TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
Diploma in Mechanical Engineering (Y1S1)
EME 2102 : Mechanical Engineering Science I (Paper 2)
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS
DATE: Sep 2018

Instruction to Candidates:

You should have the following for this examination

- *Examination Pass & Student ID Card*
- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt any **THREE** questions.
Maximum marks for each part of a question are as shown.
Do not write on the question paper.

Question ONE

a) Explain the following terms as applied to linear motion, giving units where applicable. **(8 marks)**

i. Displacement
ii. Acceleration
iii. Vector quantity
iv. Scalar quantity.

b) A car accelerates uniformly from rest at 2 m/s^2 and immediately begins to decelerate to a stop at 3 m/s^2. The total distance covered is 2 km. **(12 marks)**

i. Find the total time taken.
ii. Find the greatest velocity attained.

Question TWO

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

b) After the power to drive a shaft is shut off, it is seen to describe 200 revolutions in the first 50 seconds and finally comes to rest in a further 30 seconds. If the retardation is uniform, Calculate; **(8 marks)**

i. The initial angular velocity in rev/min.
ii. The retardation.

c) Winding drum of mass 100 tonnes has a radius of gyration of 1.5 m. Find, **(9 marks)**

i. The constant torque required to increase the speed from 40 rev/min to 90 rev/min in 50 seconds if the friction torque is 10 kNm.
ii. If the wheel is rotating freely at 90 rev/min and brakes are applied bringing it to rest in 100 revolutions, find the brake torque assuming uniform retardation.

Question THREE

a) With regard to projectiles; **(7 marks)**

i. Define a projectile.
ii. Derive the equation for the range of a projectile in the horizontal axis.

b) A stone is throne with a velocity of 70 m/s at an angle of 45° to the horizontal from the ground. Calculate, **(13 marks)**

i. the greatest height reached by the stone
ii. the range
iii. the time of flight
iv. the time the stone is three-quarters the maximum height.

Question FOUR

a) A simple pendulum was observed to perform 40 oscillations in 20 seconds, each of amplitude 7°. Calculate: **(10 marks)**

i. the length of the pendulum
ii. velocity and acceleration of the bob at a displacement of 5° from the rest position.
iii. maximum velocity and maximum acceleration and where each occurs.

b) A vertical spring of stiffness 500 N/m was set oscillating while carrying a mass of 600 g with an amplitude of 40 mm. Find: **(10 marks)**

i. the periodic time.
ii. the velocity and acceleration when at a displacement of 30mm from the rest position.
iii. the maximum velocity and maximum acceleration and where each occurs.

Question FIVE

The framework in the figure below carries a mass of 4 tonnes at the lower middle joint. Find the forces in all bars and state whether the bars are in tension or compression.

(20 marks)