UNIVERSITY OF JOHANNESBURG

PROGRAM	: BACHELOR OF ENGINEERING *TECHNOLOGY: CIVIL*
SUBJECT	: **BASIC SCIENCE (APPLIED MECHANICS) 1A**
CODE	: **APMCIA1**
DATE	: FINAL EXAMINATION 07 JUNE 2019
DURATION	: (SESSION 1) 08:30 - 11:00
WEIGHT	: 40 : 60
TOTAL MARKS	: 60

ASSESSOR	: Mr SD Ngidi
MODERATOR	: Miss N Reynecke
NUMBER OF PAGES	: 6 PAGES

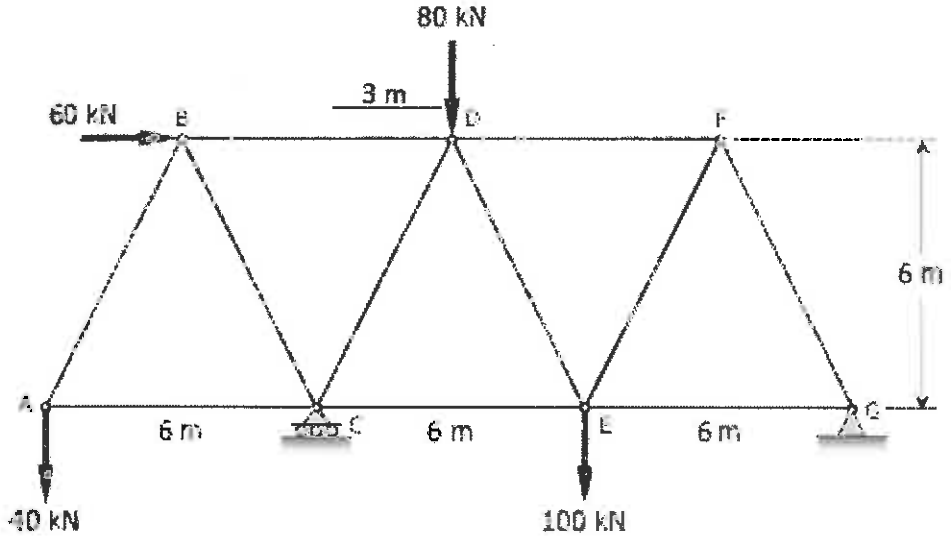
INSTRUCTIONS	: ONLY ONE POCKET CALCULATOR PER CANDIDATE MAY BE USED.
REQUIREMENTS	: 2 ANSWER BOOKLETS

INSTRUCTIONS TO STUDENTS

PLEASE ANSWER ALL QUESTIONS.
SHOW ALL THE STEPS FOR CALCULATIONS CLEARLY.

QUESTION 1 [5]

Calculate the magnitude and direction of support reactions at C and G of the truss in the following figure.

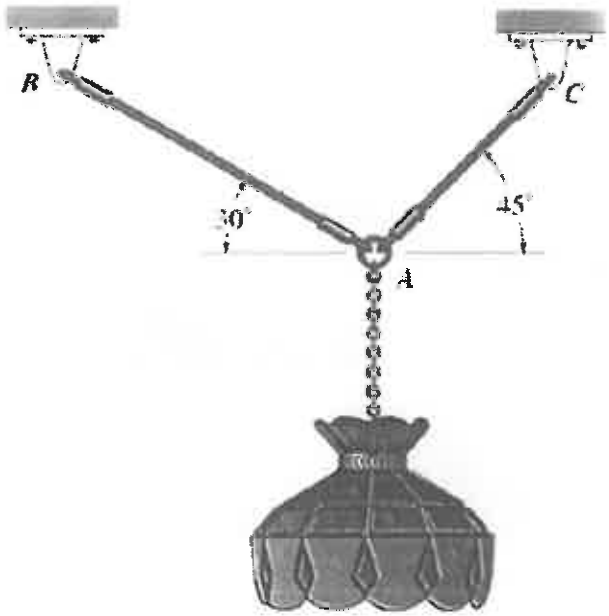


(5)

Figure Q1

QUESTION 2 [10]

Determine the forces in cables AB and AC necessary to support the light fixture of weight 150 N.

