KIMATHI UNIVERSITY COLLEGE OF TECHNOLOGY

UNIVERSITY EXAMINATION 2012/2013

YEAR ONE SEMESTER ONE EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE

IN TELECOMMUNICATION AND INFORMATION ENGINEERING, CIVIL ENGINEERING, MACHATRONIC ENGINEERING ,MECHANICAL ENGINEERING AND ELECTRICAL AND ELECTRONIC ENGINEERING

SPH 2170: PHYSICs I & SPH2173 PHYSICS FOR ENGINEERS I

Instructions: Answer question ONE and any other TWO questions

Some useful constants.

a)c= $3x10^8$ m./s

b) g = 9.8 m/s^2

c) Specific heat capacity of water = 4200J/kg K

d) Density of water $1g/cm^3$

e) Universal gas constant R = 8.314J /mol.k

f) Latent heat of fusion of water 334000J/kg

g) Specific heat capacity of copper is 390J/kg k

h) Specific heat capacity of ice is 2100J/kg k

i) 1 atm.= 101.3kpa.

j) ± =$5.67x10^{-8}$ $wm^{-2}k^{-4}$

Question one

a) Define the following terms (5mks)

i) law

ii) principle

iii) heat

iv) temperature

v) angular speed

b) Using dimensional analysis , find the dimension of energy (2mks)

c) State the Laws of reflection (2mks)

d) (i) State four characteristic of visible light as part of e.m.w. (2mks)

(ii) A certain FM station transmit at a λ of 150 km . Determine its frequency and period. (2mks)

e) A Convex lens has a focal length of 40cm . If an object is placed 55cm from the lens, draw a ray diagram to show the location of the image formed . State the characteristic of the image formed. (4mks)

f) State and explain the ways how heat loss is reduced in a thermos flask. (2mks) .

g) A block of mass M is initially at rest on a frictionless surface at the origin. At t= 0 second a increasing force F=2t +6 acts on it . Determine the equation of its velocity at any time t .{V(t)} . (3mks)

h) Determine the volume of three mole of any ideal gas at 'standard temperature and pressure`. (2mks)

i) A particle moves in the X-Y plane , its co-ordinate are given as a function of the time by $X = r\cos(\omega t)$,$Y = r\sin(\omega t)$ where r and ω are constants. Show that the magnitude of the particles acceleration is a constant. (3mks)

j) 2000g of ice at -5 ^{o}C are dropped into a calorimeter containing 3kg of water at 20^{o}C . The calorimeter is of copper and has a mass of 550g. Calculate the final temperature of the system assuming no heat losses. (3mks)

Question Two (20 marks)

a) Define the following terms (4mks)

i) Transverse waves

ii) Refraction

iii) Diffraction

iv) Plane mirror

b) Draw the ray diagram to show how a Bi-convex lens is used as a simple microscope. (4 mks)

c) A diverging lens has a focal length 0f 30cm.,determine the object distance if the image formed is 20 cm from the lens. (4 mks)

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

e) A person focuses a camera on a footballer standing 4 meters from the lens. If the lens has a focal length of 1 meter, calculate the image distance and linear magnification of the image.(5 mks)

QUESTION THREE(20 marks)

a) State (3mks)

(i)Boyle`s Law

(ii) Pressure Law

(iii) Charles Law

b) The pressure of a car tyre was checked at 60^0c and was found to be 5.2kpa gauge. After two hours its temperature increases to 75^0c. If the volume of the tyre is constant, calculate the gauge pressure reading at the new temperature. (3mks).

c) Define the following terms (4mks)

i. Heat capacity
ii. Radiation
iii. Latent heat of vaporization
iv. Latent heat of fusion

d) A thin rectangular steel plate 40 cm by 60 cm is heated in fire to a temperature of 500 degree Celsius. Taking emissivity to be unity, determine the total rate of radiation of the heat energy. (3mks)

e) When one steps out of the shower one feels cold, but as soon as one is dry one feels warmer even though the room temperature is the same. Explain why. (4mks)

f) A person wearing spectacles in a hot sunny day wishes to make fire using the spectacles. Is the person short sighted or long sighted. Explain.(3 marks)

QUESTION FOUR (20 marks)

a) Define the following terms. (2mks)

(i) direct stress (ii) volume strain (iii) elasticity (iv) plasticity

b) A diffraction grating with 2.0×10^5 line per centimeter produces third image at a diffraction angle of 20^o, determine the wavelength of the light used. (3mks)

c) A body of mass 200g moves with S.H.M of amplitude of 80cm and period of 20seconds.

i) Calculate the frequency of S.H.M .(3mks)

ii) Calculate the force on the body at t= 0.5 second (4mks)

d) The equation of a transverse wave on a string is given by $y= 2\pi \sin \{\pi (0.5x+120t)\}$ where x and y are in meters and t in seconds. Determine

i) the amplitude of the wave (2mk).

ii) frequency of the wave (3mks)

iii) velocity of the propagation (3mk)

QUESTION FIVE (20 marks)

a) Define the following terms (2mks)

i) vibration

ii) displacement

b) An object is projected with a velocity Vo m/s at an angle θ. Derive the equation of the objects trajectory. (5mks)

c) The velocity equation of an object motion is given by .

$V= (20t^2 - 10t +50)$ m/s

Calculate.

i)The instantaneous acceleration at the time t= 4 second. (3mks)

ii) The average acceleration in the time interval t = 1 seconds to t= 4 seconds. (3mks).

d)(i) State and explain two factors that determine the rate of heat conduction. (4mks)

(ii)Using dimensional analysis, find the dimensions of rate of heat conduction.(3mks)