TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING
(DME Y1 S1)

EME 2102: MECHANICAL ENGINEERING SCIENCE I

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*

This paper consists of **FIVE** questions. Answer any **THREE** questions

All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One

a) Define the following terms as applied to motion:

- **(i)** Speed
- **(ii)** Velocity
- **(iii)** Acceleration
- **(iv)** Vector quantity
- **(v)** Scalar quantity **(5 marks)**

b) State the THREE newtons equations of linear motion. **(3 marks)**

c) A train starting from rest accelerates uniformly reaching a speed of 60km/h in one minute. This speed is maintained for 2 minutes after which brakes are applied bringing the train to rest with uniform retardation. The total distance covered is 3km. By drawing a velocity-time graph find:

- **(i)** The acceleration in m/s^2
- **(ii)** The distance covered while retarding
- **(iii)** The distance covered while accelerating
- **(iv)** The time taken in acceleration **(12 marks)**

Question Two

a) State the THREE Newton's laws of angular motion. **(3 marks)**

b) A point moves in a circle of radius 1m.

- **(i)** What must be its speed to give an acceleration of $4m/s^2$ towards the centre?
- **(ii)** Find the angular velocity in rev/min **(6 marks)**

c) A flywheel 0.8m in diameter is uniformly accelerated from 40rev/min and revolves completely fifty times reaching a speed of 150rev/min. Find:

- **(i)** The angular acceleration
- **(ii)** The time taken to attain the speed of 150rev/min
- **(iii)** The linear acceleration of a point on the nim **(11 marks)**

Question Three

a) (i) State the parallelogram of forces rule: **(4 marks)**

(ii) State the triangle of forces rule. **(4 marks)**

b) Forces 6N and 4N act at an angle of 60º. Find graphically their resultant in magnitude and direction. **(6 marks)**

c) Four horizontal wires are attached to the top of a post and exert the following tensions on it. 10N due N, 15N due E, 20N 5W and 25N SE. Calculate the resultant pull on the post and the direction in which it acts. **(10 marks)**

Question Four

a) Define the following terms and give their equations:

(i) Kinetic energy
(ii) Potential energy
(iii) Work done on a body of mass Mkg **(6 marks)**

b) A linear of mass 25,000 tonnes is driven at its maximum speed of 50km/h when the engines are working at 55,000kw. Find the resistance to motion in N/tonne. **(7 marks)**

c) A body whose mass is 50kg falls freely through a vertical height of 8m.
(i) What is the velocity of striking
(ii) How much kinetic energy does it posses upon striking the ground. **(7 marks)**

Question Five

a) Define the following terms:
(i) Specific heat capacity
(ii) Specific latent heat of fusion
(iii) Coefficient of cubic expansion **(6 marks)**

b) Explain THREE modes of heat transfer. **(6 marks)**

c) Find out how much heat energy is given out when 2kg of steam at 100°C is cooled to ice at -10°C and then warmed to water at 30°C. Take:

S_P latent heat cap of water as 4.12kJ/kgk

S_P latent heat of fusion 335kJ/kg

S_P latent heat of vaporization 21kJ/kg **(10 marks)**