

SULIT



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2016

DEC5052: EMBEDDED SYSTEM APPLICATIONS

TARIKH : 22 OKTOBER 2016 (SABTU)
MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.
Bahagian A: Struktur (4 soalan)
Bahagian B: Esei (2 soalan)
Dokumen sokongan yang disertakan : **Appendix A1 – A3**

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A: 60 MARKS**BAHAGIAN A: 60 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 **THREE (3)** embedded systems attached to a smart phone.

*Senaraikan **TIGA (3)** sistem terbenam yang digunakan didalam sebuah telefon pintar.*

[3 marks]

[3 markah]

CLO1
C3

- (b) Show and explain the function of TRISx and PORTx register in I/O operation by giving a code example for each register.

Tunjuk dan terangkan fungsi daftar TRISx dan PORTx dalam operasi I/O dan berikan contoh setiap daftar.

[6 marks]

[6 markah]

CLO2
C3

- (c) Build a program in C language that will count data from 00H until FFH on the LED's connected to PORT B and PORT C of PIC16 microcontroller.

Binakan satu aturcara dalam bahasa C untuk mengira data 00H hingga FFH pada LED yang disambungkan pada PORT B dan PORT C ke dalam pengawalmikro PIC16.

[6 marks]

[6 markah]

QUESTION 2

SOALAN 2

- CLO1
C2 (a) Explain the function of TMRxH and TMRxL registers in PIC.
Terangkan fungsi pendaftar TMRxH dan TMRxL dalam PIC.
[3 marks]
[3 markah]
- CLO1
C3 (b) Calculate the value that need to be loaded into TMR0H and TMR0L register using 16-bit mode, assuming XTAL=10 MHz, with prescalar = 128 and the desired time delay is 2 ms.
Kira nilai yang diperlukan oleh pendaftar TMR0H dan TMR0L yang menggunakan mod 16-bit.. Dengan anggapan XTAL=10 MHz dan nilai pra skala ialah 128 dan nilai lengah masa ialah 2 ms.
[6 marks]
[6 markah]
- CLO2
C3 (c) Build a C program using Timer0 to generate a square wave of 3kHz. Assume that a crystal frequency is 10MHz.
Binakan satu aturcara C dengan menggunakan Timer0 untuk menghasilkan gelombang segiempat 3kHz. Anggapkan bahawa frekuensi kristal adalah 10MHz.
[6 marks]
[6 markah]

QUESTION 3

SOALAN 3

CLO1
C1

- (a) List **THREE (3)** sources of interrupt in PIC 18.

*Senaraikan **TIGA (3)** punca sampukan di dalam PIC 18.*

[3 marks]

[3 markah]

CLO1
C2

- (b) Show the instruction needed to enable (unmask) the TMR0 interrupt and external hardware interrupt 0 (INT0), and disable (mask) the TMR0 interrupt, then disable (mask) all the interrupt with a single instruction.

Tunjukkan arahan yang diperlukan untuk membenarkan (unmask) sampukan TMR0 dan sampukan perkakasan luar 0 (INT0), dan mematikan(mask) sampukan TMR0, kemudian mematikan(mask) semua sampukan dengan satu arahan.

[5 marks]

[5 markah]

CLO1
C3

- (c) Build a C language program for interface with external hardware interrupt pin RB1. The buzzer connected at pin RB7 is turned on and off at the same rate as the pulse are applied for the INT1 pin.

Binakan satu aturcara dalam bahasa C bagi sampukan perkakasan luar pin RB1. Siren yang disambungkan pada pin RB7 akan berbunyi dan padam pada kadar masa yang sama seperti denyut yang digunakan pada pin INT1.

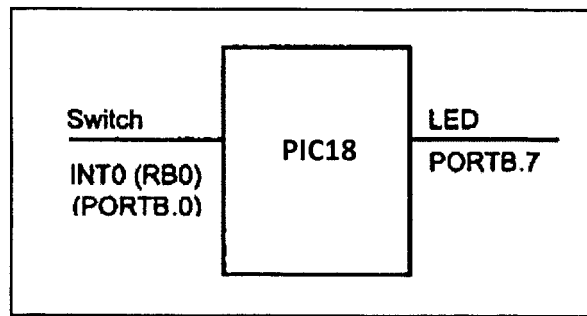
[7 marks]

[7 markah]

