POLITEKNIK
MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI DISEMBER 2015

EC501: EMBEDDED SYSTEM APPLICATIONS

TARIKH : 11 APRIL 2016
MASA : 8.30AM – 10.30AM (2 JAM)

Kertas ini mengandungi **TIGA BELAS (13)** 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)

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.*

QUESTION 1

SOALAN 1

CLO1
C2

(a) Embedded System is a computer system that cannot be programmed by the user. Describe this statement by referring to the definition of embedded system.

*Berikan **DUA (2)** contoh sistem terbenam yang digunakan sebagai peralatan perubatan.*

CLO1
C2

(b) Give **TWO (2)** examples of embedded system that has been used as medical equipment.

*Berikan **DUA (2)** contoh sistem terbenam yang digunakan sebagai peralatan perubatan.*

[4 marks]

[*4 markah*]

QUESTION 2
SOALAN 2

CLO1
C2

(a) Personal computer is not an embedded system. Explain this statement accordingly.

Komputer peribadi bukanlah satu sistem terbenam. Jelaskan kenyataan ini.

CLO1
C2

(b) Give **TWO (2)** advantages of Microcontroller compared to Microprocessor.

*Berikan **DUA (2)** kelebihan mikropengawal berbanding mikropemproses.*

[4 marks]

[*4 markah*]

QUESTION 3
SOALAN 3

CLO1
C2

In assembly language, there are a few register to be used during writing a program. Give the definition of this two register listed below:

Dalam bahasa perhimpun, terdapat beberapa daftar yang akan digunakan semasa menulis program. Berikan definisi dua daftar ini seperti di bawah:

   i.   Working register

       Daftar bekerja

   ii. Status register

       Daftar status

[4 marks]

[*4 markah*]

QUESTION 4
SOALAN 4

CLO1
C3

Write a simple program using assembly language to subtract 14(d) from 40(d).

Tulis satu program mudah dengan menggunakan bahasa penghimpunan untuk menolak 14 (d) dari 40 (d).

[4 marks]

[*4 markah*]

CLO1
C3

QUESTION 5
SOALAN 5

A programmer decides to use two (2) DC motors at pin RD4 and RD5 and two (2) sensors at pin RC0 and RC1 in his circuit . Write the input and output initialization program for his program using bit addressable in C language.

Seorang pengaturcara memutuskan untuk menggunakan dua (2) motor AT pada pin RD4 dan dua (2) penderia pada pin RC0 dan RC1 dalam litar beliau. Tuliskan program masukan dan keluaran awalan untuk program beliau menggunakan bit pengalamatan dalam Bahasa C.

[4 marks]

[*4 markah*]

CLO1
C2

QUESTION 6
SOALAN 6

Explain instructions below.

Terangkan arahan di bawah.

(a) TRISBbits.TRISB7 = 0;

(b) LATCbits.LATC0 = 1;

(c) PORTD = 0x0F;

[4 marks]

[*4 markah*]

CLO1
C1

QUESTION 7
SOALAN 7

State the range magnitude of unsigned char and unsigned int data types.

Nyatakan julat magnitud jenis data unsigned char dan unsigned int.

[4 marks]

[*4 markah*]

QUESTION 8
SOALAN 8

Calculate the timer's clock frequency and its period for PIC18 based systems with the following crystal frequencies:

Kira frekuensi jam pemasa dan tempoh bagi sistem PIC18 dengan frekuensi kristal berikut:

(a) 10 MHz

(b) 4 MHz

[4 marks]

[*4 markah*]

QUESTION 9
SOALAN 9

CLO1
C2

Describe the function of pins of R/W and E in the LCD.

Terangkan fungsi pins R/W dan E di dalam LCD.

[4 marks]

[*4 markah*]

QUESTION 10
SOALAN 10

CLO1
C1

List **FOUR (4)** brands of microcontroller other than PIC microcontroller.

Senaraikan EMPAT (4) jenama pengawalmikro selain dari pengawalmikro PIC.

[4 marks]

[*4markah*]

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) Draw a block diagram of microcontroller unit that includes support devices.

Lukiskan gambarajah blok unit pengawal mikro berserta dengan perkakasan sokongan.

