THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF CIVIL AND BUILDING ENGINEERING

DBC/DCC 09A, CA 09,HDB10

SEMESTER EXAMINATION

MAY 2010 SERIES

AH 2104: APPLIED MATHS

TIME: 2 HOURS

<u>Instructions to Candidates</u>

You should have the following for this examination;

- Answer booklet
- Pocket calculator

This paper consists of **FIVE** Questions.
Answer Question **ONE** and any other **TWO** Questions.
Maximum marks for each part of a question are as shown.

Question ONE

(a). A vehicle of mass $1.5\times10^3 kg$ travelling at 75kmh^{-1} applies brakes and comes to a stop in a distance of 45m. Find:

(i). The time taken to stop the vehicle.
(ii). The average breaking force (neglecting air resistance).

(10 Marks)

(b). A body of mass 5kg lies on a rough surface which is inclined at 30^o to the horizontal. The frictional resistance of motion is 10N. The body is connected by a light string over a smooth pulley at the top of the slope to another body of mass 7kg which hangs vertically. Find the acceleration of the bodies and the tension in the string when the system is released (g=10ms^{-2}).

(10 Marks)

(c). A train truck of mass $2\times10^4 kg$ travelling at 2kmh^{-1} collides with another truck of mass $1.5\times10^4 kg$ moving in the opposite direction at 1kmh^{-1}. The trucks get stuck automatically after collision.

(i). Find the common velocity of the trucks after collision.
(ii). If the truck continue with uniform velocity find the driving force.

(10 Marks)

Question TWO

(a). An object of mass 4kg is acted on by coplanar forces 2, 5 and 7N which are directions 30^o, 210^o, 330^o respectively with respect to the horizontal axis. Find:

(i). The resistance force and its direction
(ii). The acceleration of the object

(12 Marks)

(b). A lift of mass 200kg is descending with an acceleration of 0.5ms^{-2} and carries a load of mass 80kg. Neglecting resistance to motion find:

(i). The tension in the lifts cable.
(ii). The normal contact force between the load and the lifts floor. (g=9.8ms^{-2}).

(8 Marks)

Question THREE

(a). Figure 1 shows a pin-jointed cantilever structure in which AD is vertical while AB and DC are horizontal. Angle DBC = 80°, and angle BCD = 60°. Find the forces in the members, stating whether each force is tensile or compressive. **(10 Marks)**

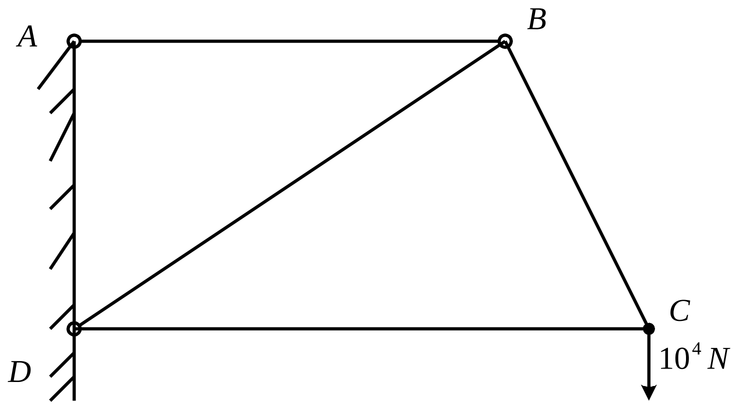

Fig. 1

(b). A sign of mass 5.0kg is hung from the end B of a uniform bar AB of mass 2.0kg and 4m long. The bar is hinged to a wall at A and held in an inclined position by an horizontal wire joining B to a point C on the wall vertically above A. The angle of inclination of the bar is 60° to the horizontal. Find:

(i). The force in the wire
(ii). The resistance force exerted by the huge at point A. ($g=10ms^{-2}$).

(10 Marks)

Question FOUR

(a). A simple pendulum has a period of 2.0 seconds and an amplitude of swing 5.0cm. Calculate the maximum magnitude of:

(i). The velocity of the bob.
(ii). The acceleration of the bob.

(11 Marks)

(b). A block of mass 3kg lies on rough horizontal surface. The block is connected by a light string over a smooth pulley to another block of mass 5kg which lies his on a smooth surface inclined downwards at 60° to the horizontal. If there is no motion when the system is released find the coefficient of friction for the rough surface. ($g=10ms^{-2}$). **(9 Marks)**

Question FIVE

(a). A crane lifts a mass of 60kg vertically upwards. Find the tension in the cranes cable when the load is travelling:

(i). with uniform acceleration $0.6ms^{-2}$

(ii). at uniform speed $5ms^{-1}$ ($g = 10ms^{-2}$).

(5 Marks)

(b). A projectile is fired from a height of 10m from the ground with a velocity of $400ms^{-1}$ at 30^o to the horizontal. Calculate:

(i). The greatest height above the ground it reaches.

(ii). Its height above the ground 30 seconds after firing

(iii). The time of flight. ($g = 10ms^2$).

(15 Marks)