SECTION A : 80 MARKS
BAHAGIAN A : 80 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO1
C1

(a) List **TWO (2)** advantages and **TWO (2)** disadvantages of microcontroller.

*Senaraikan **DUA (2)** kelebihan dan **DUA (2)** kekurangan pengawalmikro.*

[4 marks]
[*4 markah*]

CLO1
C2

(b) Explain the function of TRISx, PORTx and LATx registers.

Terangkan fungsi pendaftar-pendaftar TRISx, PORTx dan LATx.

[6 marks]
[*6 markah*]

CLO1
C3

(c) A programmer decides to toggle all LED of PORTC 45,000 times on a project board. Write the coding using C language for the task. (Initial value of PORTC = C7H). Assume no delay time is required.

Seorang pengaturcara bercadang melakukan proses 'toggle' pada semua LED pada PORTC di papan projek sebanyak 45,000 kali. Tulis aturcara bagi tugasan tersebut menggunakan bahasa C. (Nilai awal PORTC=C7H). Anggapkan tiada keperluan masa lengah.

[10 marks]
[*10 markah*]

QUESTION 2

SOALAN 2

CLO1
C1

(a) Every timer needs a clock pulse to tick. Give **TWO (2)** examples of clock source and differentiate their function.

*Setiap pemasa memerlukan denyut jam untuk aktif. Berikan **DUA (2)** contoh sumber jam dan perbezaan fungsi antara kedua-duanya.*

[4 marks]
[*4 markah*]

CLO1
C2

(b) Explain the operation modes of Timer0.

Terangkan mod-mod operasi yang terdapat di dalam Timer0.

[6 marks]
[*6 markah*]

CLO1
C3

(c) Given crystal oscillator frequency = 4MHz and the value of TMR0H:TMR0L = BAD7H. Referring to Appendix 2c, calculate the time delay generated by Timer0 if T0CON register are set to 0x05. Refer Appendix 2c.

Diberikan frekuensi pengayun kristal = 4MHz dan nilai TMR0H: TMR0L = BAD7H. Merujuk kepada Lampiran 2c, kirakan masa lengah yang dijana oleh Timer0 jika daftar T0CON disetkan kepada 0x05. Rujuk Lampiran 2c.

[10 marks]
[*10 markah*]

QUESTION 3
SOALAN 3

CLO1
C1

(a) Describe the interrupt and polling methods in a microcontroller.

Terangkan kaedah sampukan dan tinjauan di dalam sistem mikropengawal.

[4 marks]
[*4 markah*]

CLO1
C2

(b) Explain the differences between Enable Bit and Flag Bit. Give **ONE (1)** example for each bit.

*Terangkan perbezaan di antara Bit Pemboleh dan Bit Bendera. Berikan **SATU (1)** contoh untuk setiap bit tersebut.*

[*6 marks*]
[*6 markah*]

CLO1
C3

(c) You are given a project to connect a door sensor to pin RB0 and a buzzer to pin RC7. Using INT0 external hardware interrupt, write a program using C language when every time the door is opened, the buzzer activates. Refer Appendix 3c.

Anda diberikan satu projek untuk menyambungkan sensor pintu pada pin RB0 dan buzzer pada pin RC7. Menggunakan sampukan perkakasan luaran INT0, tuliskan satu aturcara menggunakan bahasa C untuk setiap kali pintu dibuka, buzzer akan diaktifkan. Rujuk Lampiran 3c.

[10 marks]
[*10 markah*]

QUESTION 4
SOALAN 4

CLO1
C3

(a) Sketch a simple circuit connection to interface a microcontroller chip with **ONE (1)** switch (active low) to pin RC0 and **ONE (1)** LED (common cathode) to pin RD4.

*Lakarkan satu sambungan litar yang mudah untuk antaramuka cip pengawalmikro dengan **SATU (1)** suis (aktif rendah) pada pin RC0 dan **SATU (1)** LED (common katod) pada pin RD4.*

[5 marks]
[*5 markah*]

CLO1
C3

(b) Refer to Diagram 4(b), draw a 16X2 LCD interfacing with microcontroller circuit. The circuit must consist the connection of a variable resistor used to control contrast LCD and also the connection of power supply to the LCD. Use all PORTD pins for data interfacing and the register select (RS), Read/Write (R/W) and Enable (E) pins should be connect to RB0, RB1 and RB2.

