SECTION A : 40 MARKS
BAHAGIAN A : 40 MARKAH

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

ARAHAN:
*Bahagian ini mengandungi **SEPULUH (10)** soalan berstruktur. Jawab **SEMUA** soalan.*

CLO1
C1

QUESTION 1

ICs can be classified into **FOUR(4)** categories, which are circuit function, fabrication method, transistor type and design methodology. Explain **TWO (2)** of the classification.

SOALAN 1

*Litar Bersepadu boleh diklasifikasi kepada **EMPAT (4)** kategori, iaitu fungsi litar, kaedah fabrikasi, jenis transistor dan metalogi rekabentuk. Terangkan **DUA (2)** bagi setiap klasifikasi tersebut.*

[4 marks]
[*4 markah*]

CLO1
C3

QUESTION 2

List the IC integration scales starting from 1947 until nowadays with the total number of transistor.

SOALAN 2

Senaraikan skala Persepaduan Litar Bersepadu bermula dari 1947 hingga sekarang beserta bilangan jumlah transistor.

[4 marks]

[*4 markah*]

CLO2
C2

QUESTION 3

Wafer polishing and edge contour are processes involved in transforming the silicon ingot into wafer. Explain both processes.

SOALAN 3

Menggilap Wafer dan Kontor Tepi adalaha proses yang terlibat di dalam mengubah jongkong silicon kepada wafer. Terangkan kedua-dua proses.

[4 marks]

[4 markah]

CLO1
C2

QUESTION 4

With the aid of diagram(s), explain the silicon crystal structure types listed below:

a. Polysilicon

b. Amorphous .

SOALAN 4

Dengan bantuan gambarajah, perihalkan jenis-jenis struktur kristal silicon yang disenarai di bawah:

a. Polisilikon

b. Amorfus

[4 marks]
[*4 markah*]

CLO2
C2

QUESTION 5

Fabrication of integrated circuits involved many processes and oxidation is one of the process involved. Explain what is oxidation process and the function of oxide layer.

SOALAN 5

Pembikinan litar Bersepadu melibatkan banyak proses dan salah satu yang terlibat adalah pengoksidaan. Terangkan apakah proses pengoksidaan dan fungsi lapisan oksida.

[4 marks]
[*4 markah*]

CLO2
C2

QUESTION 6

Latch up and parasitic capacitance are **TWO (2)** problems that exist in CMOS transistor operation. Explain the causes of this two problems.

SOALAN 6

Selak atas dan kapsitan parasitic adalah ***DUA(2)*** *masalah yang wujud di dalam operasi transistor CMOS. Terangkan punca kedua-dua masalah tersebut.*

[4 marks]
[*4 markah*]

CLO2
C2

QUESTION 7

List **TWO (2)** examples for each plastic package and examples ceramic package.

SOALAN 7

Senaraikan ***DUA (2)*** *contoh setiap satu bagi pakej plastik dan contoh pakej seramik.*

[4 marks]
[*4 markah*]

CLO2
C2

QUESTION 8

Describe **TWO (2)** methods in predicting IC failure rate.

SOALAN 8

Perihalkan ***DUA(2)*** *kaedah untuk meramal kadar kegagalan litar bersepadu.*

[4 marks]
[*4 markah*]

CLO1
C2

QUESTION 9

Differentiate **TWO (2)** characteristics between MEMS actuator and MEMS sensor.

SOALAN 9

Bezakan ***DUA (2)*** *di antara aktuator MEMS dengan sensor MEMS.*

[4 marks]
[*4 markah*]

CLO1
C2

QUESTION 10

MEMS is known as Micro-ElectroMechanical Systems. MEMS techniques allow both electronic circuits and mechanical devices to be manufactured on a silicon chip, similar to the process used for integrated circuits. Based on that statement, give **FOUR (4)** advantages of MEMS.