QUESTION 4

SOALAN 4

- CLO1
C2 (a) Summarize the ADC (Analog to Digital Converter) module in the PIC.
Rumuskan modul ADC (Penukar Analog ke Digital) di dalam PIC.
[3 marks]
[3 markah]
- CLO1
C3 (b) The LM35 series sensor are precision integrated circuit temperature sensors which the output is 10mV for each degree of centigrade temperature. Demonstrate why do we set the V_{ref} of the PIC to 2.56 V if the analog input is connected to the LM35?
Pengesan LM35 adalah litar bersepadu bagi pengesanan suhu yang memerlukan 10mV bagi setiap darjah suhu degree. Terangkan mengapa kita perlu menetapkan nilai V_{ref} bersamaan 2.56V untuk PIC jika masukan analog disambungkan dengan LM35?
[5 marks]
[5 markah]
- CLO2
C5 (c) A security door is attached to a sensor switch (SW1) which is connected to port B of PIC18 microcontroller (INT0/RB0) and a lamp (LED) connected to Port RB7. Build a program, so that every time the door is opened, the light will be turn on. Refer Figure A4(c).
*Sebuah pintu keselamatan telah dipasangkan dengan penderia suis (SW1) yang bersambung dengan port B mikropengawal PIC18 (INT0/RB0) dan lampu (LED) bersambung dengan Port RB7.
Binakan satu program, apabila setiap kali pintu dibuka, lampu akan menyala.
Rujuk Rajah A4(c).*

Figure A4(c) / *Rajah A4(c)*

[7 marks]

[7 markah]

SECTION B: 40 MARKS**BAHAGIAN B: 40 MARKAH****INSTRUCTION:**

This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **TWO (2)** soalan esei. Jawab **SEMUA** soalan.*

QUESTION 1**SOALAN 1**

CLO2
C3

A contest on developing an intelligent toy provides the rule of using the features of external interrupt in PIC microcontroller. As a participant for this contest you were required to construct a program that activate LED1 and LED2, alternately turn ON and turn OFF continuously with 2 seconds delay each. When INT1 is activated, Buzzer will beep 1 second if LED1 is turned ON, and 2 second if LED2 is turned ON. When INT2 is activated, Buzzer will beep 2 times and all LED will turn OFF for 2 second. Sketch a schematic diagram for the system which include reset button and crystal oscillator circuit.

Satu pertandingan untuk membangunkan permainan pintar menyediakan peraturan menggunakan ciri-ciri sampukan luaran dalam PIC mikropengawal. Sebagai peserta untuk pertandingan ini, anda dikehendaki membina satu program yang mengaktifkan LED1 dan, LED2, berselang-seli menyala dan apdam berterusan dengan masa 2 saat setiap satu. Apabila INT1 diaktifkan, Buzzer akan berbunyi 1 saat jika LED1 ON, dan 2 saat jika LED2 ON. Apabila INT2 diaktifkan, Buzzer akan berbunyi 2 kali dan semua LED akan dimatikan selama 2 saat. Lakarkan gambar rajah skematik bagi sistem ini berserta butang set semula, dan litar pengayun kristal.

[20 marks]

[20 markah]

QUESTION 2

SOALAN 2

CLO2
C5

Figure B2 shows a new helmet design with embedded system. One active low switch is placed in the inner shell (SW1) and the chin strap (SW2) of the helmet. Two LEDs are placed at the outer shell namely LED1 and LED2. The motorist must wear the helmet and fasten the chin strap properly, so LED1 will turn on. If the motorist does not comply with either one of the safety steps mentioned, the LED2 will continuously blink with 200ms delay. By using the PIC16/18 microcontroller, **draw** the circuit for the overall system. Then, **build** the program in C language to perform the operation. Use PORT B as input and PORTC as output port.

*Rajah B2 menunjukkan satu reka bentuk topi keledar dengan sistem terbenam. Satu suis aktif rendah diletakkan pada bahagian dalam topi keledar (SW1) dan pada tali pinggang keledar (SW2). Dua LED diletakkan dibahagian luar topi keledar iaitu LED1 dan LED2. Penunggang motosikal mesti memakai topi keledar dan memasang tali pinggang keledar dengan betul supaya LED1 akan menyala. Jika penunggang motosikal tidak mematuhi salah satu langkah-langkah keselamatan tersebut, LED2 akan berkelip-kelip dengan lengah masa 200ms. Dengan menggunakan pengawalmikro PIC16/18, **lukiskan** litar bagi keseluruhan sistem. Kemudian, **binakan** sebuah program dalam bahasa C untuk melakukan operasi tersebut. Gunakan PORTB sebagai input dan PORTC sebagai keluaran.*

