TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECE 2214: STRENGTH OF MATERIALS II
SPECIAL SUPPLEMENTARY EXAMINATION
SERIES: SEPT. 2017
TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of five questions.
Answer question ONE (COMPULSORY) and any other TWO questions
Do not write on the question paper.

QUESTION ONE (COMPULSORY)

i) Find the Euler's crushing load for a hollow cylindrical cast iron column 200 mm external diameter and 25 mm thick if it is 6.0 m long and hinged at both sides. Take E = 1.2 x 10^6 N/mm^2. Compare the load with the crushing load as given by Rankine's formula taking f_c = 550N/mm^2 and a = $\frac{1}{1600}$.
For what length of the column would these two formulae give the same crushing load?
(15 marks)

ii) A masonry trapezoidal dam 4.0 m high, 1.0 m wide at its top and 3.0 m width at its bottom retains water on its vertical face. Determine the maximum and minimum stresses at the base. (15 marks)

ATTEMPT ANY TWO QUESTIONS
QUESTION TWO

i) The reinforced concrete beam has the cross-section area shown . If it is subjected to a bending moment of M= 80 kNïm, determine the normal stress in each of the steel reinforcing rods and the maximum normal stress in the concrete.Take Est= 200 GPa and Ec = 20 GPa.
(10 marks)

ii) The reinforced concrete beam has the cross-section area shown. If the allowable normal stress for concrete is (σallow) c= 20 MPa, and for the steel is (σallow)st=300 Mpa , determine the maximum moment M the beam can support. Take Est=200 Gpa and Ec = 20 Gpa.

(10 marks)

QUESTION THREE

A short column has a square section 300 x 300 mm with square hole of 150 mm x 150 mm as shown in figure Q2(a). It carries an eccentric load of 1800 KN located as shown in the figure. Determine the maximum compressive and tensile stresses across the section

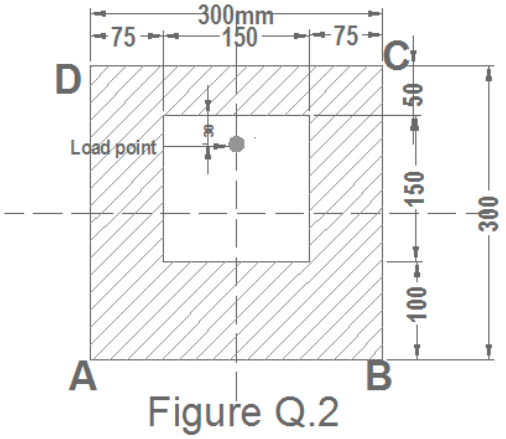

Figure Q.2

(20 marks)

QUESTION FOUR

i) State Saint Venant Principle for circular cross section bars and outline the basic assumption associated with it.

(2 marks)

ii) Two pulleys at B and C in figure Q.4 (b) are driven by a motor through a stepped, steel drive shaft (G=77 GPa) ABC. Each Pulley absorbs a torque of 113 N m. The lengths are L1= 1m, L2=1.27m. The shaft has a yield stress of Y = 414Mpa. Using a safety factor of SF = 2.0and the Tresca criterion,–Determine suitable diameter dimensions d1 and d2 for the two shaft lengths– Calculate the total angle of twist of the shaft

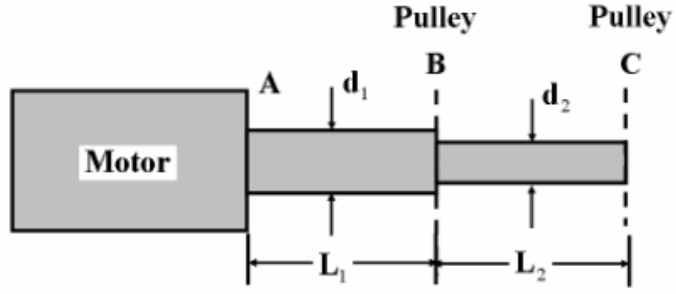

Figure Q.4 (b)

(9 marks)

iii) An elliptical bar has dimensions L= 1m, a = 2cm, b= 1cm and is made of a material with shear modulus G= 40GPa and yield stress σ0= 100MPa. Compute the maximum twist angle before the material yields plastically and the value of the torque at that point. Assume a yield criterion based on the maximum shear stress (also known as Tresca yield criterion), i.e. the material yields plastically when τmax=σ0

(9 marks)

QUESTION FIVE

i) List **THREE** assumptions made in Euler's formula and give **TWO** limitation of this formula in the determination of the critical loads.

(5 marks)

ii) Determine the ratio of buckling strengths of two columns one hollow and the other solid. Both are made of the same material and have the same length, cross- sectional area and end conditions. The internal diameter of the hollow column is half its external diameter.

(15 marks)