NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

APPLIED MECHANICS

EIE 1206

OCTOBER 2024 EXAMINATIONS

This examination paper consists of ***four(4)*** printed pages

Time Allowed:	**3 hours**
Total Marks:	**100**
Examiner's Name:	**W. Tumbudzuku**

INSTRUCTIONS AND INFORMATION TO THE CANDIDATE:

1. The question paper contains seven (7) questions.
2. Answer any ***five(5)*** questions.
3. Each question carries 20 marks.
4. Use of calculators is permissible.

Question one

With the aid of diagrams describe the six fundamental principles of engineering mechanics. [20]

Question two

(a) With reference to Figure Q2a, explain the term "***Associative"*** when adding a number of vectors. [4]

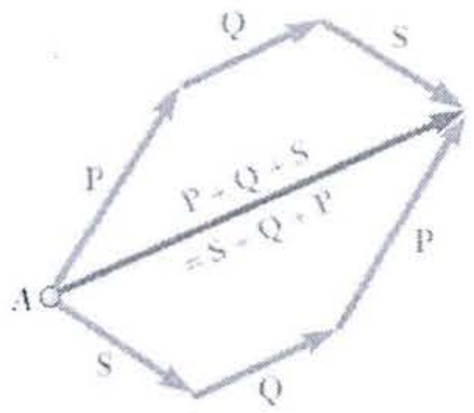

Figure Q2a Vector addition

(b) Use the diagram in Figure 2a to explain the term **"Commutative"** when adding a number of vectors. [4]

(c) Determine the resultant force of the two forces acting on the pin in Figure Q2b using:

i. The graphical method, [6]

ii. The trigonometric method. [6]

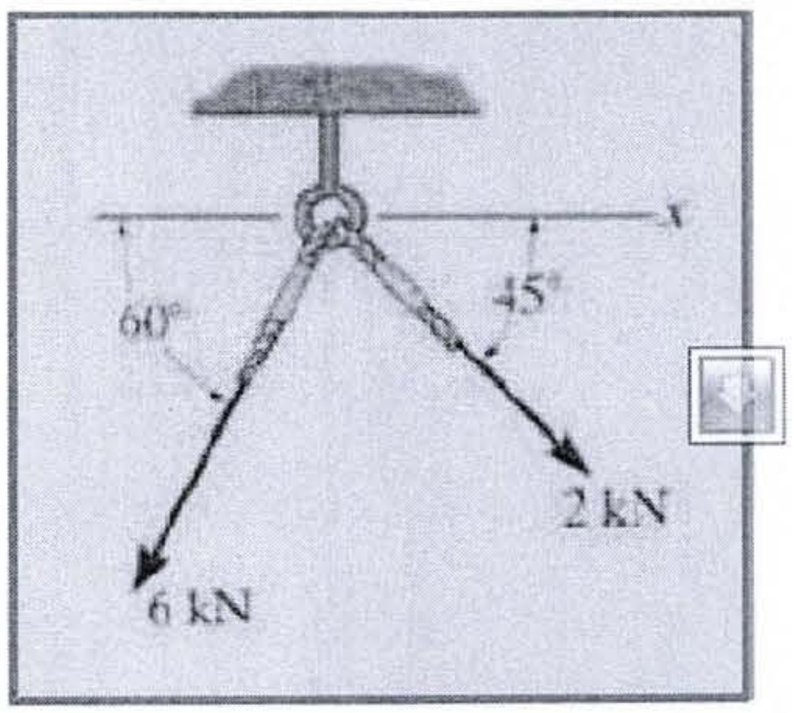

Figure Q2b Force systems

Question three

Refer to the truss in Figure Q3, and determine the forces in members in all the members using method of sections. [20]

