TECHNICAL UNVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR DEGREE IN:
BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING
(**BSME Y2 S1**)

EEE 2203: MATERIAL SCIENCE II

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2014
TIME: 2 HOURS

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

This paper consists of **FIVE** questions. Attempt any **THREE** questions
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

Question One

a) With the aid of diagrams, outline the major steps in the making of a printed circuit board (PCB).
(7 marks)

b) Explain the functions of the following:
   (i)   Resist
   (ii) Substrate
   (iii) Aligner
   (iv) Mask
   (v)   Energy   **(7 marks)**

c) Define lithography. Briefly explain how the process is conducted in a PCB making.   **(6 marks)**

Question Two

a) Explain Drudes model of metal conduction. **(6 marks)**

b) A wire sample of annealed copper alloy of conductivity 58.0 x 106 $\Omega^{-1}m^{-1}$ and 1.5mm in a diameter by 1.5m in length is placed in an electrical circuit. A voltage drop of 450mV is measured across the length of the wire it carries a 10A current. Calculate the conductivity of this alloy. **(6 marks)**

c) (i) With the aid of a diagram show the variation in electrical resistivity with large composition.
   (ii) If the temperature coefficient of resistivity for copper allow at 20°C is 0.00393°C^{-1} and the resistivity at 20°C is 23.4 x 10^{-9} $\Omega^{-1}m^{-1}$ determine resistivity at 100°C. **(8 marks)**

Question Three

a) For the following conductors, provide two material choices:
   (i) Contact metals
   (ii) Fuse metals
   (iii) Electrical resistance
   (iv) Non corroding contacts **(4 marks)**

b) Distinguish the conduction among the following: **(6 marks)**
   (i) Electrolytes
   (ii) Semiconductors
   (iii) Metals **(6 marks)**

c) Explain FOUR factors that affect conductivity in metals. **(6 marks)**

d) With the aid of diagrams, explain superconductivity **(4 marks)**

Question Four

a) Using the concept of electronic bands, explain the difference in conduction in insulator semiconductor or conductors. **(4 marks)**

b) A phosphorus doped (n-type) silicon, the Fermi level (E_F) is shifted 0.1Ev. What is the probability of an electron being thermally promoted the conduction band in silicon (Eg = 1.10eV) at room temperature (25°C)? Take k = 86.2 x 10^{-6}eVk^{-1}) **(6 marks)**

c) (i) Explain THREE ways with which the conduction of silicon can be improved.

   (ii) Provide FOUR examples of compound semi-conductor. **(10 marks)**

Question Five

a) Clearly distinguish the THREE types of magnetism. For each give an example. **(9 marks)**

b) Explain "Antiferromagnetism" in materials. **(2 marks)**

c) State TWO uses of Hard Magnets **(2 marks)**