THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

AMA 2109: APPLIED MATHEMATICS

SPECIAL/SUPPLEMENTARY EXAMINATON

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Pocket Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1

a) A solid object is thrown horizontally from the top of a hill 20m high. Find the distance the object will fall from the hill if the object had an initial velocity of $25ms^{-1}$ (Take $g=9.8ms^{-2}$). (8 marks)

b) A car of mass 1.5 x 103kg starts from rest and accelerates uniformly to a speed of 50 kmh^{-1} covering a distance of 40m. Determine;

i) The average driving force
ii) The time taken to cover the attained distance (8 marks)

c) A pin-jointed structure is as shown in figure 1.
i) Find the forces in the members of the structure
ii) State whether each force in c(i) is tensile or compressive (14 marks)

SECTION B (Answer *any TWO questions from this section*)

Question 2

a) A force of $\begin{pmatrix} -30 \\ 40 \end{pmatrix}$ N acts on a body of mass 10kg. the body then moves at a velocity of $\begin{pmatrix} 50 \\ 0 \end{pmatrix}$ ms^{-1} Find after 2 seconds;
i) Magnitude of the velocity
ii) Direction in which the velocity acts (7 marks)

b) A lorry of mass 2,000kg is towing a car of mass 500kg. Find the braking force of the lorry and force in the tow bar if towing was being carried out at $0.8ms^{-2}$. (7 marks)

c) A simple pendulum of length 50cm has an amplitude of 6.0cm. Find;
i) Maximum acceleration
ii) Velocity of the ϕ (take $g = 10ms^{-2}$) (6 marks)

Question 3

a) A body of mass 5kg lies on a rough horizontal surface. The body is connected by a light string cover a smooth pulley to another body of mass 2kg which hangs freely in a vertical direction. Find:
i) Tension in the string
ii) Acceleration of the body when the system is released (take friction resistance of 10N) (Assume $g = 9.8ms^{-2}$) (8 marks)

b) An object is thrown from a building at a velocity of $40ms^{-1}$ at an angle of 30^{o} to the horizontal. Find;
i) Horizontal range for the object
ii) Maximum height attained

iii) Height of the object after 2 seconds (take g = $10ms^{-2}$) (12 marks)

Question 4

a) A lift of mass 400kg is ascending to the top last floor of a building. The lift is carrying a 50kg load and is decelerating at $1.5ms^{-2}$. Find;

i) Tension in the lift cable
ii) The normal contact force between the man and the lift floor. (Take g = $10ms^{-2}$ and neglect resistance to motion) (8 marks)

b) A uniform ladder 5.0m long has a mass of 30kg. The ladder rests with its upper end against a smooth vertical wall and its lower end on a rough horizontal surface. The ladder is inclined at 50^o to the horizontal. A boy of mass 40kg is sitting on the ladder 3m above the ground. Find;

i) Magnitude of the force
ii) Direction in which force acts at the bottom of the ladder
iii) Coefficient of friction between the ground and the ladder (Take g = $10ms^{-2}$) (12 marks)

Question 5

a) An object of mass 8kg is acted on by coplanar forces 5N, 9N and 4N at bearings of 120^o, 45^o and 210^o respectively. Find;
i) Acceleration of the object
ii) Direction of the acceleration (10 marks)

b) The length and amplitude of a simple pendulum are 70cm and 5cm respectively. Calculate;
i) Maximum acceleration attained
ii) Velocity of the bob (Take g= $9.8ms^{-2}$)