TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR THE BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(BSCE)

SPH 2170: PHYSICS I

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME: 2 HOURS

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

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY)

Question One

a) State Newton's second law of motion. **(2 marks)**

b) Use the dimensional analysis to check the equation.

$V = 2ax$

, where V is velocity, a is acceleration and x is displacement. **(2 marks)**

c) A person is on a ride that takes him in a vertical circle of radius 8m. At the highest point, the person is upside down and his apparent weight is half his time weight. What is the speed at this point?
(4 marks)

d) A person is at the top of a building of height 100m. Ball A is thrown upward at $5ms^{-1}$ and ball B is thrown downward at $20ms^{-1}$ two seconds later.

(i) What and when do the balls meet? **(2 marks)**

(ii) What are their velocities when they meet? **(3 marks)**

e) State the first law of thermodynamics. **(1 mark)**

f) State **TWO** applications of a diabetic processes in engineering practices. **(2 marks)**

g) Differentiate between transverse and longitudinal wave. **(2 marks)**

h) A converging lens has a force length of 12cm. The image of a real object is enlarged by 50% locate the object and the image. **(3 marks)**

i) Given that an object executing a simple harmonic motion has its displacement $X = A\cos(\omega t + \phi)$, show that ω the angular frequency is given as:

$$\omega^2 = \frac{k}{m}$$

where k is spring constant and M mass of the object. **(5 marks)**

j) Differentiate the term strain and stress. **(2 marks)**

k) Differentiate near point from far point with respect to optics. **(2 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) A projectile is fired from ground level at 3s the horizontal. At a later time its horizontal displacement is 40m and its height is 20m. Determine:

(i) Initial speed **(5 marks)**

(ii) Velocity at the given point **(5 marks)**

b) A driver of truck moving at 30ms-1 suddenly notices a goat 70m straight ahead. If the driver's reaction time is 0.5s and the maximum deceleration is 8m/s2, can he avoid hitting the goat without steering to one side? **(5 marks)**

c) A particle is thrown vertically up at 28ms-1 from the ground. Determine its velocity at a height of 20m and the time the particle will be at 12m. **(5 marks)**

Question Three

In compact disc, audio information is stored in series of pits and flat areas on the areas on the surface of the disc. This information is read by the compact disc player. Given that cd player moves with a constant speed of 1.3m/s and using the figure below:

58mm

Determine:

(i) Angular speed of the disc in revolution per minute when information is being read from the innermost first track (r = 23mm) and the outermost final track. (y = 58mm) **(8 marks)**

(ii) Maximum playing time of a standard music CD is 74 min and 335. How many revolution does this disc make during the time. **(6 marks)**

(iii) What total length of track moves past the objective lens during this time? **(2 marks)**

(iv) What is the angular acceleration of the CD over the 44743 seconds time interval? Assume that α is constant. **(4 marks)**

Question Four

a) Two objects of mass M_1 and M_2 are hung vertically over a frictionless pulley of negligible mass. The system accelerates as shown below. Where M2>m1.

M_1

Determine:

(i) Magnitude of acceleration of the two objects given that:
$M_1 = 1kg \ \ and \ \ M_2 = 2kg$
(8 marks)

(ii) Tension in the cord supporting the two masses. **(4 marks)**

b) A block of mass m = 1.2kg is held against a rough wall $\mu s = 0.2$ by a force $\vec{F}$ directed at an angle $\alpha = 10^o$ above the horizontal as shown below. What is the minimum value of $\vec{F}$ for the block to remain stationary? **(5 marks)**

F

c) A piece of copper originally 305mm long is pulled with a stress of 276MPa. If the deformation is entirely elastic, what would be the resultant elongation (E of copper = 110GPa) **(3 marks)**

Question Five

a) A wheel of a car has a radius of 20cm. It initially rotates at 120rpm. In the next minute it makes 90 revolutions.

(i) What is the angular acceleration? **(4 marks)**

(ii) How much further does the car travel before coming to rest. **(4 marks)**

$$x = \left(7 - -2t + 3t^2\right)m$$

b) The position of a perhile is given by .

Determine:

(i) The average velocity between 2s and 3s. **(3 marks)**

(ii) The average acceleration between 2s and 3s. **(3 marks)**

(iii) The acceleration at 2s. **(2 marks)**

c) A car travels at 12ms-1 around a flat curve of radius 40m. What is the minimum coefficient friction required. **(4 marks)**