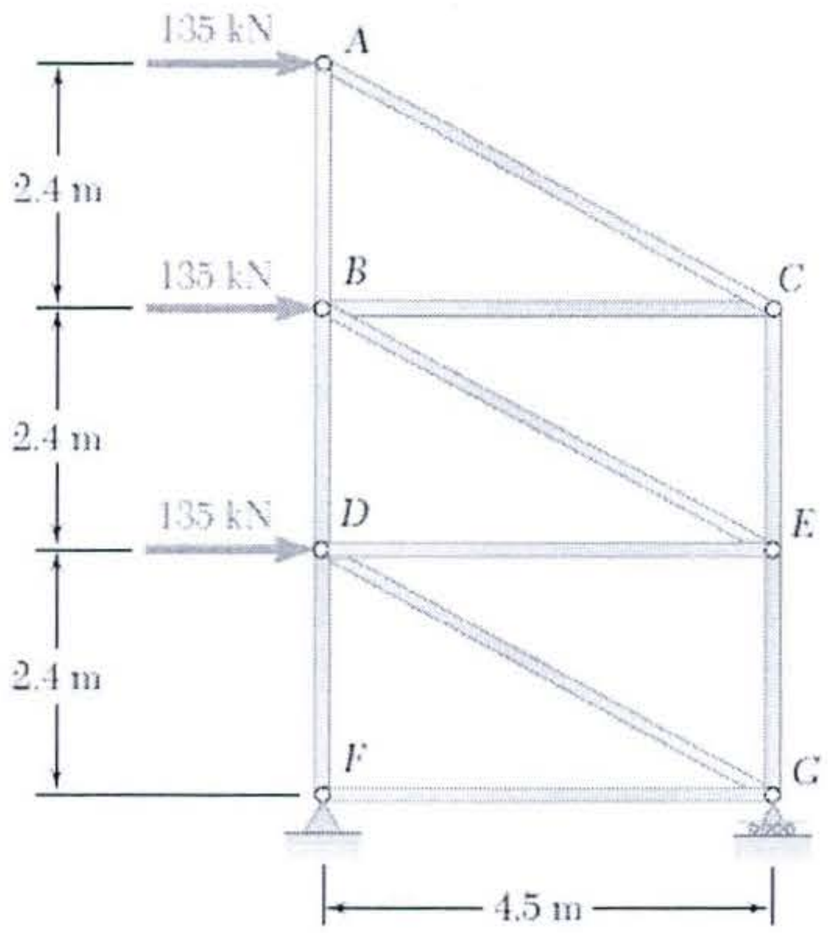

Figure Q3 Truss under loading

Question four

Refer to the truss in Figure Q3, determine the forces in members DF, DG and EG using the method of sections. [20]

Question five

(a) The following statements are made on frictional forces:
   i. Friction forces are independent of an area,
   ii. Friction forces are independent of the temperature and
   iii. Friction forces are independent of speed.

Are the statements true or false, justify your answers. [6]

(b) A rigid body is resting on a rough surface, A force is applied to this body until it's now in motion. Describe the variation of the applied load P to the frictional force F. [4]

(c) A force of 100N drags a 400N block by a frictionless rope at an angle of 30° above the horizontal surface. If the coefficient of kinetic friction is μ_k=0.3. What substituted force F will produce a constant speed. [10]

Question six

(a) For the beam loaded in Figure Q6 ,write eqautions for the variation of the shear force and bending moment along the beam. [5]

(b) Draw the shear force and bending moment diagrams. [5]