Merujuk rajah 4(b), lukiskan pengantaramuka 16x2 LCD dengan litar mikropengawal. Litar mestilah mempunyai sambungan perintang bolehlaras yang digunakan untuk mengawal kecerahan LCD dan juga sambungan bekalan kuasa kepada LCD. Gunakan semua pin PORTD untuk antaramuka data dan pin-pin daftar pilih (RS), Baca/Tulis (R/W) dan Enable (E) hendaklah disambungkan pada pin-pin RB0, RB1, dan RB2.
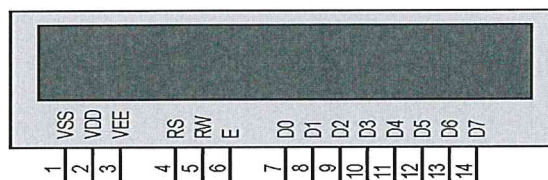

Diagram 4(b) / *Rajah 4(b)*

[5 marks]
[*5 markah*]

CLO1
C4

(c)   Two switches are connected to a microcontroller chip and a two way DC motor is interfaced to the microcontroller using a H Bridge chip. The DC motor will rotate according to the condition of both switches. Analyze and write a program using C language for the operation of the DC motor, refer to circuit Diagram 4(c) and Table 4 (c).

Dua suis disambungkan pada cip pengawal mikro dan motor DC dua hala diantaramuka dengan pengawal mikro menggunakan cip H Bridge. Motor DC akan berputar mengikut keadaan kedua-dua suis. Analisa dan tuliskan satu aturcara menggunakan bahasa C bagi operasi motor merujuk kepada litar Rajah 4(c) dan Jadual 4 (c).

Table 4(c) / *Jadual 4(c)*

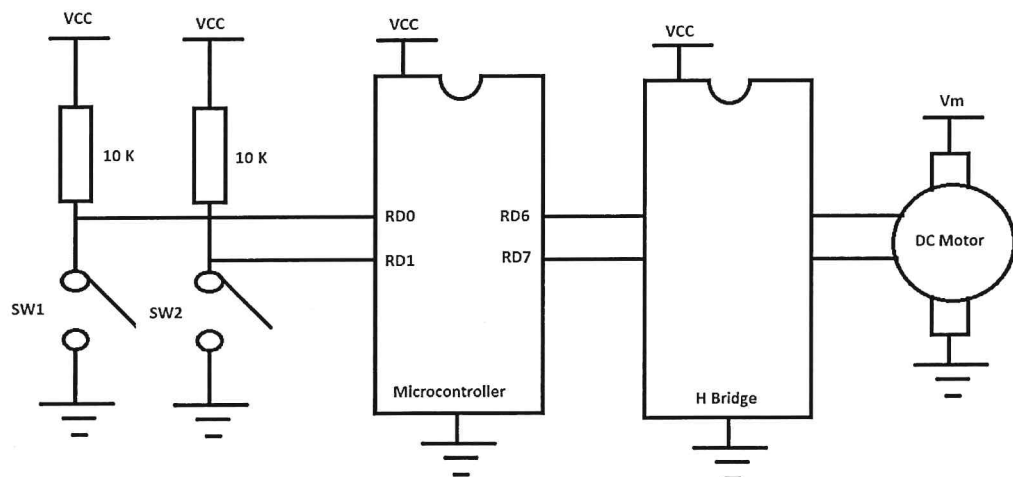| Switch condition (SW1)	Switch condition (SW2)	Output State RD6	Output State RD7	Motor direction
OFF	OFF	LOW	LOW	Stop
OFF	ON	LOW	HIGH	Clockwise
ON	OFF	HIGH	LOW	Anti clockwise
ON	ON	HIGH	HIGH	Stop

Diagram 4(c) / *Rajah 4 (c)*

[10 marks]
[*10 markah*]

SECTION B : 20 MARKS
BAHAGIAN B : 20 MARKAH

INSTRUCTION:
This section consists of **ONE (1)** essay questions. Answer **ALL** question.

ARAHAN:
Bahagian ini mengandungi SATU (1) soalan esei. Jawab SEMUA soalan.

CLO2
C6

QUESTION 1
SOALAN 1

The system to monitoring temperature will be design to install in Electrical Engineering Department. The system has ON/OFF switch as a manual reset switch, temperature sensor LM34/LM35 and zener diode LM 336-2.5 is connect parallel to the potentiometer 10K to regulate 2.5V at pin RA3. The system can be used to read and display the temperature using 8 LEDs to show temperature in binary numbers. The requirements for the design is when the analog signal (RA0) is sent to the microcontroller it will display the temperature value on the LEDs (PORTD). Design the schematic circuit of the system and build the program in C to function the system.