[7 marks]

[7markah]

CLO1
C4

(b) Compare **FOUR (4)** differences between a microprocessor and a microcontroller.

*Bandingkan **EMPAT (4)** perbezaan di antara pemproses mikro dan pengawal mikro.*

[8 marks]

[8markah]

CLO1
C3

(c) List **FIVE (5)** common characteristic for embedded system.

*Senaraikan **LIMA (5)** ciri-ciri umum sistem terbenam.*

[5 marks]

[5 markah]

QUESTION 2
SOALAN 2

A push button switch is connected to pin RB7 and FOUR (4) LEDs are connected to pin RA0, RE1, RC2 and RD3 respectively. When the switch is pressed all the LEDs will be turned ON and when it is released all LEDs will be turn OFF. Push button circuit is active low and LEDs circuit are active high.

Satu suis butang tekan disambung ke pin RB7 dan EMPAT (4) LED masing-masing disambung ke pin RA0, RE1, RC2 and RD3. Apabila suis ditekan semua LED akan dihidupkan dan apabila ia dilepaskan semua LED akan dimatikan. Litar suis butang adalah aktif rendah dan litar LED adalah aktif tinggi.

CLO1
C3

(a) Sketch the circuit for the system.

Lakarkan litar untuk sistem tersebut.

[8 marks]

[8 markah]

CLO1
C3

(b) Write a program in C language to perform the operation.

Tulis satu program dalam bahasa C untuk melakukan operasi tersebut.

[12 marks]

[12 markah]

QUESTION 3
SOALAN 3

ADC Module is widely used in microcontroller application such as analog sensors for temperature, light sensor and potentiometer. Based on the program given in Diagram B1, a potentiometer is connected to pin RA0 while two (2) LEDs is connected to pin RC0 and RD1.

Modul ADC digunakan secara meluas di dalam aplikasi pengawal mikro seperti pengesan suhu, pengesan cahaya dan perintang bolehlaras. Berdasarkan program yang diberi di dalam Rajah B1, perintang bolehlaras disambung pada pin RA0 manakala dua (2) LED disambungkan kepada pin RC0 dan RD1.

CLO1
C3

(a) Show how ADC module will control operation of all LEDs based on the programme given in Diagram B1. Use Diagram B2, B3 and B4 as references.
   Tunjukkan bagaimana modul ADC akan mengawal operasi semua LED berdasarkan program yang diberi pada Rajah B1. Gunakan Rajah B2, B3 dan B4 sebagai rujukan.

[15 marks]
[15 markah]

CLO1
C3

(b) Sketch the circuit based on the situation given.
   Lakarkan litar berdasarkan situasi yang diberikan.

[5 marks]
[5 markah]

```c
#include <xc.h>

#define _XTAL_FREQ 48000000
#define LED1 PORTBbits.RC0
#define LED2 PORTBbits.RD1

void main (void)
{
unsigned int     Result
TRISAbits.TRISA0 = 1;
TRISCbits.TRISC0=0;
TRISDbits.TRISD1=0;
ADCON0=0b00000001;
ADCON1=0b00001110;
ADCON2=0b10110110;
while (1)
{
 ADCON0bits.GO_DONE = 1;
 while (ADCON0bits.GO_DONE == 1);
 Result = ((unsigned int) ADRESH << 8) + ADRESL;

if ( Result > 100 && Result < 300 )
{ LED1 = 1; }

else if (Result > 400 && Result < 600)
{ LED2 = 1; }

else
{ LATB = 0; }
}
}
```

Diagram B1 / *Rajah B1*

REGISTER 19-1: ADCON0: A/D CONTROL REGISTER 0

U-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
		CHS3	CHS2	CHS1	CHS0	GO/DONE	ADON
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 7-6   **Unimplemented:** Read as '0'

