitude linearly from zero at the left-hand end to 120 KN/m at the right support. The beam also carries a uniformly distributed load of magnitude 40 KN/m over the remaining 3m length.

i) Calculate the reactions at the supports

ii) Draw to scale the Shear Force and the Bending Moment diagrams.

Question 2

Fig Q 2 shows a simply supported beam of length '1' and supporting a distributed load varying in magnitude linearly from zero at the left-hand end to 60 KN/m at the right-hand end. The cross-section of the beam is indicated in Fig Q 2 (ii) with the dimensions in millimeters.

If for the beam material, the limiting stresses in tension and in compression are respectively 260 MN/m^2, calculate the acceptable value of '1'.

Question 3

Fig q 3 shows a beam of length 2a, simply supported at the ends and supporting a distributed load varying in magnitude linearly from zero at the left-hand end to 'w' N/M at the right-hand end. The beam also carries an anti-clockwise couple of magnitude $0.8wa^2$ N-M at the centre.

Derive an expression for the deflection of the beam at the centre in terms of the indicated parameters as well as E and I.

E – Modulus of Elasticity of the beam

I – Second Moment of Area of the beam Gross-section

Question 4

Fig Q 4 shows a wooden beam 400 mm x 200 mm reinforced by rigidly attaching two steel plates, one of dimensions 400 mm x 20 mm to the left-hand side and another of dimensions 200 mm x 20 mm on the right-hand side.

If the maximum allowable stress in steel is 135 MN/m^2 and that in wood is 8 MN/m^2, calculate the maximum allowable Bending Moment that the beam can withstand.

E steel = 200 GN/m^2; E wood = 8.5 GN/m^2