[Given register control for ADC is setting as ADCON0=81H and ADCON1=C5H]

Sebuah sistem pengawal suhu akan direkabentukkan dan dipasang di Jabatan Kejuruteraan Elektrik. Sistem ini mengandungi suis ON/OFF sebagai suis manual untuk reset, pengesan suhu LM34/LM35 dan Zener diod LM 336-2.5 disambung secara selari dengan perintang boleh laras 10K untuk mengatur voltan sebanyak 2.5V pada pin RA3. Sistem ini boleh digunakan untuk membaca dan memaparkan suhu dalam nombor binari menggunakan 8 LED. Keperluan kepada rekabentuk ini adalah apabila isyarat analog (RA0) dihantar ke pengawalmikro, ia akan memaparkan nilai suhu mengikut nyalaan LED (PORTD). Rekabentuk satu litar skematik dan binakan aturcara dalam bahasa C bagi sistem tersebut berfungsi.

[Diberi register kawalan ADC ditetapkan sebagai ADCON0=81H dan ADCON1=C5H]

[20 marks]
[*20 markah*]

SOALAN TAMAT

T0CON

TMR0ON	T08BIT	T0CS	T0SE	PSA	T0PS2	T0PS1	T0PS0

TMR0ON   D7   Timer0 ON and OFF control bit
1 = Enable (start) Timer0
0 = Stop Timer0

T08BIT   D6   Timer0 8-bit/16-bit selector bit
1 = Timer0 is configured as an 8-bit timer/counter.
0 = Timer0 is configured as a 16-bit timer/counter.

T0CS   D5   Timer0 clock source select bit
1 = External clock from RA4/T0CKI pin
0 = Internal clock (Fosc/4 from XTAL oscillator)

T0SE   D4   Timer0 source edge select bit
1 = Increment on H-to-L transition on T0CKI pin
0 = Increment on L-to-H transition on T0CKI pin

PSA   D3   Timer0 prescaler assignment bit
1 = Timer0 clock input bypasses prescaler.
0 = Timer0 clock input comes from prescaler output.

T0PS2:T0PS0 D2 D1 D0   Timer0 prescaler selector
0 0 0 = 1:2   Prescale value (Fosc / 4 / 2)
0 0 1 = 1:4   Prescale value (Fosc / 4 / 4)
0 1 0 = 1:8   Prescale value (Fosc / 4 / 8)
0 1 1 = 1:16   Prescale value (Fosc / 4 / 16)
1 0 0 = 1:32   Prescale value (Fosc / 4 / 32)
1 0 1 = 1:64   Prescale value (Fosc / 4 / 64)
1 1 0 = 1:128   Prescale value (Fosc / 4 / 128)
1 1 1 = 1:256   Prescale value (Fosc / 4 / 256)

INTCON

REGISTER 9-1:   INTCON: INTERRUPT CONTROL REGISTER

R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-x
GIE/GIEH	PEIE/GIEL	TMR0IE	INT0IE	RBIE	TMR0IF	INT0IF	RBIF[1]
bit 7							bit 0

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'	
-n = Value at POR	'1' = Bit is set	'0' = Bit is cleared	x = Bit is unknown

bit 7   **GIE/GIEH:** Global Interrupt Enable bit

When IPEN = 0:
1 = Enables all unmasked interrupts
0 = Disables all interrupts

When IPEN = 1:
1 = Enables all high-priority interrupts
0 = Disables all interrupts

bit 6   **PEIE/GIEL:** Peripheral Interrupt Enable bit

When IPEN = 0:
1 = Enables all unmasked peripheral interrupts
0 = Disables all peripheral interrupts

When IPEN = 1:
1 = Enables all low-priority peripheral interrupts (if GIE/GIEH = 1)
0 = Disables all low-priority peripheral interrupts

bit 5   **TMR0IE:** TMR0 Overflow Interrupt Enable bit

1 = Enables the TMR0 overflow interrupt
0 = Disables the TMR0 overflow interrupt

bit 4   **INT0IE:** INT0 External Interrupt Enable bit

1 = Enables the INT0 external interrupt
0 = Disables the INT0 external interrupt

bit 3   **RBIE:** RB Port Change Interrupt Enable bit

1 = Enables the RB port change interrupt
0 = Disables the RB port change interrupt

bit 2   **TMR0IF:** TMR0 Overflow Interrupt Flag bit

1 = TMR0 register has overflowed (must be cleared in software)
0 = TMR0 register did not overflow

bit 1   **INT0IF:** INT0 External Interrupt Flag bit

1 = The INT0 external interrupt occurred (must be cleared in software)
0 = The INT0 external interrupt did not occur

bit 0   **RBIF:** RB Port Change Interrupt Flag bit[1]

1 = At least one of the RB7:RB4 pins changed state (must be cleared in software)
0 = None of the RB7:RB4 pins have changed state