UNIVERSITY OF EMBU

2017/2018 ACADEMIC YEAR

SECOND SEMESTER EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE, COMPUTER SCIENCE

CSC 126: PHYSICS FOR COMPUTING SYSTEMS

DATE:APRIL 3, 2018 **TIME: 2:00-4:00PM**

INSTRUCTIONS:

Answer Question ONE and ANY other two Questions

Important information

$\mu_0 = 4\pi \times 10^{-7} H/m$ *Speed of sound in air= 340m/s*

QUESTION ONE (30 MARKS)

a) Explain three factors that affect the magnitude of force on a conductor placed within a magnetic field. (3 marks)

b) Magnetic materials are affected by temperature changes. Explain. (3 marks)

c) Illustrate two rules applied in determination of the direction of magnetic field (2 marks)

d) Highlight Ohms law including a mathematical expression (2 marks)

e) Explaining each term, give the trigonometric expression of an alternating voltage used in RLC circuits. (3 marks)

f) Calculate the resistance of a 61cm long, 0.076cm diameter circular wire that has resistivity of $1.83 \times 10^{-6} \Omega.cm$. (3 marks)

g) Deduce three major features of conductors based on band theory. (3 marks)

h) What is a transistor? (2 marks)

i) Explain the factors that affect the periodic time for the following systems in oscillations

   i) Mass-spring oscillator (2 marks)

ii) Simple pendulum (2 marks)

j) What do you understand by the following words used in waves;

i) Period (T) (1mark)

ii) Frequency (f) (1mark)

iii) Amplitude (a) (1 mark)

k) Highlight any two characteristics of electromagnetic waves (2 marks)

QUESTION TWO (20 MARKS)

a) Deduce the mathematical expression of Biot-Savart Rule, explaining appropriately every symbol used. (3 marks)

b) Calculate the magnetic flux density at the centre of a solenoid of 200 turns and 50cm long, if the current of 0.5A flows in the coil. (3 marks)

c) Explain hysteresis phenomenon in a magnetic material. (5 marks)

d) Describe how magnetism is applied in magnetic disk drives. (5 marks)

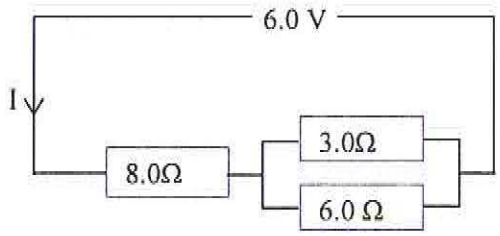
e) Calculate the force on a power cable of length 200m currying a current of 200A in a direction $N30^0E$ at a plane where the horizontal component of the earth's magnetic field is $10^{-5}T$. (4 marks)

QUESTION THREE (20 MARKS)

a) Explain three factors affecting resistance of a conductor (3 marks)

b) A coil of wire has resistance 6.0Ω at 60^0C and 5.25Ω at 15^0C. Calculate the temperature coefficient of the resistance of the wire, and resistance at 0^0C. (5 marks)

c) Calculate the current through and potential difference across each of the resistors in the circuit below (8 marks)



d) A resistor of resistance 26Ω is connected in series with an inductor of inductance 100mH and a 50μF capacitor in an A.C circuit of frequency 100Hz. If peak voltage is 400V, calculate peak current. (4 marks)

QUESTION FOUR (20 MARKS)

a) Distinguish between p-type and n-type semiconductors (4 marks)

b) Explain how a p-n junction is constructed (4 marks)

c) Highlight three major diode characteristics (4 marks)

d) Describe the working principle of LEDs (5 marks)

e) NPN Transistor has three main sections. Explain. (3 marks)

QUESTION FIVE (20 MARKS)

a) Highlight four differences between free and damped vibrations (4 marks)

b) Show that;

i. The maximum velocity (V_{max}) of a mass oscillating on a spring is given by; (4 marks)

$$V_{max} = \pm A\sqrt{\frac{k}{m}}$$

Where A is amplitude, k is spring constant and m is the mass of the body

ii. The corresponding frequency of oscillation is given by; (4 marks)

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

c) A train whistle emits sound at a frequency of 400Hz;

i. What is the pitch of the sound heard when the train is moving towards a stationary observer at a speed of 20m/s? (3 marks)

ii. What is the pitch heard when the train moves away from the observer with the same speed? (3 marks)

d) Explaining every symbol used, give the general wave equation. (2 marks)

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