THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING

EBC 2214: STRENGTH OF MATERIALS II

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: FEBRUARY/MARCH 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

- *Answer booklet*
- *Battery Powered Programmable calculators may be used*

This paper consists of **FIVE** questions
Answer question **ONE (COMPULSORY)** from **SECTION A** and any other **TWO** questions from **SECTION B**
Maximum marks for each part of a question are clearly shown
This paper consists of **FIVE** printed pages

SECTION A (COMPULSORY)

Question 1 (20 marks)

a) A solid steel shaft of diameter 60mm is to be designed using an allowable shear stress $\tau_{allow} = 60Mpa$ and an allowable angle of twist $\theta = 1.5^{O}$ per metre length. Determine the maximum permissible torque T that may be applied to the shaft, assuming G = 80GPa. (9 marks)

b) A strut with a hollow cross-section is 3m long and pinned at the supports. If the Euler buckling load is 99.02 KN, determine the internal diameter (in mm) if the external diameter of the strut is 75mm. Take E = 205GN/m^2. (10 marks)

c) Derive the expression for the Euler Buckling load of pin-ended strut (11 marks)

SECTION B (Answer any TWO questions from this section)

Question 2 (20 marks)

The retaining wall shown in figure 2 carries a surcharge of 24KN/m^2. The soil in front and behind the wall (SOIL 1) is cohesionless and has a unit weight of 18KN/m^3 and an angle of internal friction of 45^o. The soil beneath the base (SOIL 2) has a cohesion of 36KN/m2, a unit weight of 20KN/m3 and angle of internal friction of 30^o. Analyse the wall for overturning and sliding stability. Ignore the weight of soil above the toe. (20 marks)

Question 3 (20 marks)

A bending moment of 6KN/m is applied to a beam such that the top of its cross-section is in compression. The beam is constructed of a wood member 100 mm wide x 150 mm deep reinforced on its lower side by a steel bar 8mm thick X 100mm wide. By transforming the section into an equivalent STEEL section, find the maximum bending stresses σ_s *and* σ_w in the steel and wood, respectively, due to the moment if the modulus of elasticity $E_w = 10Gpa$ for wood and $E_s = 210GPa$ for steel. Also sketch the variation of the bending stress across the section. (20 marks)

Question 4 (20 marks)

A hollow steel shaft with an external diameter of 150mm is required to transmit 1.2MW at 300rev/min. Calculate a suitable

Question 5 (20 marks)