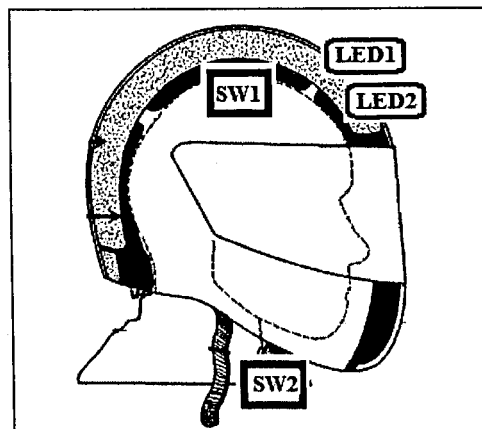


Figure B2 / Rajah B2

[20 marks]

[20 markah]

SOALAN TAMAT

APPENDIX

Appendix A1

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
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 including peripherals
When IPEN = 1:
1 = Enables all high priority interrupts
0 = Disables all interrupts including low priority
- 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 interrupts
0 = Disables all low priority 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: Port B Interrupt-On-Change (IOCx) Interrupt Enable bit⁽²⁾
1 = Enables the IOCx port change interrupt
0 = Disables the IOCx port change interrupt
- bit 2 TMR0IF: TMR0 Overflow Interrupt Flag bit
1 = TMR0 register has overflowed (must be cleared by software)
0 = TMR0 register did not overflow
- bit 1 INT0IF: INT0 External Interrupt Flag bit
1 = The INT0 external interrupt occurred (must be cleared by software)
0 = The INT0 external interrupt did not occur
- bit 0 RBIF: Port B Interrupt-On-Change (IOCx) Interrupt Flag bit⁽¹⁾
1 = At least one of the IOC<3:0> (RB<7:4>) pins changed state (must be cleared by software)
0 = None of the IOC<3:0> (RB<7:4>) pins have changed state

APPENDIX

Appendix A2

REGISTER 9-2: INTCON2: INTERRUPT CONTROL 2 REGISTER

R/W-1	R/W-1	R/W-1	R/W-1	U-0	R/W-1	U-0	R/W-1
RBPUP	INTEDG0	INTEDG1	INTEDG2		TMR0IP		RBIP
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 **RBPUP**: PORTB Pull-up Enable bit
 1 = All PORTB pull-ups are disabled
 0 = PORTB pull-ups are enabled provided that the pin is an input and the corresponding WPUB bit is set.
- bit 6 **INTEDG0**: External Interrupt 0 Edge Select bit
 1 = Interrupt on rising edge
 0 = Interrupt on falling edge
- bit 5 **INTEDG1**: External Interrupt 1 Edge Select bit
 1 = Interrupt on rising edge
 0 = Interrupt on falling edge
- bit 4 **INTEDG2**: External Interrupt 2 Edge Select bit
 1 = Interrupt on rising edge
 0 = Interrupt on falling edge
- bit 3 **Unimplemented**: Read as '0'
- bit 2 **TMR0IP**: TMR0 Overflow Interrupt Priority bit
 1 = High priority
 0 = Low priority
- bit 1 **Unimplemented**: Read as '0'
- bit 0 **RBIP**: RB Port Change Interrupt Priority bit
 1 = High priority
 0 = Low priority

APPENDIX

Appendix A3

REGISTER 9-3: INTCON3: INTERRUPT CONTROL 3 REGISTER

R/W-1	R/W-1	U-0	R/W-0	R/W-0	U-0	R/W-0	R/W-0
INT2IP	INT1IP		INT2IE	INT1IE		INT2IF	INT1IF
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 **INT2IP:** INT2 External Interrupt Priority bit
 1 = High priority
 0 = Low priority
- bit 6 **INT1IP:** INT1 External Interrupt Priority bit
 1 = High priority
 0 = Low priority
- bit 5 **Unimplemented:** Read as '0'
- bit 4 **INT2IE:** INT2 External Interrupt Enable bit
 1 = Enables the INT2 external interrupt
 0 = Disables the INT2 external interrupt
- bit 3 **INT1IE:** INT1 External Interrupt Enable bit
 1 = Enables the INT1 external interrupt
 0 = Disables the INT1 external interrupt
- bit 2 **Unimplemented:** Read as '0'
- bit 1 **INT2IF:** INT2 External Interrupt Flag bit
 1 = The INT2 external interrupt occurred (must be cleared by software)
 0 = The INT2 external interrupt did not occur
- bit 0 **INT1IF:** INT1 External Interrupt Flag bit
 1 = The INT1 external interrupt occurred (must be cleared by software)
 0 = The INT1 external interrupt did not occur