TECHNICAL UNIVERSITY OF MOMBASA

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

SECOND YEAR UNIVERSITY EXAMINATION FOR THE DEGREE IN BACHELOR OF SCIENCE IN ELECTRICAL & ELECTRONIC ENGINEERING (BSEE)

EME 2211
MECHANICAL ENGINEERING PRINCIPLES

END OF SEMESTER EXAMINATIONS

SERIES: DECEMBER, 2013

TIME: 2 HOURS

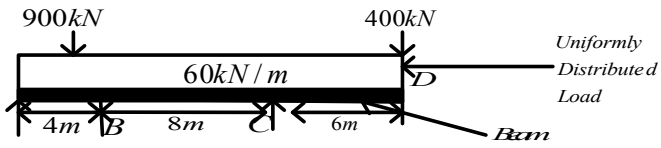
INSTRUCTION TO CANDIDATES

1. You should have the following for this examination:-
   - Answer Booklet
   - Scientific Calculator

2. This paper consists of **FIVE** questions.
3. Answer Question **ONE** and any other **TWO** Questions.
4. This paper consists of **FOUR** printed pages.

Question ONE (Compulsory)

(a) A wooden beam ABCD of length 18cm is simply supported at the points A and C. The beam is loaded as shown in Figure Q.1(a).



(i) Determine the reactions at the supports at points A and C. **(2 marks)**

(ii) Derive expressions (Equations) to determine the shearing forces and bending moment, on the beam. **(8 marks)**

(iii) Sketch the shearing force and bending moment diagrams of the beam. **(8 marks)**

(iv) Determine the position and magnitude of the maximum bending moment. **(2 marks)**

(b) An aluminum alloy of height 0.06m and breadth 0.028m as shown in Figure 1(b) is bent along the planes of the longer sides. Estimate the greatest allowable bending moment if the bending stresses are not to exceed 60mN/m^2 in tension or compression. **(10 marks)**

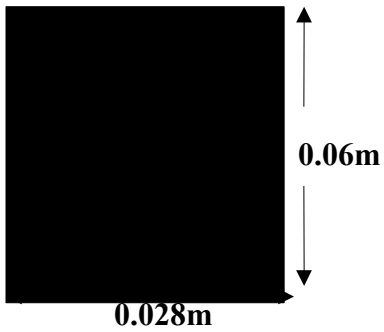


Fig. Q.1(b)

(8 marks)

Question TWO

(a) A horizontal cantilever of uniform section and of length L, carries a point load, w at the free end. Derive an expression for the slope and deflections and from these obtain an expression for the maximum deflection. **(12 marks)**

(b) With the aid of diagrams derive the flexure equation:

$$\frac{M}{I_x} = \frac{E}{R} = \frac{\delta}{y}$$

Where:

	M	=	Moment
	I	=	Second moment of area (moment of inertia)
	E	=	Youns modulus (Modulus of elasticity)
	R	=	Radius of curvature
	δ	=	Stress
	y	=	Distance above/below the neutral axis

(8 marks)

Question THREE

(a) State **FOUR** factors that determining the coefficient of fraction between the belt and the pulley. **(4 marks)**

(b) If the slip between the driver and the belt is S_1% and that between the belt and follower is S_2%. Show that:

Velocity Ratio $= \frac{d_1 + t}{d_2 + t}\left(1 - \frac{s}{100}\right)$

Where: t is the diameter of the belt
d_1 is the diameter of the driver
d_2 is the diameter of the follower

(6 marks)

(c) Two pulleys one 450mm diameter and the other 200mm diameter on parallel shafts 1.95m apart are connected by an open belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200Rpm if the maximum permissible tension in the belt is 1KN, and the coefficient of friction between the belt and pulley is 0.45?

(10 marks)

Question FOUR

A synthetic belt of 0.01m thickness and 0.25m breadth is used to run a steel pulley 1m in diameter at a speed of 5 revolutions per second. If the active arc on the smaller pulley is 110^o and stress on the tight side is 2mpa, find the power capacity of the belt the density of the belt may be taken as 980kg/m^3 and the coefficient of friction of the belt (snynthetic) on steel is 0.35. **(20 marks)**

Question FIVE

(a) Explain the terms gauge pressure and absolute pressure. **(2 marks)**

(b) Describe with sketches **TWO** methods of measuring atmospheric pressure. **(4 marks)**

(c) With the aid of a diagram show that the intensity of pressure at a point in a fluid at rest is the same in all direction. **(8 marks)**

(d) A tube manometer, Figure 5, measures the pressure difference between two points A and B in a liquid of specific weight W_2. Calculate the difference in pressure if a = 1.5m, b = 0.75m and L = 0.5m. If the liquid at A and B is water [$W_1 = 9.81 \times 10^3 N/m^3$] and the specific gravity of mercury is 13.6 (so that $W_2 = 13.6W$]. **(6 marks)**

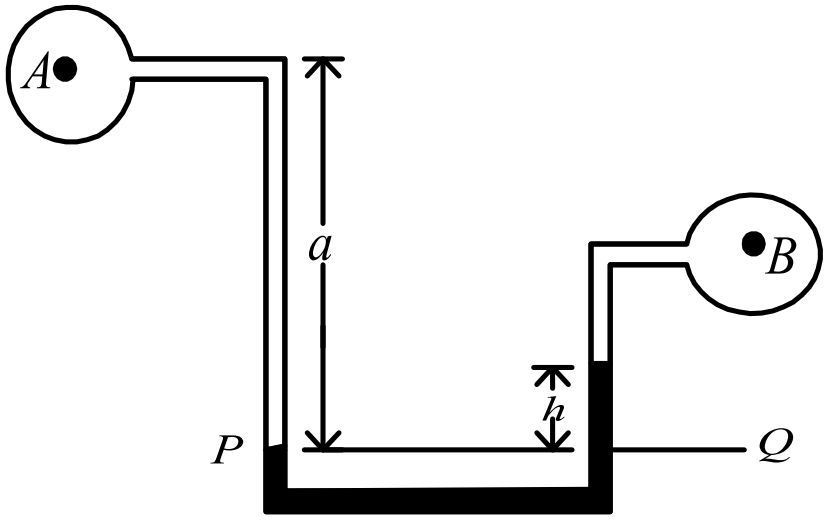


Fig. 5