KOLEJ UNIVERSITI TEKNOLOGI TUN HUSSEIN ONN

PEPERIKSAAN AKHIR
SEMESTER I
SESI 2006/07

NAMA MATAPELAJARAN	:	MIKROPENGAWAL
KOD MATAPELAJARAN	:	DEK 3133
KURSUS	:	DET, DEX, DEE
TARIKH PEPERIKSAAN	:	NOVEMBER 2006
JANGKA MASA	:	**2 JAM 30 MINIT**
ARAHAN	:	JAWAB **EMPAT(4)** SOALAN DARIPADA ENAM(6) SOALAN

KERTAS SOALAN INI MENGANDUNGI 8 MUKA SURAT

SOALAN DALAM BAHASA MELAYU

S1 (a) Unit Pusat Pemprosesan (CPU) adalah merupakan jantung kepada mikropemproses dimana ia melaksanakan arahan sesuatu program dan juga memproses data. Senaraikan LIMA (5) langkah bagaimana sesuatu program dilaksanakan oleh CPU.

(10 markah)

(b) Secara ringkasnya sebuah mikropengawal mempunyai semua elemen utama sebuah sistem mikropemproses konvensional dalam satu cip. Nyatakan semua elemen tersebut termasuk rajah strukturnya dan terangkan fungsi setiap elemen.

(15 markah)

S2 (a) Sampukan adalah satu mekanisma sebuah mikropengawal di mana ia membolehkan ia memberi tindak balas pada satu-satu keadaan pada saat sampukan itu terjadi. Apakah proses yang dipanggil sebagai 'Rutin Layanan Sampunkan' (ISR)? Nyatakan EMPAT (4) sumber sampukan.

(10 markah)

(b) Satu kitar arahan mempunyai empat kitar jam; Q1, Q2, Q3 dan Q4. Apakah yang dipanggil apabila satu arahan dilaksanakan secara efektif dalam satu kitar arahan? Lukiskan satu arahan perlaksanaan berdasarkan pada arahan di bawah dengan tiga kitar arahan.

```
clrw
movlw  55h
movwf  portb
```

(15 markah)

S3 (a) Sebuah mikropengawal menggunakan kristal berkelajuan 1212Hz. Tuliskan aturcara bahasa himpunan untuk lengahan 1 saat.

(10 markah)

(b) Berdasarkan litar skematik pada Rajah S3(b), terdapat dua butang masukan (*Clear* dan *Count*) yang disambungkan pada *Port A* (RA0 dan RA1) dan lapan LED disambungkan pada pangkalan B. Butang *Clear* adalah untuk *Reset* (membolehkan memadam pangkalan keluaran) dan Butang *Count* pula adalah untuk pengiraan(membolehkan menokok keluaran). LED akan meningkatkan nilainya apabila butang *Count* ditekan. Tuliskan satu program berdasarkan pada rajah aliran seperti di Rajah S3(b).

(15 markah)

S4 (a) Penghimpun langsung adalah arahan yang dimasukkan ke dalam kod sumber PIC di mana ia mengawal operasi penghimpun tersebut. Nyatakan LIMA (5) jenis penghimpun langung beserta contohnya.

(10 markah)

(b) PIC16F84 mempunyai beberapa ciri-ciri istimewa yang membolehkan dan menambah kelenturan dan julat aplikasi. Ciri-ciri istimewa ini termasuk pengayun. Beri DUA (2) jenis pengayun beserta gambarajah dan nyatakan perbezaan di antara kedua-duanya.

(15 markah)

S5 (a) Rajah S5(a) menunjukkan litar skematik sebuah PIC yang mempunyai satu masukan sampukan pada RB0/INT dan tiga keluaran pada LED (RB1, RB2 dan RB3). Litar beroperasi dengan menyalakan LED secara berjujukan bermula daripada LED1, LED2, LED3, LED1, LED2 dan seterusnya. Lengahan setiap nyalaan adalah selama 1 saat.. Apabila butang SW1 ditekan, sampukan berlaku dimana LED1, LED2 dan LED3 akan berkelip-kelip serentak sebanyak dua kali (4 saat) sebelum kembali semula kepada nyalaan LED mengikut jujukan sebelumnya. Tuliskan aturcara bahasa himpunan untuk PIC melaksanakan operasi tersebut.

