TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MEDICAL LABORATORY SCIENCES

APS 2106: MEDICAL PHYSICS.

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: Sep 2018

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of FIVE questions. Attempt question one (compulsory) and any other Two questions.
Do not write on the question paper.

Question ONE (30MKS)

a)Define the following terms

i)Angular velocity   (1mk)

ii)Centripetal acceleration   (1mk)

iii)Explain the term interference.   (1mk)

b)Give two differences between heat and temperature   (2mks)

c)Calculate the quantity of heat required to raise the temperature of a metal block with a heat capacity of 460 JK^{-1} from 15^0c to 45^0c   (3mks)

d) The figure I below shows how rays from a distant and near objects are focused inside a human eye with a certain defect.

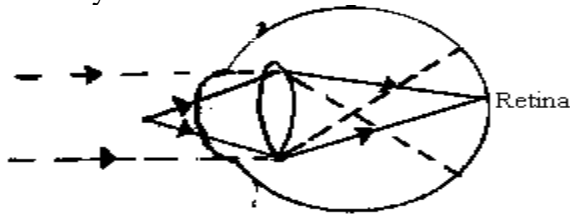figure 1

       i)   Name the defect   (1mk)

       ii)   State two causes of the defect.   (2mks)

       iii)   Suggest a corrective measure to the defect.   (1mk)

(e)   A stone is whirled with uniform speed in horizontal circle having radius of 10cm. It takes the stone 10 seconds to describe an arc of length 4cm. Determine:

(i)   The angular velocity ω (2mks)

(ii)   The period T (3mks)

f)i) Differentiate between a dimension and a unit with giving examples   (2mks)

  ii) Differentiate between precision and accuracy   (2mks)

g) What are some of the advantages of MRI   (2mks)

h)Define Magnetic Resonance Imaging (MRI)   (2mks)

i) i)Define pressure and give its SI unit   (2mks)

ii)The left side of the heart creates a pressure of 120mmHg by exerting a force directly on the blood over an effective area of $15.0cm^2$. What force does it exert to accomplish this. (density of mercury is $13600kg/m^3$)   (3mks)

Question TWO (20MKS)

a)State the basic law of electrostatic charges   (1mk)

b)Define electric charge and give its SI unit   (2mks)

c) i)State **two** factors that determine the capacitance of a parallel plate capacitor.   (2mks)

ii) Figure 2 shows a circuit containing three capacitors C_1, C_2 and C_3

Figure 2
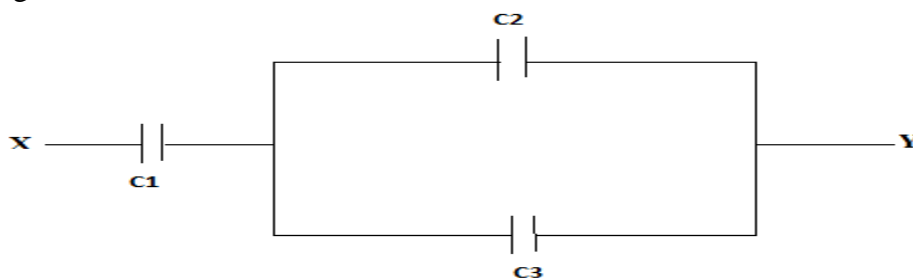
    (i) Write an expression for the effective capacitance between X and Y.   (2mks)

(ii) If C1=6µF, C2=4.5µF and C3 = 7.5µF. Calculate the effective capacitance.　(3mks)
(d) What are the effect on capacitance of a parallel plate capacitor when
  (i) Increasing the area overlap of the plate?　(1mk)
  (ii) Increasing the distance of separation between the plates?　(1mk)
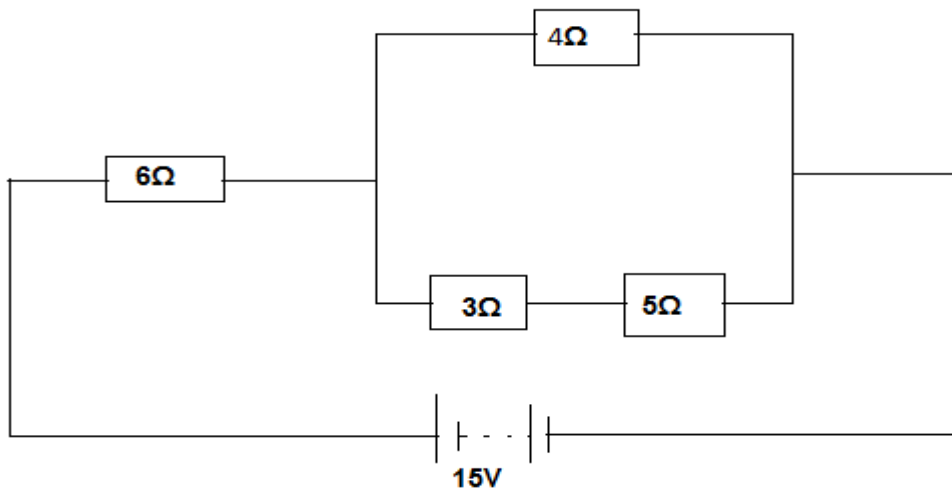e)Figure 3 shows a network of resistors connected to power supply of 15V.

