DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY
UNIVERSITY EXAMINATIONS 2016/2017

FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAMINATION FOR THE BACHELOR OF SCIENCE IN CIVIL ENGINEERING, MECHANICAL ENGINEERING, MECHATRONIC ENGINEERING, BSc ELECTRICAL AND ELECTRONICS ENGINEERING, BSc GIS AND GEGIS, BACHELOR OF EDUCATION TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING, BACHELOR OF EDUCATION TECHNOLOGY IN MECHANICAL ENGINEERING

SPH 2170 PHYSICS I/SPH 2173 PHYSICS FOR ENGINEERS I

_23/06/2017_   **11-1PM**

INSTRUCTIONS: Answers question <u>One</u> and any other **two** questions.

<u>Some Useful Constants:</u>

  i. $c = 3 \times 10^8$ m/s
 ii. $g = 10$ m/s^2
iii.   Density of water $= 1$ g/cm^3
 iv.   Specific heat capacity of water $= 4200$ J/kgk
  v.   Atmospheric pressure $= 101.3$ kpa
 vi.   Universal gas constant 8.314 J/mol.k.
vii.   Specific heat capacity of ice $= 2100$ J/kgk
viii.   Specific heat capacity of ice$=390$ J/kgk.
 ix.   Latent heat of fusion Ice $= 3.6 \times 10^5$ J/kg
  x.   Latent heat of vaporization of water $= 2.26 \times 10^6$ J/kg.

Question One (30 Marks)

a) Define the following terms

(i) vector (1 mark)

(ii) Angular speed.(1 mark)

(iii) Critical Velocity(1 mark)

b) A horizontal rope pull a 40kg round block along a smooth horizontal track. If the tension in the cable is 450 N how long will it take the block to reach a speed of 15m/s taking that the block moves from rest. (3marks)

c) State two factors that affect the conduction of heat.   (2 marks)

d) State the Snell's law.   (1marks)

e) A horizontal merry go round rotates at 80 revolutions per minute. It has diameter of 2.8 meters. What is the linear speed of a person standing at the edge of the merry go round? (3 marks)

f) A person wants to have a bath in water at 38^0C. How much water at $90°C$ should the person add to 50kg of water at $23°C$ to achieve the desired temperature?. (3 marks)

g) State three characteristics of electromagnetic waves in a vacuum.   (3 marks)

h) Determine the volume of one mole of any ideal gas at "Standard temperature and pressure i.e. s.t.p. (3 marks)

i) An object of 3cm high is placed 24cm from a concave mirror whose focal length is 10cm.Calculate the image height. (4 marks)

j) State Newton's first and third laws of motion.   (2 marks)

k)Two forces $(400N, 300°)$ and$(350N, 160°)$are acting at one point. Calculate the resultant force.(3 marks)

Question Two (20 marks)

(a)Draw a ray diagram to show how prisms are used in periscopes. (3 marks)

(b)State the two conditions necessary for total internal reflection to occur. (2 marks)

(c)A photographer focuses his camera on a person standing 8 meters from the lens. If the lens has a focal length of 3m, calculate the image distance and linear magnification of the image.(4 marks)

(d)The equation of a certain traveling transverse wave is given by$y = 4.6 \sin(120\pi t - 20x)$ where x and y are in meters and t in seconds. Determine:

i) the frequency and period of the wave. (4 marks)

ii) the speed of the propagation.(3 marks)

(e)State 3 principal rays of a convex lens. (3 marks)

Question 3 (20marks)

a) State

i) Hooke`s law.(1 mark)

ii) Principle of conservation of energy.(1 mark)

iii) Principle of conservation of linear momentum.(1 mark)

b) Define the following terms.

    (i) Simple harmonic motion.(1 mark)

      (ii)angular speed .(1 mark)

c) A body of mass 300g moves with S.H.M of amplitude of 55cm and period of .02 seconds. Calculate the frequency of the S.H.M and the magnitude of force of the body at t= 2 seconds. (4 marks)

d) A block of mass M is initially at rest on a frictionless surface at the origin. At t = 0 a decreasing force of $F = (4t^2 - e^{2t} + 4)N$ acts on it. Determine the equation of its velocity two seconds later. (4 marks)

e) State 2 factors that affect the rate of heat radiation. (2 marks)

f) Show that a particle in a projected at an angle θ traces a parabolic curve.(5 marks)

Question 4 (20 marks)

    a) State

      i) Boyles law.(1mark)

      iii) Pressure law.(1 mark)

    b) A cylinder fitted with a movable piston contains $500cm^3$ of a gas at 77^0C and 240 kpa. It is heated to 517^0C. If the pressure is reduced to 130kpa by moving out the piston, determine the new volume of the gas. (4 marks)

    c) A metal container of mass 300g contains 800g of water at a temperature of $25°C$. A block of copper of 1.5kg at a temperature of $83°C$ is dropped into the container and the temperature is observed to increase to $33°C$. Neglecting the heat losses to the surrounding, determine the specific heat capacity of the container. (5marks)

    d) How much heat is required to convert 220g of ice $at - 5°C$ to steam at $98°C$ assuming no heat losses to the surrounding? (4 marks)

    e) State three factors that determine the terminal velocity of a fluid in horizontal tubes.(3 marks)

Question 5(20 mks)

    a) Define the following terms.

      (i) Stress.(1mark)

      (ii) Elasticity.(1 mark)

(iii) tensile strength.(1 mark)

b) Sketch and explain stress-strain curve of an elastic object under tensile test.(4 marks)

c))A mass of 250kg is suspended from a wire whose length is 4m.The wireis found to stretch to 4.025m. The coiled-stretched area of the wire, which can be assumed to be constant, is 0.36mm^2. Determine the Young's modulus of elasticity of the wire. (5marks)

d) Water at a speed of 8m/s is pumped through a pip e with a diameter of 9cm to a shower terminal having 80 holes, each with a diameter of 0.5mm. Determine the speed of delivery of the water from the shower. (5 marks)

e) State three kinds of strains.(3 marks)