(25 markah)

S6 (a) TMR0 adalah daftar fail untuk pemasa larian bebas. Sekiranya jam berkelajuan 4.5 Mhz dibekalkan kepada TMR0 dan dengan tetapan skala 1:256, berapakah masa yang diambil oleh PIC untuk menyelesaikan kiraan 0 sehingga 255?

(10 markah)

(b) (i) 4.5 Mhz frekuensi jam dibekalkan kepada PIC. Berapakah masa yang diambil oleh PIC untuk melaksanakan satu arahan?

(10 markah)

(ii) Berapa arahan yang dapat dilaksanakan oleh PIC tersebut dalam tempoh 2 saat?

(5 markah)

SOALAN DALAM BAHASA INGGERIS

Q1 (a) The heart of microprocessor is the Central Processing Unit (CPU) where it executes instructions of the program and process data. List FIVE (5) steps how a program being executed.

(10 marks)

(b) The microprocessor can provide, in a simplified form, all the main elements of the conventional microprocessor system on one chip. List down all the elements including its structure diagram and explain each its function.

(15 marks)

Q2 (a) Interrupts are a mechanism of a microcontroller which enables it to respond to some events at the moment they occur. What process is called the 'Interrupt Service Routine' (ISR)? List FOUR (4) interrupts sources.

(10 marks)

(b) One instruction cycle has 4 clock cycles; Q1, Q2, Q3 and Q4. What does it called when one instruction is effectively executed in one instruction cycle? Draw an execution instruction based on the program below for three instruction cycle.

```
clrw
movlw  55h
movwf  portb
```

(15 marks)

Q3 (a) The crystal fitted to microcontroller board run at 1212Hz. Write a assembly language program for 1 second delay.

(10 marks)

(b) Based on Figure Q3(b), there are two input buttons (Clear and Count) connected to Port A (RA0 and RA1), and eight LEDs are connected to Port B. Clear button are for Reset (enable to Clear Output Port) while Count Button are for counting (enable to Increment Output). LEDs will increase the value once the Count Button is pressed. Write a program based on the flowchart as shown in Figure Q3(b).

(15 marks)

Q4 (a) Assembler directives are commands inserted in PIC source code which control the operation of the assembler. List FIVE (5) types of directives including examples.

(10 marks)

(b) The PIC16F84 has a number of special features that enhance its flexibility and range of applications. This special feature includes oscillator. Give TWO (2) types of oscillator including diagram and what are the differences between them?

(15 marks)

Q5 (a) Figure Q5(a) shows the schematic circuit of PIC with one interrupt input at RB0/INT and three output LEDs (RB1,RB2 and RB3). The operational of the circuit is to switch ON the LEDs in sequence starting from LED1, LED2, LED3, LED1, LED2 and so on. The delay between every sequence is 1 second. When the SW1 button is pressed, interrupt is activated and at this moment LED1, LED2 and LED3 is blinking simultaneously for two times (4 seconds) before it back to the previous LED pattern instruction sequence. Write an assembly language program for PIC to operate this operation.

(25marks)

Q6 (a) TMR0 is a file register for free run timer. If the 4.5 Mhz clock frequency is feed to TMR0 with the prescaler at 1:256, how long the PIC takes to count from 0 until 255?

