

**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**  
**SOALAN 1**

Integrated circuit (IC) can be categorized into three types of transistors according to the type of transistor used in the IC which are Bipolar Junction Transistor (BJT), Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and BiCMOS. Give **TWO (2)** examples of BJT and **TWO (2)** examples of MOSFET.

*Litar bersepadu boleh dikategorikan kepada tiga jenis transistor merujuk kepada jenis transistor yang digunakan di dalam IC iaitu 'Bipolar Junction Transistor (BJT)', 'Metal oxide Semiconductor Field Effect Transistor (MOSFET)' and 'BiCMOS'. Berikan **DUA (2)** contoh BJT dan **DUA (2)** contoh MOSFET.*

[4 marks]  
[4 markah]

CLO1  
C2 **QUESTION 2**  
**SOALAN 2**

Compare the differences between NMOS and PMOS transistors.

*Nyatakan perbezaan diantara transistor NMOS dan PMOS*

[4marks]  
[4markah]

CLO2  
C2 **QUESTION 3**  
**SOALAN 3**

Give **TWO (2)** benefits of using a larger diameter wafer.

*Berikan **DUA (2)** faedah menggunakan diameter wafer lebih besar.*

[4 marks]  
[4 markah]

CLO2  
C1 **QUESTION 4**  
**SOALAN 4**

State **FOUR (4)** sources of contamination that affect the production yield in an IC fabrication  
*Nyatakan **EMPAT (4)** sumber pencemaran yang menjejaskan hasil pengeluaran dalam IC fabrikasi*

[4 marks]  
[4 markah]

SULIT

**POLITEKNIK**  
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KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2013

**EE503: INTEGRATED CIRCUIT FABRICATION AND  
PACKAGING TECHNOLOGY**

**TARIKH : 21 OKTOBER 2013**  
**TEMPOH : 2 JAM (2.30 – 4.30 PM)**

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.  
Bahagian A: Struktur (10 soalan)  
Bahagian B: Esei (3 soalan)  
Dokumen sokongan yang disertakan : Tiada

**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

CLO1  
C1  
**QUESTION 8**  
**SOALAN 8**

Draw a bath-up curve in predicting the reliability of an IC.  
*Lukiskan lengkung bath-up dalam meramal kebolehpercayaan sesebuah IC.*

[4 marks]  
[4 markah]

CLO1  
C2  
**QUESTION 9**  
**SOALAN 9**

Explain the differences between bulk micromachining and surface micromachining in the MEMS fabrication process.

*Terangkan perbezaan di antara "bulk micromachining" dengan "surface micromachining" dalam proses fabrikasi MEMS.*

[4 marks]  
[4 markah]

CLO1  
C2  
**QUESTION 10**  
**SOALAN 10**

i) Compare bulk micromachining with LIGA in MEMS fabrication process in terms of parts of fabrication complexity and aspect ratio.

*Bandingkan "bulk micromachining" dengan LIGA dalam proses fabrikasi MEMS dari segi kerumitan fabrikasi bahagian dan nisbah aspek.*

ii) Explain the meaning of "lithography" in the LIGA during MEMS fabrication process?

*Terangkan maksud "lithography" yang terdapat dalam LIGA semasa proses fabrikasi MEMS?*

[4 marks]  
[4 markah]

CLO2  
C1  
**QUESTION 5**  
**SOALAN 5**

(a) Define doping process.

*Takrifkan proses pengedopan*

(b) State **TWO (2)** methods of a doping process.

*Nyatakan **DUA (2)** kaedah proses pengedopan*

[4 marks]  
[4 markah]

CLO2  
C1  
**QUESTION 6**  
**SOALAN 6**

Draw the physical structure of a NMOS.

*Lakarkan struktur binaan NMOS.*

[4 marks]  
[4 markah]

CLO2  
C1  
**QUESTION 7**  
**SOALAN 7**

Refer to the cross section of IC in Dual-in-line package (DIP) in Figure A1, label all the components (a, b, c and d).

*Merujuk kepada keratan rentas IC dalam dual-in-line package (DIP) dalam Rajah A1, labelkan komponen yang berkaitan (a, b, c dan d).*

