PROGRAM: NATIONAL DIPLOMA
ENGINEERING: COMPUTER SYSTEMS
ENGINEERING: ELECTRICAL

SUBJECT: DIGITAL SYSTEMS 3

CODE: EDS341

DATE: MID YEAR SUPPLEMENTARY EXAMINATION
29 JULY 2016

DURATION: (SESSION 1) 08:00 - 11:00

WEIGHT: 60: 40

TOTAL MARKS: 110=100%

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MODERATOR: MR. J. SEBASTIAN

NUMBER OF PAGES: 4 PAGES

INSTRUCTIONS TO CANDIDATES:

1. ANSWER ALL THE QUESTIONS.
2. MARKS WILL BE DEDUCTED FOR UNTIDY WORK.
3. NO CALCULATORS ARE ALLOWED.
4. KEEP ALL PARTS OF QUESTIONS TOGETHER

2/ ....
QUESTION 1
ALL Questions = PIC16F877A

1.1 Distinguish the two main differences between memory map and I/O map. (2)
1.2 Explain the function of the pseudo-opcode END. (1)
1.3 What happens during “pass one” through the source code program? (1)
1.4 How many instructions are handled by the RISC CPU? (1)
1.5 Explain the purpose of the DECISION making symbol in flow charts? (1)
1.6 List the four files created when assembling a software program. (2)
1.7 What debugging tool will enable you to execute the software in real time? (1)
1.8 What are the other two debugging and testing tools used for? (2)
1.9 What problem will be eliminated by making use of pipelining? (1)
1.10 What type of instruction set has no special instruction/register combination? (1)
1.11 Where will you find the INTERRUPT vector and at what address? (2)
1.12 What will happen if you set bit GIE of the INTCON register? (1)
1.13 What is the function of the destination (d) bit on the instruction set? (1)
1.14 When in sleep mode, what is the current drawn by the controller? (1)
1.15 Explain the compare instruction used by the PIC. (1)
1.16 What must be done to convert from ASCII to BCD? (1)
1.17 What is the maximum time delay that can be calculated with one 8-bit counter/register? (1)
1.18 What happens when a Subtract instruction is executed? (1)
1.19 *What and where* must you place data to make PORTD an input port? (2)
1.20 What is the status of a port if both drivers (P and N) in PORTA stay off? (1)
1.21 What is the maximum source current for each pin of the O/P ports? (1)
1.22 What component is used to isolate between the input circuit and controller when high voltages are used? (1)
**Question 1 (continued)**

1.23 How long will it take for the contacts of a switch to settle after contact bounce has started?  

1.24 When can interrupts be very useful?  

1.25 For how long will the Brown-out keep the controller in the reset state?  

1.26 What value must be loaded in TMR0 when used in counter mode to count twelve counts every time?  

1.27 What is the purpose of the LOAD pin on the shift register when used to expand the ports?  

**Question 2**

2.1 Explain four (4) features of an assembler.  

2.2 What are three types of memories found in the PIC16F877A and what are the memory sizes?  

2.3 Sketch the programming model of the PIC16F877A. (Only show the registers/files done in S3 syllabus)  

**Question 3**

3.1 Sketch and explain the Program Counter when loaded with a GOTO instruction.  

3.2 Explain the sizes and the alternate purposes of the five ports of the PIC 16F877A.  

3.3 Sketch the complete block diagram of the structure of Port A for pin RA4 of the PIC16F877A.  

3.4 Explain the purpose/functionality of the internal pull-up resistors as used in Port B of the PIC16F877A (and where is it enabled?)  

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QUESTION 4

4.1 Sketch the PWRT (Power-up timer) timing diagram for the PIC16F877A and explain the purpose of each stage. \((5)\)

4.2 Sketch a LOGIC diagram of the 3 internal interrupt sources of the PIC16F877A. \((4)\)

4.3 Sketch block diagram of Timer0 and explain each pin/block in detail. \((8)\) \([17]\)

QUESTION 5

Sketch a block diagram of the outside of the PIC and show how the following peripherals can be connected to the pins/ports. (Show the methods of connection and give all the component names and values).

5.1 A 4MHZ crystal oscillator. \((3)\)

5.2 An input buffering using an OPTO-COUPLER on PortB. \((3)\)

5.3 A 8 Bit output port expansion on PORT C. \((3)\)

5.4 A 7-Segment (common cathode) connected to PORT D. \((3)\)

5.5 A 12V output using a J-FET connected to PORT E. \((3)\) \([15]\)

QUESTION 6

6.1 Design and sketch a complete PIC based microprocessor system with 16K of EPROM (consisting of 2764 devices) and 8K of SRAM. The EPROM’s start address is 6000h while the SRAM start address is C000h. A 74LS138 decoder is to be used for decoding. Show all busses, their sizes and directions. Also show all control lines and addresses used. \((8)\) \([8]\)

TOTAL = 110