(10 marks)

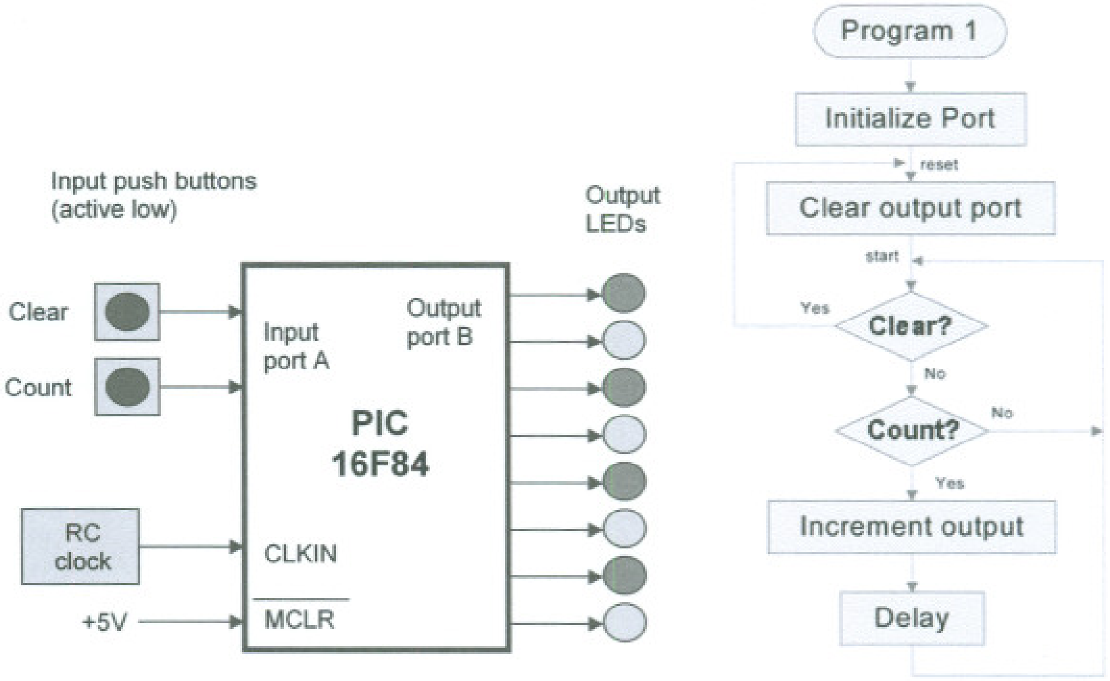
(b) (i) 4.5 Mhz clock frequency is feed to the PIC board. How long PIC need to execute 1 instruction?

(10 marks)

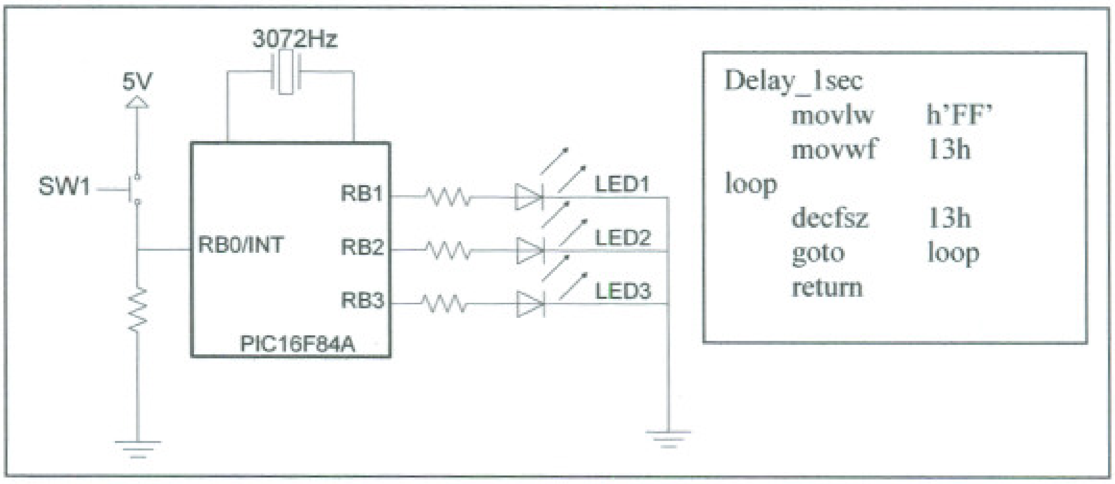
(ii) How many instructions can be execute by the PIC in 2 second?

