



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING 2ND YEAR/2ND SEMESTER EXAMINATIONS

**BACHELOR OF ENGINEERING IN ELECTRICAL & ELECTRONIC ENGINEERING
INSTITUTIONAL-BASED PROGRAMME**

EEE 2221: MECHANICAL ENGINEERING

SERIES: JULY 2011

TIME: 2 HOURS

Instructions to Candidates:

This paper consists of **FIVE** questions. Attempt any **THREE** questions

This paper consists of **THREE** printed pages

Question 1 (Compulsory)

The following results were obtained in a tensile test on a mild steel specimen of original diameter of 20mm and gauge length of 40mm. At the limit of proportionality the load was 80,000N and the extension 0.048mm.

The specimen yielded at a load 85,000N, and the maximum load withstood was 150,000N. when the two parts were fitted together after being broken, the length between gauge points was found to be 55.6mm, and the diameter at the neck was 15.8mm.

Calculate:

- a) Young's Modulus
 - b) The stress at the limit of proportionality
 - c) The yield stress
 - d) The ultimate tensile stress
 - e) Percentage elongation
 - f) Percentage contraction
- (20 marks)

Question 2

A beam ABCD, 6m long is simply supported at the right-hand D and at a point B 1m from the left-hand end. It carries a point load of 10kN at A, a second concentrated load of 20kN at C, 3m from D, and a uniformly distributed load of 10kN/m between C and D.

- a) Determine the reactions at the supports B and D
 - b) The position and magnitude of the maximum bending moment
 - c) Draw the shearing force and bending moment diagrams for the beam
- (20 marks)

Question 3

A simply supported beam of rectangular cross-section supports a load that deflects the beam 25mm at the midpoint. The beam is to be replaced by a new beam of the same material and same span length. The new beam also has a rectangular cross-section but its width is only one and a half the width of the original beam. What must be the height of the new compound to the height of the original beam if the new beam is to deflect only 15mm under the same load?

(20 marks)

Question 4

- a) With the aid of a diagram, show that at any point in a fluid at rest, the rate of increase of pressure in a vertically downward direction is equal to the specific weight of the fluid at that point.
- b) A U-tube manometer in figure Q4 is used to measure the gauge pressure of a fluid P of density 630kg/m³ while density Q of second fluid is 13000g/m³. Determine the gauge pressure at A when
 - i) $h_i = 0.8m$ and D is 0.8m above BC
 - ii) $h_i = 0.3m$ and D is 0.4m below BC

c) Explain “differential manometer”

(20 marks)

Question 5

a) Explain “Slip” of the flat belt

b) Derive an expression for velocity ratio of a belt drive

c) Show that for a driven pulley on a flat belt

$$\log_e \left(\frac{T_1}{T_2} \right) = \mu \theta$$

is the coefficient of friction T_1 and T_2 are tensions in the tight and slack side and θ is the angle of contact is radians (20 marks)