TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

CERTIFICATE IN MECHANICAL ENGINEERING (PLANT OPTION)
CERTIFICATE IN MECHANICAL ENGINEERING (AUTOMOTIVE OPTION)

EME 1103
MECHANICAL SCIENCE I

END OF SEMESTER EXAMINATIONS

SERIES: DECEMBER, 2013

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

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

2. This paper consists of **FIVE** Questions.
3. Answer **ANY THREE** Questions.
4. All Questions have equal marks.
5. **This paper consists of FOUR printed pages.**

Question ONE

(a) Give the basic SI units of the following qualities:

(i) Mass
(ii) Time
(iii) Velocity
(iv) Density

(4 marks)

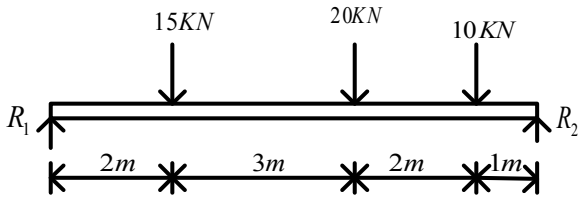
(b) Explain the following is standard form and in SI units:

(i) 6.7mΩ
(ii) 20kV
(iii) 3500rev/min

(3 marks)

(c) (i) State the principle of moments. **(13 marks)**

(ii) The beam shown in Figure Q.1 is simply supported at its ends and loaded as shown. Determine the support reactions:



Question TWO

(a) (i) Define the following as applied to Kinematics:

(I) Speed
(II) Retardation

(ii) State the **THREE** equations of motion linear.
(iii) State the **THREE** Newton's laws of linear motion.

(8 marks)

(b) A train starts from nest and accelerates uniformly to a speed of 30km/h in 25 seconds. This speed is kept constant for one minute after which the brakes are applied to bring the train to rest with uniform deceleration. The total distance covered in 2km. With aid of a velocity-time graph calculate:

(i) The acceleration
(ii) The distance covered while decelerating
(iii) The time taken in deceleration

(12 marks)

Question THREE

(a) State the **THREE** equations of angular motion. **(3 marks)**

(b) The speed of a shaft increases from 300rev/min to 360rev/min while turning through eighteen complete revolutions. Calculate:

(i) The angular acceleration
(ii) The time taken for this change

(8 marks)

(c) A flywheel 0.7m in diameter is uniformly accelerated from 45 rev/min and rotates sixty times in reaching a speed of 100rev/min. Determine:

(i) The angular acceleration
(ii) The time taken to attain the speed of 100rev/min
(iii) The linear acceleration of a point on the rim

(9 marks)

Question FOUR

(a) (i) Define force.
(ii) State the parallelogram rule of forces.

(3 marks)

(b) Two forces of 15N and 10N act on a body at 80^{o} to each other. Calculate the resultant of the two forces in magnitude and direction. **(7 marks)**

(c) Four horizontal wires are attached to the top of a post and exert the following tensions on its. 10N due North, 15N due E, 20N due Southwest and 25N due South East.

Calculate the magnitude of the resultant and the direction in which it acts.

(10 marks)

Question FIVE

(a) State **FOUR** examples of simple machines and express the velocity ratio in each case.

(8 marks)

(b) A pulley system consists of an upper block fitted with four pulleys and a lower block fitted with three pulleys. An effort 240N is required to raise a body having a mass of 85kg.

Sketch the arrangement and calculate:

(i) The velocity ratio
(ii) Mechanical advantage
(iii) the efficiency
(iv) The deal mechanical advantage

(12 marks)