(5 marks)

Senarai Rajah-rajah/ Figures



Rajah S3(b) / Figure Q3(b)



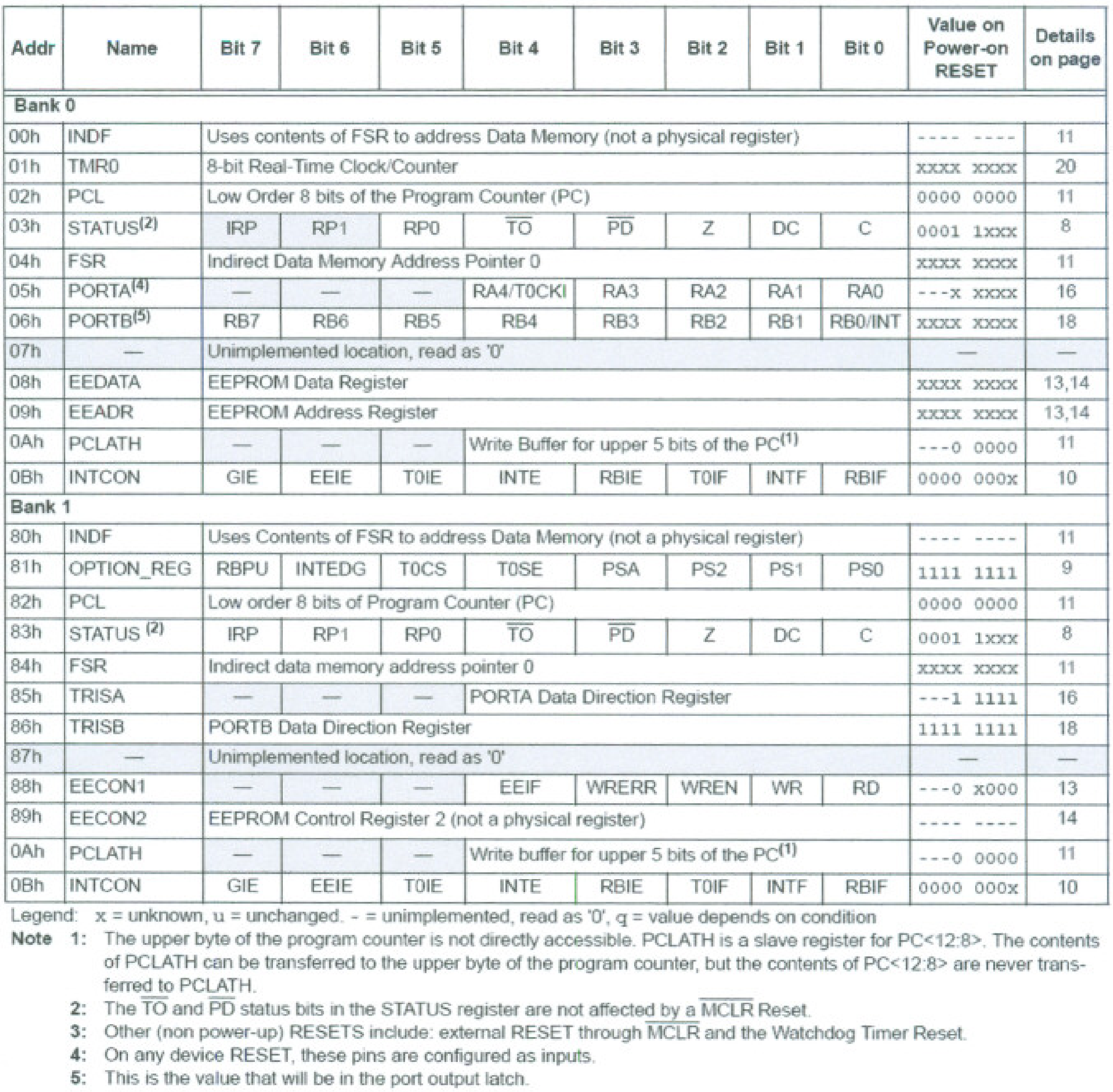
```
Delay_1sec
        movlw     h'FF'
        movwf     13h
loop
        decfsz    13h
        goto      loop
        return
```

