UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
WEEKDAY PROGRAMME END OF SEMESTER ONE EXAMINATIONS

ACADEMIC YEAR 2024/2025

DEPARTMENT: ICT

SEMESTER: ONE

PROGRAMME(S): HIGHER EDUCATION CERTIFICATE – ENGINEERING (HECE)

YEAR OF STUDY: ONE

COURSE: PHYSICS I

COURSE CODE : HECE112

DATE: WEDNESDAY 11TH, DECEMBER 2024

TIME: 2:00 PM – 5:00 PM

DURATION: 3 HOURS

INSTRUCTIONS:

(i) This paper contains two Sections: A (40 marks) & B (60 marks).
(ii) Attempt ALL questions in Section A, and ONLY THREE questions in Section B.
(iii) All questions in Section B carry equal marks.
(iv) Credit will be given for use of relevant examples and illustrations.
(v) Begin each number in Section B on a new page of the answer sheet.
(vi) DO NOT write on this question paper.

SECTION A [40 MARKS]

Attempt **ALL** the Questions in this Section.

Question 1

1. A car of mass 1000kg moving on a rough horizontal surface is brought to rest in a distance of 10m by steady applications of brakes. If the coefficient of the sliding frictional force between the surface and the tyres is 0.4. Calculate the work done by the frictional force. **(4 marks)**
2. Values of the property.

	Ice point	Steam point	Room temperature
Pressure in mmHg	760	1040	795

Using the above data, calculate the room temperature on the scale of a gas constant volume gas thermometer **(4 marks)**

3. Define thermometric property **(2 marks)**
4. (i) What is meant by *specific heat capacity* of a substance? **(2 marks)**
   (ii) Calculate the amount of heat required to raise the temperature of 20g of water from 30^0c to 60^0c. **(4 marks)**
5. A current of 5A and voltage of 48V heats a 1kg mass of a block for 1 minute. If the temperature of the block changes by 16^0c, calculate the specific heat capacity of the block. **(4 marks)**
6. Define the following terms stating their units;
   (i) Latent heat of fusion **(2 marks)**
   (ii) Latent heat of vaporization **(2 marks)**
7. During a complete cycle of operation a system is subjected to the following heat transfers: 800KJ supplied and 500KJ rejected. At the two points work is done by the system to the extent of 96KNm and 20kNm. At a third point, there is a further work transfer. Determine its amount and state whether it is work done by or on the system. **(4 marks)**

8. The specific internal energy of a fluid if increased from 120KJ/Kg during a constant volume process. Determine the amount of heat energy required to bring about this increase for a 2Kg of fluid. **(4 marks)**
9. During and adiabatic expansion, 0.5Kg of fluid transfers 43.5KJ of work energy. Determine the change in specific internal energy of the fluid during the process. **(4 marks)**
10. When a body of mass 50Kg stands at the end of a spring, it is depressed by 15cm. what would be the depression of the spring when a man of 80Kg stands at the end. **(4 marks)**

SECTION B [60 MARKS]

Attempt **ONLY THREE** Questions in this Section.

Question 1

a) Define the following terms stating their S.I unit
   i) Work. **(1 mark)**
   ii) Potential energy **(1 mark)**
   iii) Power **(1 mark)**

b) A block of mass 6.5kg is projected with a velocity of 4ms-1 up a line of greatest slope of a rough plane. Calculate the initial kinetic energy of the block. **(3 marks)**

c) The coefficient of friction between the block and the plane in (b) above is $\frac{2}{3}$ and the plane makes an angle, Θ, with the horizontal where $\sin\theta = \frac{5}{13}$. The block travels a distance of dm up the plane before coming instantaneously to rest. Express in terms of d;
   i) The potential energy gain by the block before coming to rest. **(4 marks)**
   ii) The work done against friction by the block in coming to rest. **(3 marks)**
   iii) Hence calculate the value of d. **(7 marks)**

   (Take g = 10ms^{-2})

Question 2

a) State the following laws as applied to perfect gases indicating their expression

(i) Boyles' law **(2 marks)**

(ii) Charles' law **(2 marks)**

b) $0.06m^3$ of oxygen are contained in a sealed cylinder at a pressure of 1.3bar and a temperature of 21^0C. A cylinder contains $0.28m^3$ of a perfect gas at 1.035bar and 29^0C. Determine;

(i) The quantity of heat energy which must be supplied to the oxygen to increase its temperature to 93^0C. **(8 marks)**

(ii) The pressure of the oxygen at the final conditions. **(8 marks)**

Take C_v = 0.986KJ/KgK, R_0 = 8.314KJ/Kg-molK and Molecular mass of oxygen 32

Question 3

(a) With the aid of sketches, difference between hogging and sagging. **(6 marks)**

(b) A beam ABCD is simply supported at A and D which are 10m apart and carries a uniformly distributed load of 10kN/m between C and D. C is 2m from A and D is 6m from A. A point load of 50 and 40kN is situated at C and D respectively.

Draw the shear force (S.F) and bending moment (B.M) diagram for the beam. **(14 marks)**

Question 4

a) Define the following terms as applied to mechanical properties of materials **(2 marks @)**

(i) Strength

(ii) Stiffness (toughness)

(iii) Ductility (workability)

(iv) Brittleness.

(v) Creep (cold flow)

b) (i) State Hooke's law of elasticity **(2 marks)**

(ii) The extension produced in a material is due to the displacement of the molecules from their mean/average positions. State any other four factors which the expansion depends on. **(4 marks)**

c) A spring has a natural length of 12cm. when a load X is suspended from it, its length increases to 22cm and when load of 250N is attached to it, the length to 27cm. find the value of X. **(4 marks)**

Question 5

a) State Newton's law of cooling **(1 mark)**

b) (i) Define heat transfer and give its three forms of heat transfer **(4 marks)**

(ii) Define land breeze and explain and explain how it occurs **(5 marks)**

c) A wall consists of two layers each of thickness L_1 and L_2 and thermal conductivities K_1 and K_2 respectively. If the surfaces of the walls are maintained at temperatures T_1 and T_2. Show that the rate of heat transfer through the walls is

$$\frac{Q}{t}=\frac{A(T_2-T_1)}{\frac{L_1}{K_1}+\frac{L_2}{K_2}};\ Where\ A\ is\ the\ surface\ area\ of\ the\ wall$$ **(10 marks)**

END