University Examinations 2013/2014

SECOND YEAR, FIRST SEMESTER EXAMINATIONS FOR DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE
AND
FIRST YEAR, SECOND SEMESTER EXAMINATIONS FOR DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

ICS 2200: ELECTRONICS

DATE: APRIL 2014   **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question one and any other two questions.*

QUESTION ONE – (30 MARKS)

(a) P-type and n-type semiconductors are made from a pure semiconductor by a process called 'doping'
  (i)   What is meant by doping?   (1 Mark)
  (ii)   Explain how doping produces n-type semiconductor.   (4 Marks)
(b) State two principle uses of light-emitting diode (LED)   (2 Marks)
(c) Define the following terms related to transistor currents.
  (i)   Alpha factor   (1 Mark)
  (ii)   Beta factor   (1 Mark)
(d) A transistor has a collector current of 10mA and base current of 40mA. What is the current gain of the transistor.   (2 Marks)
(e) State two major drawbacks of Bipolar Junction Transistor (BJT).   (2 Marks)
(f) A transistor has a collector current of 2mA. If the current gain is 135, what is the base current?   (2 Marks)
(g) Give any three differences between Bipolar Junction Transistors (BJT) and Junction Field Effect Transistors (JFET).   (6 Marks)

(h) Consider the figure below showing the transfer characteristic of a JFET. Write the equation for drain current. (3 Marks)

(i) Briefly, explain the meaning of the following terms used in JFET circuit analysis.
    (i) Shorted-gate drain current (I_{DSS}). (2 Marks)
    (ii) Pinch off voltage (V_P) (2 Marks)
(j) What is a sinusoidal oscillator? (2 Marks)

QUESTION TWO – (20 MARKS)

(a) Explain how a Zener diode acts as a voltage regulator. (12 Marks)
(b) The base current in a transistor is 0.01mA and the emitter current is 1mA. Calculate the values of $\propto$ and β, where $\propto$ and β have their usual meanings. (8 Marks)

QUESTION THREE – (20 MARKS)

(a) Using a clearly well labelled sketch diagram, explain the working principle of an n-type Junction Field Effect Transistor (JFET). (7 Marks)

(b) Consider the diagram below showing the JFET amplification circuit.

Briefly explain how amplification is achieved. (6 Marks)

(c) Sketch the current voltage graph showing the output characteristics of a JFET.

(3 Marks)

(d) A JFET has a drain current of 5mA. If $I_{DSS} = 6mA$ and $V_{GS\,(off)} = -6V,$ Calculate the values of

(i)　　V_{GS}　　　　　　　　　　　　　　　　　　(3 Marks)

(ii)　　V_P　　　　　　　　　　　　　　　　　　(2 Marks)

QUESTION FOUR – (20 MARKS)

(a) Consider a sketch diagram for an n-channel MOSFET.

Explain the depletion mode of operation of a MOSFET.   (5 Marks)

(b) Using a clearly well labelled sketch diagram, explain the working principle of a Thyristor under the following conditions:

    (i)   When the gate is open   (6 Marks)

    (ii)   When the gate is positive with respect to cathode.   (5 Marks)

(c) A hay-wave rectified circuit employing an SCR is adjusted to have a gate current of 1mA. The forward breakdown voltage of SCR is 100V for $I_G = 1mA$. If a sinusoidal voltage of 200V peak is applied, find:

    (i)   Firing angle   (1 Mark)

    (ii)   Conduction angle   (1 Mark)

    (iii)   Average current   (2 Marks)

          Assume load resistance = 100Ω and holding current is zero.