Rajah S5(a) / Figure Q5(a)

PEPERIKSAAN AKHIR

SEMESTER/SESI: I / 2006/2007 KURSUS: 3DET, 3DEX, 3DEE
MATA PELAJARAN : MIKROPENGAWAL KOD MATA PELAJARAN: DEK3133

Jadual 1/Table 1 : Ringkasan Fail-fail daftar khas/ Special Function Register File Summary



Addr	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on Power-on RESET	Details on page
Bank 0											
00h	INDF	Uses contents of FSR to address Data Memory (not a physical register)								---- ----	11
01h	TMR0	8-bit Real-Time Clock/Counter								xxxx xxxx	20
02h	PCL	Low Order 8 bits of the Program Counter (PC)								0000 0000	11
03h	STATUS[2]	IRP	RP1	RP0	$\overline{\text{TO}}$	$\overline{\text{PD}}$	Z	DC	C	0001 1xxx	8
04h	FSR	Indirect Data Memory Address Pointer 0								xxxx xxxx	11
05h	PORTA[4]	—	—	—	RA4/T0CKI	RA3	RA2	RA1	RA0	---x xxxx	16
06h	PORTB[5]	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0/INT	xxxx xxxx	18
07h	—	Unimplemented location, read as '0'								—	—
08h	EEDATA	EEPROM Data Register								xxxx xxxx	13,14
09h	EEADR	EEPROM Address Register								xxxx xxxx	13,14
0Ah	PCLATH	—	—	—	Write Buffer for upper 5 bits of the PC[1]					---0 0000	11
0Bh	INTCON	GIE	EEIE	T0IE	INTE	RBIE	T0IF	INTF	RBIF	0000 000x	10
Bank 1											
80h	INDF	Uses Contents of FSR to address Data Memory (not a physical register)								---- ----	11
81h	OPTION_REG	RBPU	INTEDG	T0CS	T0SE	PSA	PS2	PS1	PS0	1111 1111	9
82h	PCL	Low order 8 bits of Program Counter (PC)								0000 0000	11
83h	STATUS [2]	IRP	RP1	RP0	$\overline{\text{TO}}$	$\overline{\text{PD}}$	Z	DC	C	0001 1xxx	8
84h	FSR	Indirect data memory address pointer 0								xxxx xxxx	11
85h	TRISA	—	—	—	PORTA Data Direction Register					---1 1111	16
86h	TRISB	PORTB Data Direction Register								1111 1111	18
87h	—	Unimplemented location, read as '0'								—	—
88h	EECON1	—	—	—	EEIF	WRERR	WREN	WR	RD	---0 x000	13
89h	EECON2	EEPROM Control Register 2 (not a physical register)								---- ----	14
0Ah	PCLATH	—	—	—	Write buffer for upper 5 bits of the PC[1]					---0 0000	11
0Bh	INTCON	GIE	EEIE	T0IE	INTE	RBIE	T0IF	INTF	RBIF	0000 000x	10

Legend: x = unknown, u = unchanged. - = unimplemented, read as '0', q = value depends on condition

Note 1: The upper byte of the program counter is not directly accessible. PCLATH is a slave register for PC<12:8>. The contents of PCLATH can be transferred to the upper byte of the program counter, but the contents of PC<12:8> are never transferred to PCLATH.

