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**Question Paper Code : 80557**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Sixth/Seventh/Eighth Semester

Electrical and Electronics Engineering

EE 8018 – MICROCONTROLLER BASED SYSTEM DESIGN

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention the significance of PCLATH in PIC microcontroller.
2. List three features of PIC16c6x.
3. Determine the resolution of a 10-bit counter if PR2 is initialized to 47.
4. Emphasize the role of IntService.
5. If XTAL=10Mhz, what frequency is used by the UART to set the baud rate (Assuming default mode)?
6. What is N-key roll over?
7. Write the features of ARM architecture.
8. Briefly signify the role of memory state in ARM system.
9. What are structural hazards?
10. What is the major source of complexity in the 5-stage pipeline?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the architecture of PIC16C61 microcontroller in detail using relevant diagrams. (8)  
(ii) Write a program to generate square wave with 80% duty cycle. (5)

Or

- (b) (i) Explain Program memory map and stack in detail using illustrations. (7)
- (ii) Write a subroutine to insert a delay of exactly 10 milliseconds into the code execution. (6)
12. (a) (i) Write a test program for the PIC16C6x chip to toggle all the bits of PORTA and PORTB every  $1/4^{\text{th}}$  of a second. Assuming the crystal frequency of 4 MHz. (6)
- (ii) Assume that file register RAM locations 40-43H have the following hex values: 40=(7D); 41=(EB); 42=(C5); 43=(5B). Write a program to find the sum of the values. At the end of the program location 6 of the file register should contain the low byte and location 7 the high byte of the sum. (7)

Or

- (b) (i) Write a program to get the  $x$  value from PORTB and send  $x^2 + 2x + 3$  to PORTA. Assume PB3-PB0 has the  $x$  value of 0-9. Use a look-up table instead of multiplication. (7)
- (ii) Assume that file register location  $0 \times 15$  has value FD (hex). Write a program to convert it to decimal. Save the digits in locations  $0 \times 22$ ,  $0 \times 23$  and  $0 \times 24$  where the least significant digit is in  $0 \times 22$ . (6)
13. (a) (i) Write a subroutine called Backup that will copy all 96 bytes of a PIC's bank 0 RAM beginning at address H'20', into the serial EEPROM, beginning at address zero. (7)
- (ii) Using the  $I^2C$  in subroutine as a model, create a  $I^2C$  in 2 subroutine that reads 2 bytes of data into DATAINH and DATAINL. (6)

Or

- (b) (i) Write a subroutine called ADCadjust that converts the value read from the ADRES (H '1E') register into a 2-byte "accumulator" located in RAM called ACC1 and ACC0. (6)
- (ii) Assume the transmitter transmits data at exactly 9,600 baud and assume the receiver measures its sampling times from the exact moment when the STOP to START transition occurs. How far from 9600 baud can the receiver's baud rate clock be and still recover the data and the STOP bit correctly. (4)
- (iii) What is the size, expressed in microvolts of each  $\frac{1}{512}^{\text{th}}$  increment of the reference voltage when a 3.00V reference is used with the ADC. (3)

14. (a) With relevant illustrations, explain the following in detail:
- (i) ARM's visible registers (ii) ARM memory organization (iii) CPSR format (13)

Or

- (b) (i) Write a subroutine to output a text string immediately following the call. (7)
  - (ii) With diagrams, explain why does r15 give pc + 8 in the first cycle of an instruction and pc + 12 in subsequent cycles on an ARM7? (6)
15. (a) (i) Write a subprogram which copies a string of bytes from one memory location to another. The start of the source string will be passed in r1, the length (in bytes) in r2 and the start of the destination string in r3. (6)
- (ii) Explain the following: (1) Coprocessor data operations (2) Coprocessor data transfers. (7)

Or

- (b) (i) Write a program to dump the ARM registers in hexadecimal with formatting given as: r0 = 9ABCDEF0 r1=12345678 (6)
- (ii) Explain the ARM multi-cycle instruction 3-stage pipeline operation in detail. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Analyze in detail, the impact of ARM system in VLSI ISDN Subscriber Processor with sufficient illustration.

Or

- (b) In data handling circuits, Discuss the primary considerations for designing a high speed, low power consumption circuit and also discuss how do these considerations differ when implementing synchronous and Asynchronous data handling mechanisms.