OFFICE OF THE DEPUTY PRINCIPAL

ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2019 /2020 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

MAIN EXAMINATION

COURSE CODE: COM 324 E

COURSE TITLE: MICROELECTRONICS

DATE: 2ND NOVEMBER, 2020 **TIME: 9.00 AM – 12.00 NOON**

INSTRUCTION TO CANDIDATES

- SEE INSIDE

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REGULAR – MAIN EXAM

COM 324 E: MICROELECTRONICS

STREAM: BSc (Computer Science) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. *Answer **ALL** questions from section A and any **THREE** from section B.*

ii. *Maps and diagrams should be used whenever they serve to illustrate the answer.*

iii. *Do not write on the question paper.*

SECTION A (24 MARKS) COMPULSORY

QUESTION ONE [12 MARKS]

a. Define photolithography process. [2 Marks]

b. Define the term diffusion [2 marks]

c. Describe how residual solvents of the photoresist are removed. [2 Marks]

d. With the aid of a diagram, explain how positive photoresist is achieved. [3 Marks]

e. Elaborate how atomic diffusion is performed to ensure that the electrical properties of the silicon atoms are altered to enable the creation of electrical devices on a wafer. [3 marks]

QUESTION TWO [12 MARKS]

a. Explain why hotplate prebaking is preferred to conventional oven prebaking. [2 Marks]

b. Explain a situation which calls for use of electron beam lithography despite it being slow and more expensive compared to other lithography methods. [2 Marks]

c. Describe how grounding is achieved in electron beam lithography process. [2 Marks]

d. Explain why magnetic lenses are preferred to electrostatic lenses for focusing electrons in electron beam lithography. [2 Marks]

e. Explain the difference between dry etching and wet etching. [4 Marks]

SECTION B [36 MARKS]

QUESTION THREE [12 MARKS]

a. Explain why ion implantation has largely displaced diffusion when it comes to doping in modern semiconductor manufacturing. [2 Marks]

b. Explain the consequence of refilling a wrong photoresist in the spinner. [3 Marks]

c. Despite being preferred over atomic diffusion, ion implantation damages the silicon lattice. Explain how this drawback is corrected. [3 Marks]

d. Explain how photolithography and analog-photography are similar. [4 Marks]

QUESTION FOUR [12 MARKS]

a. List the three major process steps used in photolithography [3 Marks]

b. Despite ultraviolet light being one of the techniques used in lithography, it is not used for very large scale integrated circuit development. Outline the techniques through which lithography can take place for very large scale integrated circuit development. [3 Marks]

c. With the aid of diagrams, explain the two primary techniques for patterning additive and subtractive photolithography. [6 Marks]

QUESTION FIVE [12 MARKS]

a. Define the term Streaks with respect to photolithography [2 Marks]

b. State the type of metal which is preferred for metallization and the properties which makes it suitable. [5 Marks]

c. With the aid of a diagram, describe how electron beam lithography process is achieved. [5 Marks]

QUESTION SIX [12 MARKS]

a. Define the following terms with respect to microelectronics:

i. Polymerization [2 Marks]

ii. Photo-solubilization [2 Marks]

b. Explain why lithography is essential in microelectronics. [2 Marks]

c. Describe the main parameters which are inspected after developing a micro-electronic device using lithography process. [6 Marks]

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