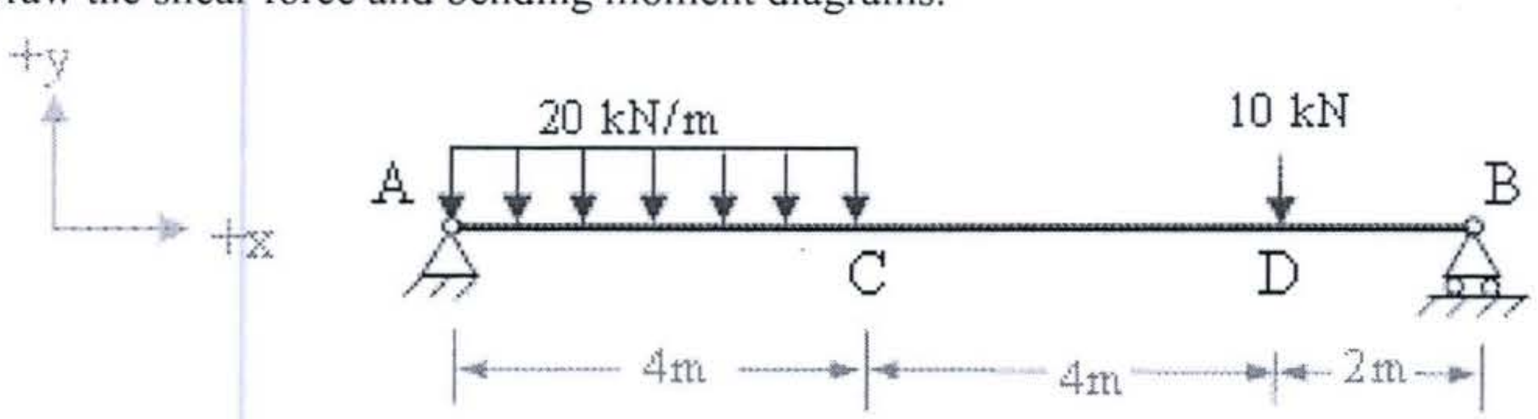

Figure Q6a,b Beam under loading

(c) Refer to Figure Q6c below, use the differential method to derive the relationship between:

i. The shear force (**V**) and the intensity **(w)**. [5]

ii. The shear force (V) and the bending moment (**M**) diagrams. [5]

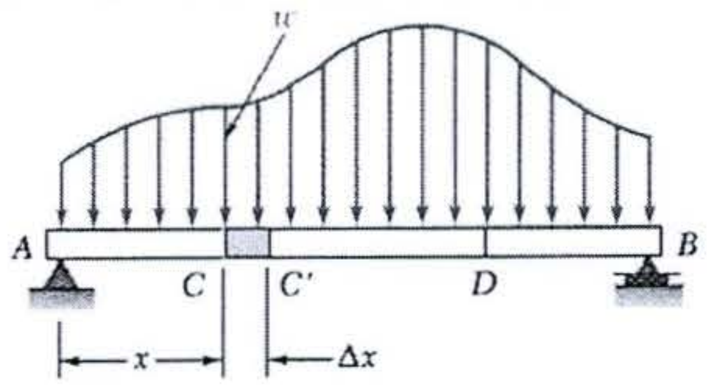

Figure Q6c Beam under loading

Question seven

Locate the centroid of the geometrical shape shown in Figure Q7 below. [20]

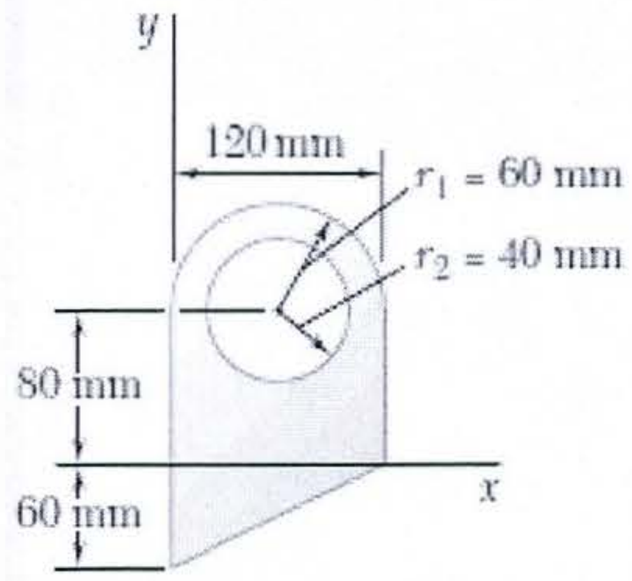

Figure Q 7 Composite shape

End of examination !!!