

THE TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

DEE2

EME 2130 MECHNANICAL SCIENCE

SERIES: APRIL/ MAY 2016

TIME: 2 HOURS

Instructions to candidates

You should have the following for this examination:-

- Answer booklet
- Scientific calculator
- Drawings instruments

The paper consists of FIVE Questions. Answer any THREE questions

Question One

- (a) State two advantages and two disadvantages of friction. (4 marks)
- (b) A body of weight 520N is prevented from sliding down a plane inclined at 45° to the horizontal by a force of 268N acting upwards and parallel to the plane.
- (i) If the body is to be pulled up the plane by a force acting at 20° to the horizontal upwards, find its value.
- (ii) What would be the least force to pull this body up the plane?

16 marks)

Question Two

- (a) A ship's fuel oil storage tanks contain oil to a depth of 8m. Calculate the load on a circular plate 540mm diameter in the base of the tank due to the weight of fuel oil. Specific gravity of fuel is 0.8, while specific weight of water is 9.8KN/m^3 . (10 marks)
- (b) A dock gate is 5m high and 10m wide. It is supported at its base A and held vertical by a cable at the top of the gate at an angle of 30° as shown below. There is a total depth of 3m of seawater of density 1030kg/m^3 on one side of the gate. Determine the tension in the cable.

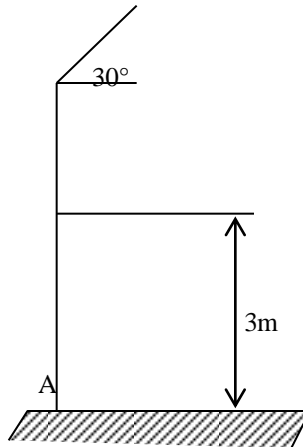


Figure 1

(10 marks)

Question Three

- (a) A uniform beam with mass of 32kg is 16m long and rests horizontally on two vertical supports. One support is 2m from the left-hand end of the beam and the other is 3m from the right-hand end. The beam carries concentrated loads of 1.3kN at the left-hand end and 1.5kN at the right-hand end. The beam also carries a uniformly distributed load of 100N/m length over the first 10m from the left-hand end. Calculate the reactions at the supports.

(7 marks)

- (b) The diagram below shows a number of forces in the same vertical plane acting on a light horizontal beam. Calculate:-

- The magnitude and direction of the equilibrant force
- The distance from C where this equilibrant force should be applied to keep the beam in equilibrium.

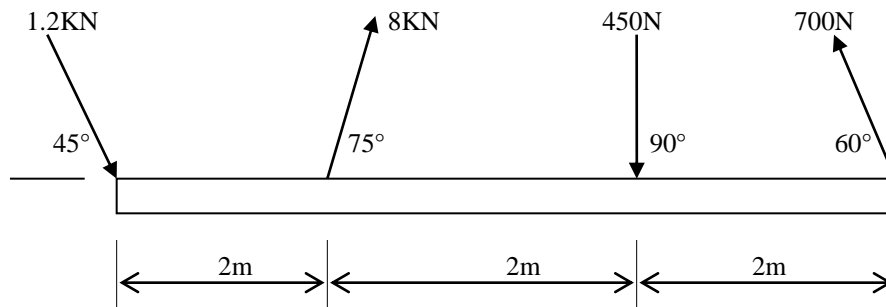


Figure 2

(13 marks)

Question Four

- (a) The figure below shows a steel strut with two grooves cut out along part of its length. Calculate the total compression of the strut due to a load of 240kN. $E = 200\text{GN/m}^2$

(10 marks)

- (b) An aluminium tie rod is 48cm long and 15mm diameter. If it is turned down to 7.5mm diameter for a length of 6cm at each end. Calculate the total extension due to a tensile load of 40,000N. $E = 70\text{GN/m}^2$

(10 marks)

Question Five

- (a) Derive the three equations of linear motion using letters u , v , t , a and s . (8 marks)
- (b) A pile-driving hammer of mass 0.5 tonne falls 2.4m from rest on to a pile of mass 145kg/ There is no rebound and the pile is driven 150mm into the ground. Calculate:-
- (i) The common velocity after impact
- (ii) The average resisting force of the ground in bringing the pile and driver to rest. (12 marks)