EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

ELECTRICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESSION

EE503: IC FABRICATION AND PACKAGING TECHNOLOGY

DATE : 19 NOVEMBER 2012 (MONDAY)
DURATION : 2 HOURS (2.30 PM TO 4.30 PM)

This paper consists of FIVE(5) pages including the front page.
Section A: Structure (10 questions – answer all)
Section B: Essay (3 questions – answer all)

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THE CHIEF INVIGILATOR

(The CLO stated is for reference only.)
SECTION A

STRUCTURE (40 marks)

INSTRUCTION:
This section consists of TEN (10) structured questions.
Answer ALL questions.

QUESTION 1

a) Define integrated circuit. [CLO1:C1] (2 marks)

b) Integrated circuits are used in most electronic equipment nowadays. List FOUR (4) of the applications. [CLO1:C1] (2 marks)

QUESTION 2

BiCMOS transistor is central to BiCMOS technology which is the current trend in IC technology. The transistors merge two existing transistors, which are the BJT's and the CMOS transistors. Draw the cross-section of a BiCMOS transistor. [CLO1:C1] (4 marks)

QUESTION 3:

Name and explain the silicon crystal structure below: [CLO2 : C2] (4 marks)

a) 

b) 

(4 marks)
QUESTION 4
a) Define epitaxial layer [CLO2:C1] (2 marks)
b) Give TWO (2) methods of epitaxial growth techniques.[CLO2:C2] (2 marks)

QUESTION 5
State FOUR (4) advantages of dry etching [CLO2:C2] (4 marks)

QUESTION 6
Give THREE (3) advantages and ONE (1) disadvantage of Silicon on Insulator (SOI). [ CLO 2 : C2 ] (4 marks)

QUESTION 7
One of the advanced packaging techniques that is used nowadays in semiconductor industry is flip chip technique. Give TWO (2) reasons why flip chip technique is preferred over the traditional packaging.[CLO2:C2] (4 marks)

QUESTION 8
The reliability of the chip depends on the design and process conditions.
Give FOUR (4) major causes in chip reliability problems. [ CLO 2 : C2 ] (4 marks)

QUESTION 9
Distinguish between MEMS actuator and MEMS sensor. [ CLO1:C2] (4 marks)

QUESTION 10
List FOUR (4) MEMS based sensors currently available in the market.[CLO1:C1] (4 marks)
SECTION B
ESSAY (60 marks)

INSTRUCTION:
This section consists of THREE (3) essay questions. Answer ALL questions.

QUESTION 1

a) The CMOS IC technology is preferred in the manufacturing of portable electronic products such as calculators, cellular telephone and note book computers. Explain the important criteria of CMOS IC technology. (4 marks) [CLO2:C2]

b) Explain FOUR (4) differences between the method of Floating Zone and Czochralski in terms of growth speed, diameter size, impurity content and crystal structure. [CLO2:C2]

c) Illustrate and explain in detail the floating zone process in wafer manufacturing with the aid of a diagram. [CLO2:C2]

(12 marks)

QUESTION 2

a) Define etching in IC fabrication process. [CLO2:C1] (2 marks)

b) Give THREE (3) purposes of etching used in IC fabrication. [CLO2:C2] (6 marks)

c) Explain with the aid of a diagram the etch profile below. [CLO2:C2] (6 marks)

i. Isotropic
ii. Anisotropic
QUESTION 3

a) Briefly explain the functions of Integrated Circuit (IC) packaging. [CLO2:C2] (2 marks)

b) Draw the inside of ordinary IC dual-in-line package and label the parts of die, wire bonding, bonding pad and lead frame. [CLO2:C1] (4 marks)

c) i) Define the die attachment in IC final assembly [CLO2:C1] (2 marks)
   ii) Explain the processes of Epoxy attach and Eutectic attach method. [CLO2:C1] (4 marks)

d) Explain the differences between the methods of wire bonding below:
   i) Thermocompression. [CLO2:C2] (4 marks)
   ii) Thermosonic Ball. [CLO2:C2] (4 marks)