TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FOURTH EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 2408: INTEGRATED CIRCUITS

END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME: 2HOURS

DATE: May 2016

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO Questions.
Do not write on the question paper.

Question ONE (Compulsory 30 marks)

a) Define the following terms as used in Integrated circuits technology   **(5 Marks)**
   i)   Photolithography
   ii)   Deposition
   iii)   Epitaxy
   iv)   Wet oxidation
   v)   Wafers

b) With the aid of diagrams, differentiate between **isotropic** etching and **anisotropic** etching (4 Marks)

c) PMOSFET and NMOSFET are complimentary. Explain   **(4 Marks)**

d) Conductivity of an intrinsic semiconductor is given by

$$\sigma = q(\mu_n n + \mu_p p),$$

where σ –conductivity, q –charge of an electron, μ_n – Electron Mobility, μ_p –Hole mobility, n-electron concentration, and p –Hole concentration.

Show that conductivity of an extrinsic semiconductor material is given by

$$\sigma = q \{\mu_n (n_i^2/N_A) + \mu_p N_A\}$$ **(7 Marks)**

Question TWO

Using your own intuition and imagination, design your own Digital system. In the design, clearly capture the following;

a) Topic or system to design **(1 mark)**
b) Objective of designing the system **(1 Mark)**
c) Steps involved in designing the digital system **(4 Marks)**
d) Circuit diagram **(4 Marks)**
e) Expected Results **(2 marks)**
f) Clear description of how the system works **(5 Marks)**
g) Expected limitations of the system **(3 Marks)**

Question THREE

a) i) Explain what is meant by Electronic Digital Automation (EDA)

   ii) Explain two benefits of Electronic Digital Automation **(6 Marks)**

b) Defects are inevitable in the production of complex systems such as ICs. Explain the two distinct types of tests carried out on wafers upon production to avoid such defects **(6 Marks)**

c) i) Using a diagram, explain the power dissipation model in the packaging of ICs

   ii) Calculate the power dissipated by a packaged IC if the chip temperature is 70°C, room temperature is 30°C and the combined case and junction temperature per watt is 110°C/W **(8 Marks)**

Question FOUR

a) i) Define **magnetic bubble memories**

   ii) Explain the formation of magnetic bubble in an Orthoferrite ($RFeO_3$) material with the aid of diagrams. **(6 marks)**

b) i) Name any four elements used in doping

   ii) Describe any three methods used in doping **(11 marks)**

c) Briefly describe what is meant by pulling an ingot as applied in Integrated Circuit wafer production.

(3 marks)

Question FIVE

a) i) Describe Top-Down approach of digital systems design

ii) Explain two advantages of Top-Down approach of digital systems design. **(6 marks)**

b) A dice measures 4mm×4mm is produced from an integrated circuit processing procedure. During the process 20 dice were defective from a circular wafer whose diameter was 7cm.Calculate the yield (Y) using the two Murphy model equations. (**10 marks)**

c) Explain **nanoimprint** as used in photolithography (**4 marks)**