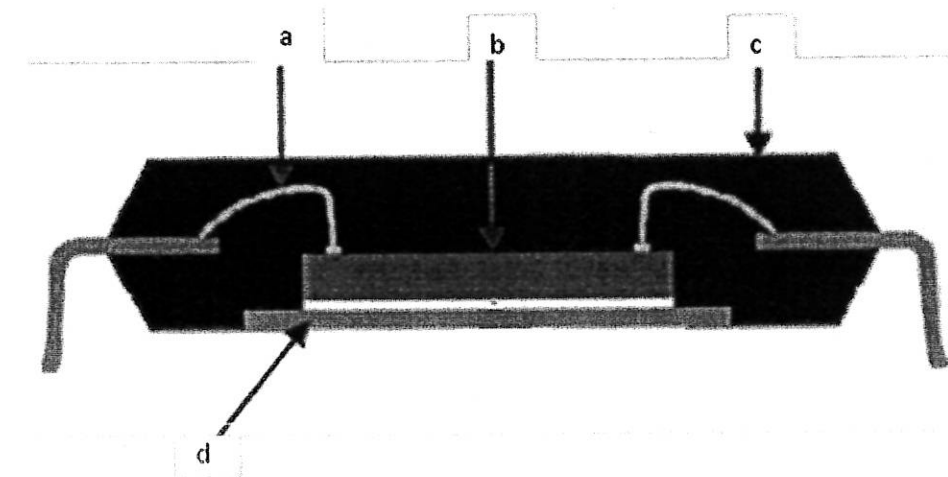


Figure A1 / Rajah A1

[4 marks]  
[4 markah]

**QUESTION 2**  
**SOALAN 2**

- CLO2 C2 (a) Explain the sequence of the NMOS transistor fabrication process.  
*Terangkan turutan proses fabrikasi NMOS transistor.*
- [6 marks]  
[6 markah]
- CLO2 C1 (b) Give ONE (1) advantage and ONE (1) disadvantage of a Twin Tub CMOS and SOI CMOS.  
  
*Berikan SATU (1) kelebihan dan SATU (1) kelemahan Twin Tub CMOS dan SOI CMOS*
- [4 marks]  
[4 markah]
- CLO2 C1 (c) Define the following doping process;  
i. Diffusion  
ii. Ion implantation  
  
*Takrifkan proses pengedopan berikut ;*  
i. Resapan  
ii. Penanaman Ion
- [4 marks]  
[4 markah]
- CLO2 C1 (d) List **FOUR (4)** differences between diffusion and Ion Implantation in a doping process.  
  
*Senaraikan EMPAT (4) perbezaan di antara resapan dan penanaman ion di dalam proses dopan.*
- [4 marks]  
[4 markah]
- CLO2 C1 (e) State the function of photolithography process in an IC fabrication.  
  
*Nyatakan kegunaan proses fotolitografi di dalam fabrikasi IC.*
- [2 marks]  
[2 markah]

**QUESTION 3**  
**SOALAN 3**

- CLO2 C1 (a) State **SIX (6)** functions of an Integrated Circuit (IC) packages.  
  
*Senaraikan ENAM (6) fungsi bagi pembungkusan Litar Bersepadu (IC).*
- [6 marks]  
[6 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)
- i. Define Integrated Circuit.  
*Takrifkan litar bersepadu (IC)*
- [2 marks]  
[2 markah]
- ii. State the advantages of using an integrated circuit over discrete components.  
*Nyatakan kelebihan menggunakan litar bersepadu berbanding komponen diskret.*
- [4 marks]  
[4 markah]
- iii. List the IC integration scales based on total number of transistors.  
*Senaraikan skala integasi litar bersepadu berdasarkan bilangan transistor.*
- [4 marks]  
[4 markah]
- CLO2 C2 (b) Explain each process below in transforming the silicon ingot into wafer :  
*Terangkan setiap proses di bawah dalam mengubah jongkong silikon ke dalam bentuk wafer*
- i. Ingot diameter grinding  
*Pengisaran diameter jongkong*
- ii. Wafer slicing  
*Pemotongan wafer*
- iii. Wafer lapping and edge contour  
*Mengisar Wafer dan membentuk pinggir*
- iv. Wafer etching  
*Punaran wafer*
- v. Wafer polishing  
*Mengilap Wafer*

[10 marks]  
[10 markah]

- CLO2  
C2 (b) Give **TWO (2)** comparisons between dual-in-line package (DIP) and single-in-line package (SIP) based on their pitch count (lead count) and pitch spacing.
- Berikan DUA (2) perbandingan di antara 'dual-in-line package (DIP)' dan 'single-in-line package (SIP)' berdasarkan bilangan 'pitch' (bilangan kaki) dan jarak 'pitch'.*
- [4 marks]  
[4 markah]
- CLO2  
C2 (c) Explain the meaning of "burn-in" in the Integrated Circuit testing.
- Terangkan maksud "burn-in" dalam Integrated Circuit testing.*
- [3 marks]  
[3 markah]
- CLO2  
C2 (d) Explain the probe testing in an electrical evaluation of integrated circuits (ICs).
- Terangkan tentang 'probe testing' dalam penilaian elektrik litar bersepadu (IC)*
- [2 marks]  
[2 markah]
- CLO1  
C2 (e) Explain the Bulk Micromachining process involved in a MEMS fabrication process.
- Terangkan proses "Bulk Micromachining" yang terlibat dalam proses fabrikasi MEMS.*
- [5 marks]  
[5 markah]

**SOALAN TAMAT**