



UNIVERSITY OF EMBU

2016/2017 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF COMPUTER
SCIENCE

CSC 126: PHYSICS FOR COMPUTING SYSTEMS.

DATE: APRIL 5, 2017

TIME: 11:00AM-1:00PM

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

Use the following constants where necessary

$$e = 1.6 \times 10^{-19} \text{C}$$

$$k = 9.0 \times 10^9 \text{Nm}^2\text{C}^{-2}$$

QUESTION ONE (30 MARKS)

- a) State the second coulomb's law of electrostatics. (2 marks)
- b) Distinguish between intrinsic and extrinsic semiconductors. (3 marks)
- c) Outline the two categorization of waves. (4 marks)
- d) Highlight the three transistor configurations (3 marks)
- e) List four data storage devices used in computers. (2 marks)
- f) Distinguish between magnetic disks and magnetic tapes giving the working principle of each of them. (4 marks)
- g) Distinguish between constructive and destructive interferences. (4 marks)
- h) Using a circuit, show how ac rectification is done using a PN junction diode. (4 marks)
- i) Distinguish between BJT and FET transistors. (4 marks)

QUESTION TWO (20 MARKS)

- a) A water wave traveling in a straight line on a lake is described by the equation

$$y(x,t) = (3.75\text{cm})\cos(0.45\text{cm}^{-1}x + 5.40\text{s}^{-1}t)$$

where y is the displacement perpendicular to the undisturbed surface of the lake. (i) How much time does it take for one complete wave pattern to go past a fisherman in a boat at anchor, and what horizontal distance does the wave crest travel in that time? (ii) What are the wave number and the number of waves per second that pass the fisherman? (iii) How fast does a wave crest travel past the fisherman, and what is the maximum speed of his cork floater as the wave causes it to bob up and down? (8 marks)

- b) Adjacent antinodes of a standing wave on a string are 15.0 cm apart. A particle at an antinode oscillates in simple harmonic motion with amplitude 0.850 cm and period 0.0750 s. The string lies along the $+x$ -axis and is fixed at $x=0$. (i) How far apart are the adjacent nodes? (ii) What are the wavelength, amplitude, and speed of the two traveling waves that form this pattern? (iii) Find the maximum and minimum transverse speeds of a point at an antinode. (iv) What is the shortest distance along the string between a node and an antinode? (12 marks)

QUESTION THREE (20 MARKS)

- a) You have a 200Ω resistor, a 0.400-H inductor, and a $6.00\mu\text{F}$ capacitor. Suppose you take the resistor, inductor and capacitor make a series circuit with a voltage source that has voltage amplitude 30.0 V and an angular frequency of 250rad/s . (i) What is the impedance of the circuit? (ii) What is the current amplitude? (iii) What are the voltage amplitudes across the resistor and across the inductor? (iv) What is the phase angle ϕ of the source voltage with respect to the current? Does the source voltage lag or lead the current? (v) Construct the phasor diagram. (12 marks)
- b) In an L - R - C series circuit, $R=300\Omega$, $L=0.400\text{H}$ and $C=6.00\times 10^{-8}\text{F}$ When the ac source operates at the resonance frequency of the circuit, the current amplitude is 0.500 A . (i) What is the voltage amplitude of the source? (ii) What is the amplitude of the voltage across the resistor, across the inductor, and across the capacitor? (iii) What is the average power supplied by the source? (8 marks)

QUESTION FOUR (20 MARKS)

- a) Sketch the circuit symbols for (i) a p-n-p and (ii) an n-p-n transistor. Mark on the emitter electrodes the direction of conventional current flow and explain why the current flows in the direction indicated. (8 marks)
- b) Using the circuit symbols for transistors show how (i) common-base, and (ii) common-emitter configuration can be achieved. Mark on the symbols the inputs, the outputs, polarities under normal operating conditions to give correct biasing and current directions. (12 marks)

QUESTION FIVE (20 MARKS)

The inverter is the simplest logic gate. Draw the circuit diagram for an inverter using a transistor as a switch and explain how it works. Hence draw the input and output voltage curves for the inverter and use it to explain the concept of bits (0 and 1) (20 marks)

--END--