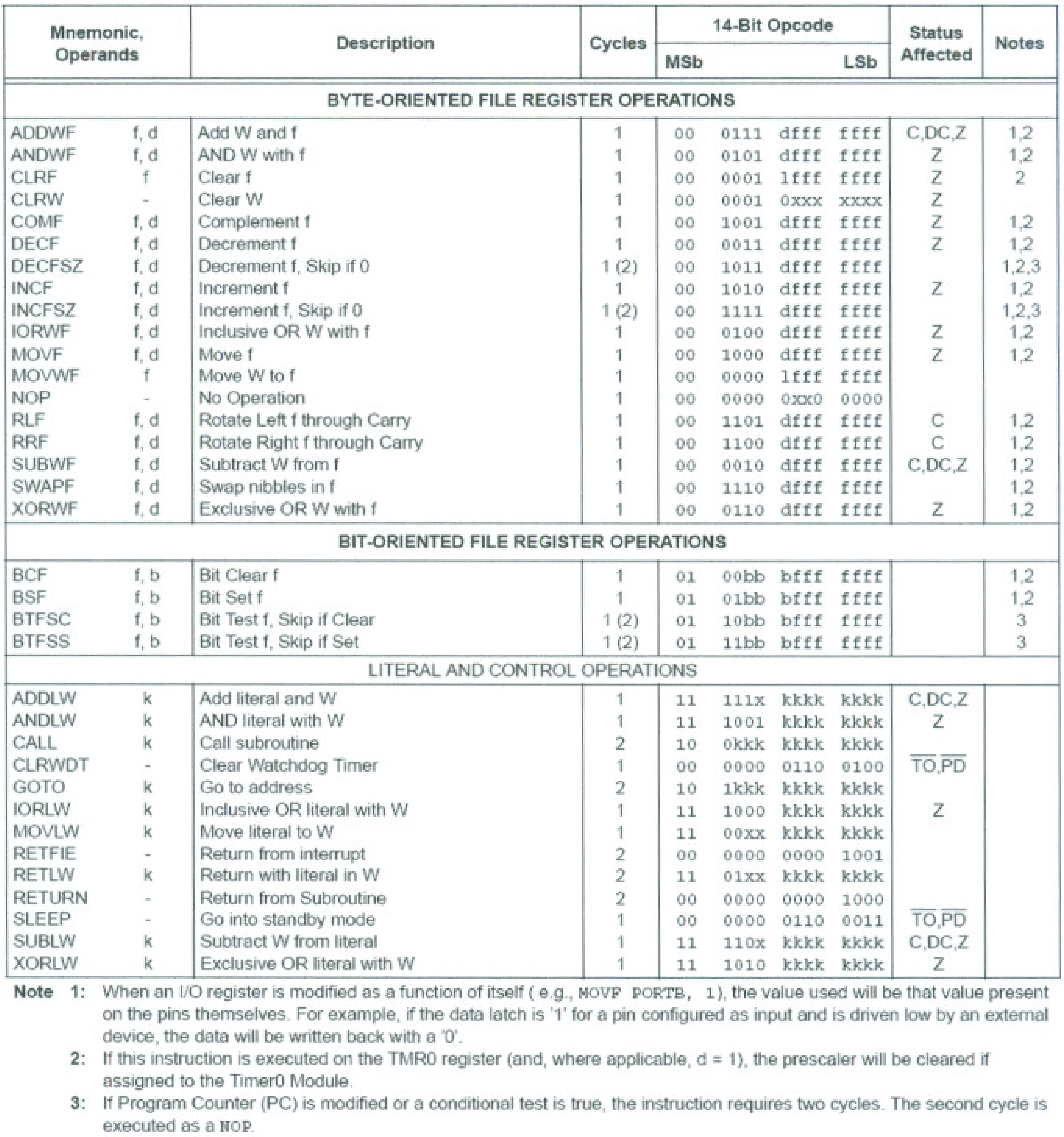
2: The $\overline{\text{TO}}$ and $\overline{\text{PD}}$ status bits in the STATUS register are not affected by a $\overline{\text{MCLR}}$ Reset.

3: Other (non power-up) RESETS include: external RESET through $\overline{\text{MCLR}}$ and the Watchdog Timer Reset.

4: On any device RESET, these pins are configured as inputs.

5: This is the value that will be in the port output latch.

