



TECHNICAL UNIVERSITY OF MOMBASA

**Faculty of Engineering & Technology
in Conjunction with
Kenya Institute of Highways and
Building & Technology (KIHBT)**

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

HIGHER DIPLOMA IN TECHNOLOGY

EME 3130: MECHANICAL TECHNOLOGY I

END OF SEMESTER EXAMINATION

SERIES: MAY 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Drawing Instruments*
- *Scientific Calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions
 All questions carry equal marks
 Use neat, large and well labeled diagrams where required
 This paper consists of **THREE** printed pages

Question One

- a) Figure 1 shows a cantilever loaded as shown. Apply castigliano’s theorem to show that the deflection at C is given by:

$$Y_c = \frac{WL^4}{8EI}$$

Symbols have the usual meaning **(20 marks)**

Question Two

Figure 2 shows a beam loaded and supported as shown using Macaulay’s method. Determine the deflection at a point 1m from the left-hand end of the beam. $EI = 0.65MNm^2$ **(20 marks)**

Question Three

Shown in figure 3 is a steel shaft with applied Torque, $T = 2400Nm$. The shaft has the following dimensions: $L = 500mm$, $D_1 = 40MM$, $D_2 = 50mm$. Taking $G = 77Gpa$, determine:

- a) The minimum and maximum shearing stress in the shaft,
 b) The angle of twist at the free end **(20 marks)**

Question Four

- a) State SEVEN assumptions made in the simple theory of bending **(7 marks)**
- b) An I-section girder 300mm wide by 400mm deep, with flange and web of thickness 20mm is used as a simply supported beam over a span of 7m. The girder carries a distributed load of 6KN/m and a concentrated load of 30KN at midspan. Determine:
 (i) The second moment of are of the cross-section of the girder
 (ii) The maximum stress set up **(13 marks)**

Question Five

- a) For compound bars show that the combined modulus is given by:

$$E_c = \frac{\sum EA}{\sum A}$$

where the symbols have their usual meaning **(8 marks)**

- b) A 30mm diameter steel rod passes concentrically through a bronze tube 300mm long, 50mm external diameter and 40mm internal diameter. The ends of the steel rod are threaded and provided with nuts and washers which are adjusted initially so that the there is no change in the thickness of the washes when one of the nuts is tightened by giving it one-twelfth of a turn. Determine the stress produced in the steel and bronze.

The pitch of the thread is 2.5mm; for steel = 200 GN/m², E for bronze = 100GN/m² **(12 marks)**