MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST SEMESTER EXAMINATION FOR DIPLOMA IN MECHANICAL ENGINEERING

STRENGTH OF MATERIALS II

DATE: 3/8/2018 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS:

Answer all questions in Section A and any other TWO questions in Section B

SECTION A: (COMPULSORUY)

1. a) Derive the simple bending theory equation. (10 marks)

   b) State and proof the Macaulay's formula for deflection and slope in beams. (10 marks)

   c) Show from 1st principles, that for a bar of cross-sectional area A, length L and subjected to tensile force P, resilience is given by the expression:

   Resilience = $^1/_2$strain X stress (10 marks)

SECTION B: ANSWER ANY OTHER TWO QUESTIONS

2. A beam of length 8m is simply supported at its ends and carries two concentrated loads of 20kN and 40kN respectively 2m and 6m from the left-hand end together with a uniformly distributed load of 15kN/m on the 4m between the concentrated loads. Calculate the deflection at the center and also the position and magnitude of the maximum deflection. E = 200GN/m^2 and I = 0.18x10^{-3}m^4. (20 marks)

3. a) The working conditions to be satisfied by a shaft transmitting power are: - (i) that the shaft must not twist more than 1^0 on a length of 15 diameters, and (ii) the shear stress must not exceed $55N/mm^2$. If G = $80,000N/mm^2$, what is the actual working stress, and the diameter of the shaft to transmit 1MW at 240 r.p.m.? (10 marks)

b) A solid steel rod 1m long has a diameter of 25mm except for the Centre portion 300mm long where diameter has been turned down to 15mm. determine the strain energy stored in the rod when a tensile load of 50kN is gradually applied. Determine also the diameter required for a brass rod of the same length and of constant diameter which will have the same proof resilience as the steel rod. E_{steel}= $210kN/mm^2$, E_{brass}= $85kN/mm^2$, yield stress: steel = $220N/mm^2$, brass $140Nmm^2$ (10 marks)

4. A built-in beam of span 12m carries a uniformly distributed load of 10kN/m over its whole length together with concentrated loads of 20kN at 3m and 30kN at 8m from the left end. If the bending stress is limited to $100N/mm^2$, calculate the section modulus required and sketch the bending moment diagram. (20 marks)

5. A beam of symmetrical I-section has the following dimensions: flange 150mm wide, 30mm thick, web 30mm thick; total depth of beam 200mm. Calculate the second moment of area of the beam about an axis through the centroid parallel to the flange face.

If the beam is simply supported over a span of 2 metres and carries a uniformly distributed load of 6 tonnes per metre run, calculate the maximum bending stress in the beam. (20 marks)