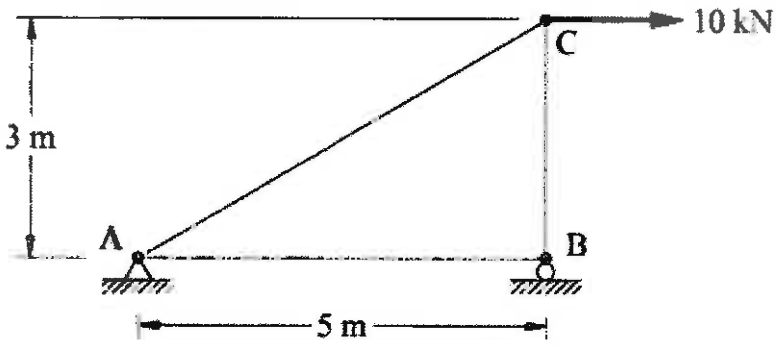


(10)

Figure Q2

QUESTION 3 [10]

Determine the force in each member of the truss in Figure Q3. Indicate whether the member is in Tension or Compression.



(10)

Figure Q3

QUESTION 4 [10]

(a) A helical spring has a free length of 250 mm and a spring rate of 0.5 N/mm.

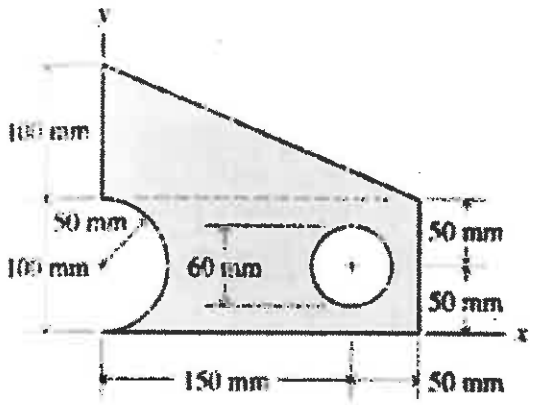
(i) Sketch a force vs deflection graph and calculate the work done to compress this spring 70 mm from its free length. **(3)**

(ii) Calculate the work done required to compress this spring from 200 mm to 115 mm in length. **(3)**

(b) A tractive effort of 3kN drives a 5 tonne truck from rest up a 1 in 40 incline. If the tractive resistance is constant at 380N and the tractive effort is parallel to the plane, use method of conservation of energy to calculate the speed of the truck after it has travelled 250 m. (in km/hr) **(4)**

QUESTION 5 [15]

Determine the centre of gravity of the lamina shown in Figure Q5. (Use the origin as a reference point)



(15)

Figure Q5

QUESTION 6 [10]

The weight of blocks A and B are W and 4W respectively. The rope that links the two blocks goes over a smooth pulley at C. If the coefficient of friction between all the surfaces is 0.5, calculate the magnitude of the force F (as a multiple of W) necessary to make block A just to move to the right.

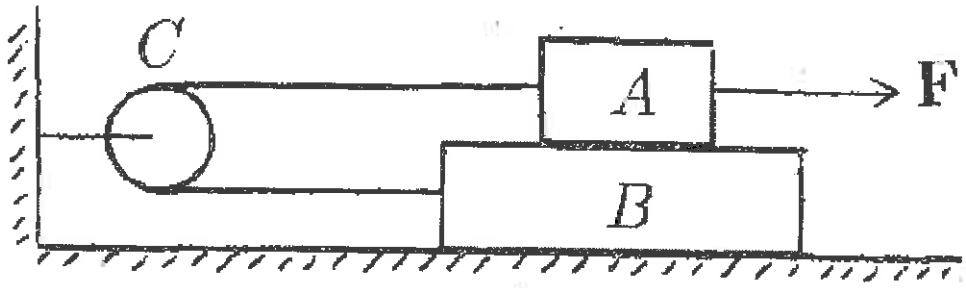


Figure Q6

(10)

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Basic equations

$$\text{average velocity} = \frac{\text{initial velocity} + \text{final velocity}}{2}$$

$$\bar{v} = \frac{u + v}{2}$$

$$\text{displacement} = \text{average velocity} \times \text{time}$$

$$s = \bar{v} \times t$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$= \frac{\Delta v}{t}$$