TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

APS 2301: PHYSICS TECHNIQUES III

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**
Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question One

a) Define the following terms:
- **(i)** Doping
- **(ii)** Intrinsic semiconductors
- **(iii)** Extrinsic semiconductors
- **(iv)** N-type and p-type semiconductors **(8 marks)**

b) State **FIVE** ideal properties of operational Amplifiers. **(5 marks)**

c) Given the following Boolean Expressions:

$$Y = \left(\overline{A \bullet B}\right)\left(\overline{\overline{A} \bullet \overline{B}}\right)\left(\overline{A \bullet B \bullet \overline{C} + \overline{D}}\right)$$

(i)

$$y = A \bullet \overline{B} \bullet C + \left(\overline{A + \overline{B \bullet C}}\right) \bullet B$$

(ii)

Draw their general logic gates arrangement. **(7 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) Define the following terms:
- **(i)** Logic gate
- **(ii)** Truth table
- **(iii)** Flip-flop **(6 marks)**

b) With the aid of circuit diagrams, show that the gains of an inverting amplifier and a non-inverting amplifier using OP-AMPS, are given by $-R_f/R_{in}$ and $I + R_f/R_1$ respectively. **(10 marks)**

c) Using symbols differentiate between:
- **(i)** N-P-N and P-N-D Transistors
- **(ii)** Crystal diode and zener diode **(4 marks)**

Question Three

a) Explain the following concepts:
- (i) Rectification
- **(ii)** Voltage regulation **(4 marks)**

b) With the aid of a circuit diagram and wave form diagrams, explain the operation of a full-wave bridge rectifier. **(10 marks)**

c) With the aid of a diagram show how a multimeter can be used to measure current and voltage in a circuit. **(6 marks)**

Question Four

a) Describe the operations of the following flip-flops, showing their logic gates arrangement and truth tables:
- **(i)** J-K flip-flop
- **(ii)** R-S flip flop **(10 marks)**

b) Convert the following decimal numbers to binary numbers:
- **(i)** 197
- **(ii)** 56 **(4 marks)**

c) With the aid of a circuit diagram, show how a N-P-N transistors can be used as a single stage voltage amplifier. **(6 marks)**

Question Five

a) Using symbolic diagrams, explain:
- **(i)** Forward biasing and
- **(ii)** Reverse biasing of P-N function diodes **(8 marks)**

b) With the aid of a graph, describe the following parameters of silicon controlled Rectifier (SCR)
- **(i)** Forward break over voltage
- **(ii)** Holding current
- **(iii)** Forward and reverse blocking regions
- **(iv)** Reverse breakdown voltage **(12 marks)**