Figure 2

Determine
  (i) The effective resistance of the network　(3mks)
  (ii) The total current flowing through the circuit　(2mks)
  (ii) The voltage across the 3 Ω resistor　(3mks)

Question THREE (20MKS)

Define the following terms

a)Angular acceleration　(1mk)

b)Angular displacement　(1mk)

c)A body has an angular velocity of 125 rad/s. Find the time it will take to make 550 complete revolutions　(4mks)

d)A body attached to one end of a string 0.8m long is whirled in space in a horizontal circle at 30 revolutions per minute. What is the speed of the body along the circumference?　(3mks)

e) A model car moves round a circuit track of radius 0.4m at 2 revolution per second.

   What is:

   i) Period T?　(2mks)

   ii) Angular velocity ω?　(3mks)

   iii) Speed v?　(3mks)

f)The diagram below figure 4 contains suspension in a liquid. The tube is rotated in an horizontal circle as shown below.
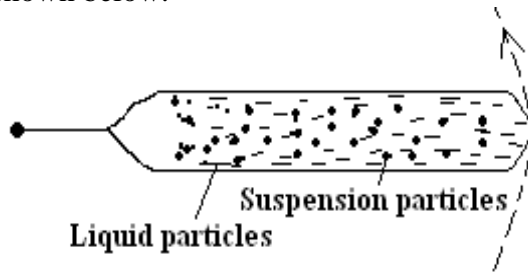

Figure 4

i) Explain what happens to the liquid and suspension particles. (2mks)

ii) Show the position f the suspension and liquid particles after the rotation stops. (1mk)

Question FOUR (20MKS)

a)Differentiate between transverse and longitudinal waves. (2mks)

b)Give two main differences between electromagnetic waves and mechanical waves (2mks)

c)Define the following terms as used in waves

i)Period (1mk)

ii)Frequency (1mk)

iii)Radio X is broadcast on wavelength 150m at a frequency of 200KHz. Calculate the velocity of the radio waves. (3mks).

d) For the following diagram of a wave which is drawn on a graph grid:
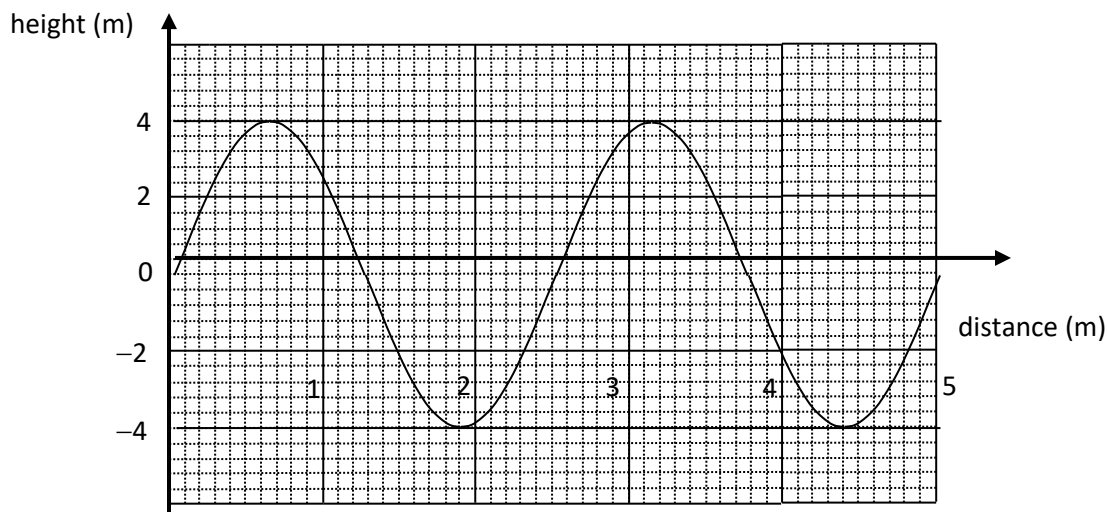
i)Give the name of the wave drawn above and give reasons for your answer (2mks)

ii)State the amplitude and the wavelength of the wave (2mks)

e)Explain in details the following terms as used in optics

   i) Reflection (2mks)

ii)Refraction (2mks)

f)Explain the advantages of optical imaging over x-rays in examining of internal organs (3mks)

Question FIVE (20MKS)

a)Explain any three modes of heat transfer (6mks)

(b) Define the term specific heat capacity and state its SI unit (2mks)

(c) A block of metal of mass 300g at 100^0c is dropped into a logged calorimeter of heat capacity $400Jk^{-1}$, containing 200g of water at 20^0c. The temperature of the resulting mixture is 34^0c.
  (Specific heat capacity of water = $4200Jkg^{-1}k^{-1}$)
  Determine:
  (i) Heat gained by calorimeter. (3mks)

  (ii) Heat gained by water. (3mks)

  (iii) Heat lost by the metal block. (3mks)

  (iv) Specific heat capacity of the metal block. (3mks)