Jadual 2/Table 2 : Set-set suruhan/ Instruction Set



Mnemonic, Operands		Description	Cycles	14-Bit Opcode				Status Affected	Notes
				MSb			LSb		
BYTE-ORIENTED FILE REGISTER OPERATIONS									
ADDWF	f, d	Add W and f	1	00	0111	dfff	ffff	C,DC,Z	1,2
ANDWF	f, d	AND W with f	1	00	0101	dfff	ffff	Z	1,2
CLRF	f	Clear f	1	00	0001	1fff	ffff	Z	2
CLRW	-	Clear W	1	00	0001	0xxx	xxxx	Z	
COMF	f, d	Complement f	1	00	1001	dfff	ffff	Z	1,2
DECF	f, d	Decrement f	1	00	0011	dfff	ffff	Z	1,2
DECFSZ	f, d	Decrement f, Skip if 0	1 (2)	00	1011	dfff	ffff		1,2,3
INCF	f, d	Increment f	1	00	1010	dfff	ffff	Z	1,2
INCFSZ	f, d	Increment f, Skip if 0	1 (2)	00	1111	dfff	ffff		1,2,3
IORWF	f, d	Inclusive OR W with f	1	00	0100	dfff	ffff	Z	1,2
MOVF	f, d	Move f	1	00	1000	dfff	ffff	Z	1,2
MOVWF	f	Move W to f	1	00	0000	1fff	ffff		
NOP	-	No Operation	1	00	0000	0xx0	0000		
RLF	f, d	Rotate Left f through Carry	1	00	1101	dfff	ffff	C	1,2
RRF	f, d	Rotate Right f through Carry	1	00	1100	dfff	ffff	C	1,2
SUBWF	f, d	Subtract W from f	1	00	0010	dfff	ffff	C,DC,Z	1,2
SWAPF	f, d	Swap nibbles in f	1	00	1110	dfff	ffff		1,2
XORWF	f, d	Exclusive OR W with f	1	00	0110	dfff	ffff	Z	1,2
BIT-ORIENTED FILE REGISTER OPERATIONS									
BCF	f, b	Bit Clear f	1	01	00bb	bfff	ffff		1,2
BSF	f, b	Bit Set f	1	01	01bb	bfff	ffff		1,2
BTFSC	f, b	Bit Test f, Skip if Clear	1 (2)	01	10bb	bfff	ffff		3
BTFSS	f, b	Bit Test f, Skip if Set	1 (2)	01	11bb	bfff	ffff		3
LITERAL AND CONTROL OPERATIONS									
ADDLW	k	Add literal and W	1	11	111x	kkkk	kkkk	C,DC,Z	
ANDLW	k	AND literal with W	1	11	1001	kkkk	kkkk	Z	
CALL	k	Call subroutine	2	10	0kkk	kkkk	kkkk		
CLRWDT	-	Clear Watchdog Timer	1	00	0000	0110	0100	$\overline{TO}$,$\overline{PD}$	
GOTO	k	Go to address	2	10	1kkk	kkkk	kkkk		
IORLW	k	Inclusive OR literal with W	1	11	1000	kkkk	kkkk	Z	
MOVLW	k	Move literal to W	1	11	00xx	kkkk	kkkk		
RETFIE	-	Return from interrupt	2	00	0000	0000	1001		
RETLW	k	Return with literal in W	2	11	01xx	kkkk	kkkk		
RETURN	-	Return from Subroutine	2	00	0000	0000	1000		
SLEEP	-	Go into standby mode	1	00	0000	0110	0011	$\overline{TO}$,$\overline{PD}$	
SUBLW	k	Subtract W from literal	1	11	110x	kkkk	kkkk	C,DC,Z	
XORLW	k	Exclusive OR literal with W	1	11	1010	kkkk	kkkk	Z	

Note 1: When an I/O register is modified as a function of itself (e.g., `MOVF PORTB, 1`), the value used will be that value present on the pins themselves. For example, if the data latch is '1' for a pin configured as input and is driven low by an external device, the data will be written back with a '0'.

2: If this instruction is executed on the TMR0 register (and, where applicable, d = 1), the prescaler will be cleared if assigned to the Timer0 Module.

3: If Program Counter (PC) is modified or a conditional test is true, the instruction requires two cycles. The second cycle is executed as a `NOP`.