JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY SPECIAL RESIT EXAMINATIONS FOR THE DEGREE IN SCIENCE IN CONSTRUCTION MANAGEMENT

SECOND YEAR RESIT 2020/2021 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TCM 3222

COURSE TITLE: Structures I

EXAM VENUE: **STREAM: BSc CONSTRUCTION MGT**

DATE: ../11/2020 **EXAM SESSION:**

DURATION: …HOURS

Instructions

1. **Answer question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE (30 Marks)

i. Briefly explain the difference between mechanics of rigid bodies and the mechanics of deformable bodies **(2 Marks)**

ii. Explain why you need to study this course (**3 Marks**)

iii. Differentiate between strength and toughness. Also indicate how each may be applied in engineering design **(6 Marks)**

iv. Differentiate amongst the following **(6MARKS)**
   a) Load and stress
   b) Resilience and strain Energy
   c) Strain and elongation

v. State Hooke's law and gives its mathematical expression involving the three known elastic moduli. Explain its importance in structural design work (**7 Marks**)

vi. In an experiment, a steel specimen of 13 mm diameter was found to elongate 0.2 mm in a 200 mm gauge length when it was subjected to a tensile force of 26.8 kN. If the specimen was tested within the elastic range, what is the value for the elastic modulus for the steel? (**6 Marks**)

QUESTION 2 (20 Marks)

i. Briefly explain the following **(6 Marks)**
   a) Temperature stress
   b) Composite bar
   c) Factor of safety

ii. Draw the stress- strain curve for a ductile material and briefly explain the key points on the curve (ie LP, EL, YP, US, and BS) **(14 Marks)**

QUESTION 3

i. List three types of structural stresses **(3 Marks)**

ii. Briefly describe and illustrate how each of the three stresses mentioned in i above arise. **(6 Marks)**

iii. Define and illustrate the following types of beams **(6MARKS)**
   a) Simple beam
   b) Fixed beam
   c) Propped cantilever

iv. A short hollow cast iron cylinder of wall thickness of 10 mm is to carry a compressive load of 600 kN. Assuming the ultimate strength of the material as 500 MN/m^2 and a factor of safety of 4, determine the size of the cross-section **(5MARKS)**

QUESTION 4

i. A bar 450mm long is 50 mm square in section for the first 150 mm of its length, 25 mm diameter for the next 150 mm and 50 mm diameter for the remaining 150 mm length. A tensile load of 100KN is applied to the bar. Given $E = 2 \times 10^5$ MN/m^2, determine : **(10MARKS)**
   a) The stress in each portion

   b) The total elongation

ii. A railway line is laid so that there is no stress at 10^oC. The rails are 25m long, the modulus of elasticity is 2×10^5 MPa and the coefficient of linear expansion of rail steel is $12.5 \times 10^{-6}/^oC$ Compute **(10MARKS)**

(i) The stress in the rails at 50 ^{o}C if there is no allowance for expansion,

(ii) The stress in the rails at 50 ^{o}C if the expansion allowance is 10mm;

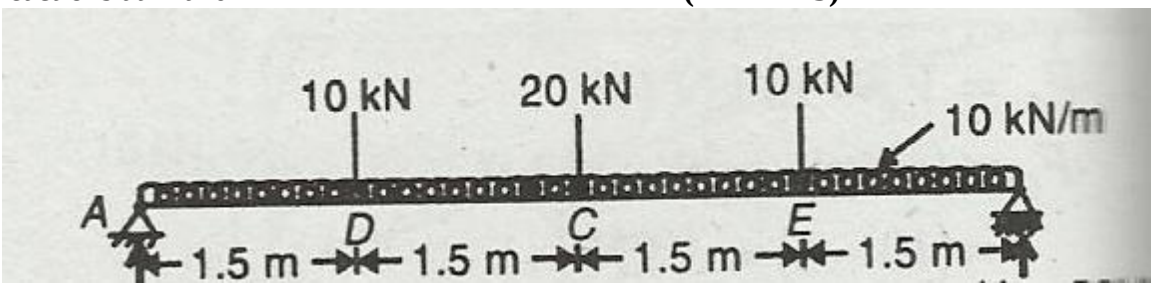
(iii) The expansion allowance required if the stress is to be zero at 50 ^{o}C,

(iv) The maximum temperature if there should be no stress in the rails for an expansion allowance of 15mm.

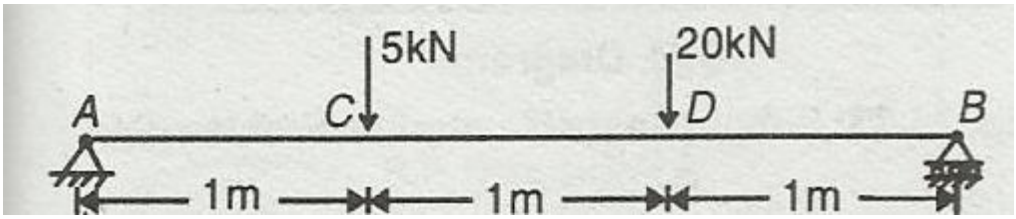
QUESTION FIVE (MARKS 20)

i. State the three laws of equilibrium which are applied in the analysis of structural members **(3MARKS)**

ii. The figure below is a beam diagram subjected to various loads. Compute the support reactions at A and B **(7MARKS)**



iii. A simply supported beam of 3m span shown below is loaded with point loads of 5kN and 20 kN at 1m and 2m from the left end.



Sketch:

a) Loading diagram **(2MARKS)**

b) Shear force diagram **(4MARKS)**

c) Bending Moment diagram **(4MARKS)**