bit 5-2   **CHS<3:0>:** Analog Channel Select bits
       0000 = Channel 0 (AN0)
       0001 = Channel 1 (AN1)
       0010 = Channel 2 (AN2)
       0011 = Channel 3 (AN3)
       0100 = Channel 4 (AN4)
       0101 = Channel 5 (AN5)[1,2]
       0110 = Channel 6 (AN6)[1,2]
       0111 = Channel 7 (AN7)[1,2]
       1000 = Channel 8 (AN8)
       1001 = Channel 9 (AN9)
       1010 = Channel 10 (AN10)
       1011 = Channel 11 (AN11)
       1100 = Channel 12 (AN12)
       1101 = Unimplemented)[2]
       1110 = Unimplemented)[2]
       1111 = Unimplemented)[2]

bit 1   **GO/DONE:** A/D Conversion Status bit
       When ADON = 1:
       1 = A/D conversion in progress
       0 = A/D Idle

bit 0   **ADON:** A/D On bit
       1 = A/D Converter module is enabled
       0 = A/D Converter module is disabled

Diagram B2 / *Rajah B2*

REGISTER 19-2: ADCON1: A/D CONTROL REGISTER 1

U-0	U-0	R/W-0	R/W-0	R/W-0	R/W-q[1]	R/W-q[1]	R/W-q[1]
		VCFG1	VCFG0	PCFG3	PCFG2	PCFG1	PCFG0
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 7-6   **Unimplemented:** Read as '0'

bit 5   **VCFG1:** Voltage Reference Configuration bit (VREF- source)
       1 = VREF- (AN2)
       0 = VSS

bit 4   **VCFG0:** Voltage Reference Configuration bit (VREF+ source)
       1 = VREF+ (AN3)
       0 = VDD

bit 3-0   **PCFG<3:0>:** A/D Port Configuration Control bits:

PCFG3:PCFG0	AN12	AN11	AN10	AN9	AN8	AN7[2]	AN6[2]	AN5[2]	AN4	AN3	AN2	AN1	AN0
0000[1]	A	A	A	A	A	A	A	A	A	A	A	A	A
0001	A	A	A	A	A	A	A	A	A	A	A	A	A
0010	A	A	A	A	A	A	A	A	A	A	A	A	A
0011	D	A	A	A	A	A	A	A	A	A	A	A	A
0100	D	D	A	A	A	A	A	A	A	A	A	A	A
0101	D	D	D	A	A	A	A	A	A	A	A	A	A
0110	D	D	D	D	A	A	A	A	A	A	A	A	A
0111[1]	D	D	D	D	D	A	A	A	A	A	A	A	A
1000	D	D	D	D	D	D	A	A	A	A	A	A	A
1001	D	D	D	D	D	D	D	A	A	A	A	A	A
1010	D	D	D	D	D	D	D	D	A	A	A	A	A
1011	D	D	D	D	D	D	D	D	D	A	A	A	A
1100	D	D	D	D	D	D	D	D	D	D	A	A	A
1101	D	D	D	D	D	D	D	D	D	D	D	A	A
1110	D	D	D	D	D	D	D	D	D	D	D	D	A
1111	D	D	D	D	D	D	D	D	D	D	D	D	D

A = Analog input   D = Digital I/O

Diagram B3 / *Rajah B3*

REGISTER 19-3:   **ADCON2: A/D CONTROL REGISTER 2**

R/W-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
ADFM		ACQT2	ACQT1	ACQT0	ADCS2	ADCS1	ADCS0

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   **ADFM: A/D Result Format Select bit**

                    1 = Right justified
                    0 = Left justified

bit 6   **Unimplemented: Read as '0'**

bit 5-3   **ACQT<2:0>: A/D Acquisition Time Select bits**

                    111 = 20 T_{AD}
                    110 = 16 T_{AD}
                    101 = 12 T_{AD}
                    100 = 8 T_{AD}
                    011 = 6 T_{AD}
                    010 = 4 T_{AD}
                    001 = 2 T_{AD}
                    000 = 0 T_{AD}[1]

bit 2-0   **ADCS<2:0>: A/D Conversion Clock Select bits**

                    111 = F_{RC} (clock derived from A/D RC oscillator)[1]
                    110 = Fosc/64
                    101 = Fosc/16
                    100 = Fosc/4
                    011 = F_{RC} (clock derived from A/D RC oscillator)[1]
                    010 = Fosc/32
                    001 = Fosc/8
                    000 = Fosc/2

Diagram B4 / *Rajah B4*

SOALAN TAMAT