THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

EME 2108 : MECHANICAL ENGINEERING SCIENCE I

YEAR I SEMESTER I

SUPPLEMENTARY/SPECIAL EXAMINATIONS

SERIES: MAY, 2011

TIME: 2 HOURS

Instructions to Candidates:

1. You should have the following for this examination:

    - Answer booklet
    - Drawing instruments
    - Calculator

2. This paper consists of **FIVE** Questions.
3. Question **ONE** is **COMPULSORY.**
4. Answer any other **TWO** Questions.

Question ONE

(a) A car is travelling at a uniform speed of 60km/h. It maintains this speed for 2 mins. It is then uniformly accelerated to 100km/h in one minute and then immediately retarded and brought to rest after a total of 6 minutes travelling time. The braking force is uniform:

(i) Draw a velocity-time graph.
(ii) Determine distance covered while accelerating.
(iii) The distance covered while braking.
(iv) The total distance covered while braking.
(v) The total distance covered.

(11 Marks)

(b) A vehicle fitted with tyres having a running radius of 380mm is brought to rest in a distance of 70m from a speed of 45km/h. Calculate:

(i) The retardation of the vehicle.
(ii) The initial angular velocity of the wheels in revs per minutes.
(iii) The angular retardation of the wheels.

(9 Marks)

(c) A car of mass 900kg has its speed reduced from 126km/h to 36km/h in 10s by the application of brakes. Assuming the deceleration is constant. Determine:

(i) The value of the deceleration produced.
(ii) The force producing the deceleration.
(iii) The distance travelled during braking period.
(iv) The heat generated at braking surface.

(10 Marks)

Question TWO

The pin-jointed framework in figure 2 is loaded and supported as shown. Using the graphical method determine the magnitude and nature of the forces in all members.

(20 Marks)

Question THREE

(a) A projectile is aimed at a mark on the horizontal plane through the point of projection. It falls 12m short when the angle of projection is 15˚; while it overshots the mark by 24m, when the same angle is 45˚. Assuming no air resistance, determine the angle of projection to hit the mark. (13 Marks)

(b) A particle is fired with a velocity of 8m/s at an elevation of 65˚. Find its velocity and direction after 5 seconds.

(7 Marks)

Question FOUR

(a) Referring to fig. 1. If the combined moment of the two forces about c is zero, determine:

(i) The magnitude of the force P.
(ii) The resultant of the two forces.

Figure 1a

(13 Marks)

(b) A triangle ABC has three forces of 40N, 50N and 30N as shown in figure 1b. Determine the magnitude of the resultant.

Figure 1b

(7 March)

Question FIVE

(a) Define simple harmonic motion. (2 Marks)

(b) A body of mass 12kg moves with Shm in a straight line over a distance of 400mm on each side of its central position. If the frequency of the motion is 2.5Hz. Determine:

(i) The maximum acceleration of the body.
(ii) The maximum force acting on body.
(iii) The maximum velocity of the body.
(iv) The acceleration and velocity of the body at a point 150mm from the central position.

(12 Marks)

(c) A mass of 4kg is placed on a rough plane as shown in fig. 5. This mass is attached to a light inelastic cord passing over a light fractioness pulley and other end connected to a body of mass 2kg hanging vertically. The cord is parallel to the plane and the frictional force opposing motion of 4kg mass is 10N. If the system is released from rest, calculate:

(i) The acceleration of the system.
(ii) The tension in the rope.

(6 Marks)

Figure 5