SOALAN 10

MEMS dikenali sebagai 'Micro-ElectroMechanical Systems'. MEMS dihasilkan melalui kombinasi komponen elektronik dan mekanikal dalam satu cip silicon sama seperti pemprosesan litar bersepadu. Berdasarkan kenyataan tersebut,berikan ***EMPAT (4)*** *kelebihan MEMS.*

[4 marks]
[*4 markah*]

SECTION B : 60 MARKS
BAHAGIAN B : 60 MARKAH

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

ARAHAN:
Bahagian ini mengandungi ***TIGA (3)*** *soalan esei. Jawab semua soalan.*

QUESTION 1
SOALAN 1

CLO1
C1

a. Define the terms Integrated Circuit and Discrete component.

Takrifkan istilah bagi Litar Bersepadu dan komponen Diskret.

[4 marks]
[*4 markah*]

CLO1
C2

b. Monolithic, film and hybrid are fabrication methods for Integrated Circuits. Explain each of the fabrication method.

Monolitik, filem dan hybrid adalah kaedah-kaedah fabrikasi Litar Bersepadu. Terangkan setiap kaedah fabrikasi tersebut.

[6marks]
[*6 markah*]

CLO1
C3

c. Illustrate in details of Czochralski process in silicon ingot growth with the aid of a diagram.

Illustrasikan secara terperinci proses ‘Czochralski’ dalam penumbuhan jongkong silicon dengan bantuan gambarajah

[10 Marks]
[*10 Markah*]

QUESTION 2
SOALAN 2

CLO2
C1

a. Etching is one of the process involved in IC Fabrication that used etchant. Describe etchant and types of etchant.

Punaran adalah salah satu proses yang terlibat di dalam fabrikasi litar bersepadu. Terangkan 'etchant' dan jenis- jenis etchant.

[4 marks]
[*4 markah*]

CLO2
C2

b. Give **THREE (3)** comparisons between isotrophic and anisotrophic etching methods.

*Berikan **TIGA (3)** perbezaan diantara kaedah punaran isotropik dan anisotropik..*

[6 marks]
[*6 markah*]

CLO2
C1

c. Draw the structure that is produced using isotrophic and anisotropic etching method.

Lukiskan bentuk struktur yang terhasil melalui kaedah punaran jenis isotropic dan anisotropic.

[2 marks]
[*2 markah*]

CLO2
C3

d. Sketch the physical structure of CMOS transistor below:

i. P-well
ii. Twin-tub
iii. Silicon On Insulator

Lakarkan struktur fizikal bagi transistor CMOS berikut:

i. P-well
ii. Twin-tub
iii. Silicon On Insulator

[8 marks]
[8 *markah*]

QUESTION 3
SOALAN 3

CLO2
C1

a. Chip on Board (COB) technology is one of the Advance IC Packaging Technique State **FOUR (4)** advantages offered by Chip on Board (COB) technology.

Chip on Board (COB) teknologi adalah salah satu daripada teknik pembungkusan IC termaju. Nyatakan ***EMPAT (4)*** *kelebihan teknologi Chip on Board (COB).*

[4 marks]
[4 *markah*]

b. In Wire bonding process, the wires will be attached between the pads and substrate using Ultrasonic, Thermosonic, or Thermocompression Bonding. Describe the Thermocompression Bonding method.

CLO2
C2

Di dalam proses 'wire bonding', wayar dipasang di antara pad dan substrat menggunakan kaedah 'Ultrasonic', 'Thermosonic', or 'Thermocompression Bonding'. Perihalkan kaedah 'Thermocompression Bonding'

[6 marks]
[*6 markah*]

CLO2
C2

c. List FOUR (4) types of chip defect that occur during fabrication

Senaraikan EMPAT (4) jenis bagi kerosakan cip yang berlaku semasa fabrikasi

[4 marks]
[4 markah]

CLO1
C1

d. Describe TWO (2) main functions of LIGA.

Terangkan DUA (2) fungsi utama bagi LIGA

[2 marks]

[2 markah]

CLO1
C2

e. Explain bulk micromachining in MEMS fabrication process.

Terangkan micromachining pukal dalam proses fabrikasi MEMS.

[4 marks]

[4 markah]

SOALAN TAMAT