NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF TECHNICAL AND ENGINEERING EDUCATION AND TRAINING

ENGINEERING MECHANICS 1- STATICS AND DYNAMICS

PTE 1246

Main Examination

May 2019

This examination paper consists of 4 pages

Time allowed: 3 hours

Total marks: 100

Examiner's name: Eng. G Munhuwamambo

INSTRUCTIONS

1. Answer any **FIVE** questions out of **SEVEN**.
2. Each question carries **20 marks**.
3. Show all working
4. There are five **(5)** printed pages.
5. Use of calculator is allowed

QUESTION ONE

Determine the magnitude and direction of the resultant of system of forces shown below .

150N at 30^0

80N at 110^0

110N at 270^0

100N at 345^0 **[20]**

NB USE Bow s notation to position your concurrent forces

QUESTION TWO

A beam AC 6m long is simply supported at R_A at the extreme left hand end and at R_B , 5m from R_A. It carries a 10KN point load at position E, 1m from R_A, a 15KN load, 4m from R_A and a 8KN point load at the other end C. It also carries a Uniformly Distributed Load of 6 KN/m for a length of 5 metres starting from R_A.

a) Draw the shear force diagram **[6]**
b) Draw the bending moment diagram **[9]**
c) Determine the position of any point of contraflexture **[5]**

QUESTION THREE

A locomotive and train have masses 90 tonne and 400 tonne respectively. The coefficient of friction is 0,5 . If 80% of the weight of the locomotive is supported by the wheels and the tractive resistance is 100N/tonne , find the maximum possible starting acceleration

[**20**]

QUESTION FOUR

Determine the magnitude of forces acting in the truss shown in Figure question four below and for each member , state whether it is in tension or compression .

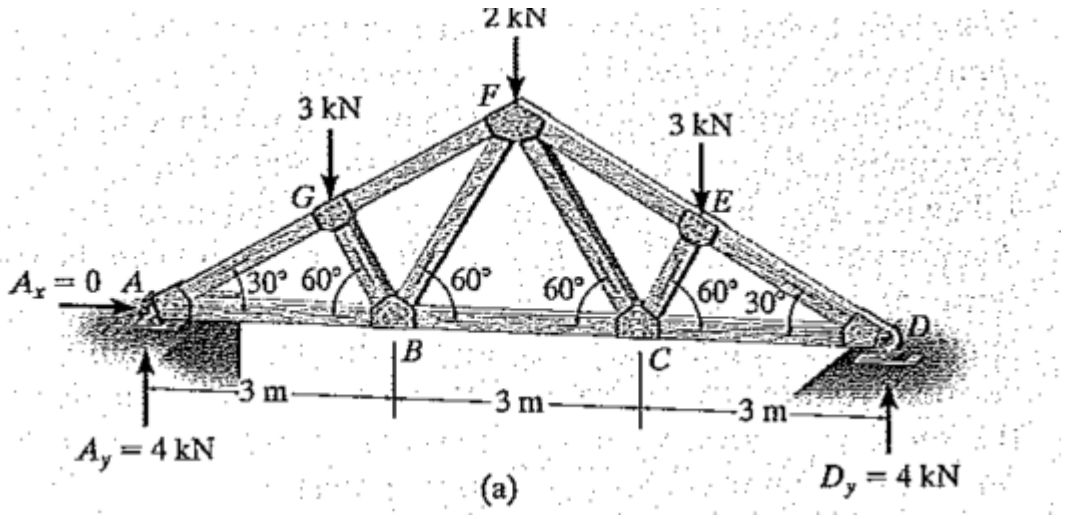

Figure Question Four

[20]

QUESTION FIVE

A 400 kg aluminium block rests on a plane inclined at 30 degrees to the horizontal and is hauled up the incline using force P inclined at 30 degrees to and above the plane. The co-efficient of friction between the surfaces in contact is 0, 25 . Determine the magnitude of force P required to haul the copper block up the incline. [**20**]

QUESTION SIX

A table carrying a machine tool is traversed by a three start screw of pitch 4 mm . The mass of the table is 300 kg and the co-efficient of friction between the table and its guides is 0.1 . The screw is driven by a motor rotating at 12 revs/sec . The efficiency of the operation is 80% .

Find: a) the speed of operation of the tool per minute . [**6**]

a) Determine the power required [**14**]

QUESTION SEVEN

a) A diameter 100 mm shaft , 140 mm long is machined down to diameter 80 mm over a length of 60 mm and then drilled to diameter 40 mm over a length of 40 mm from the diameter 100 mm end.

Determine the centre of gravity of the shaft from the diameter 100 mm end [**12**]

b) Train A leaves a station at an acceleration of 0.3 m/sec^2 and train B leaves the same station 10 seconds later, at an acceleration rate of 0,45 m/sec^2 . Determine the distance travelled by the trains before train B catches up with train A . **[8]**

THE END