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Printed Page:-4 **Subject Code:- BCSIOT0305**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: III - THEORY EXAMINATION (2025 - 2026)
Subject: Microcontrollers for Embedded Systems

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*
1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*
2. *Maximum marks for each question are indicated on right -hand side of each question.*
3. *Illustrate your answers with neat sketches wherever necessary.*
4. *Assume suitable data if necessary.*
5. *Preferably, write the answers in sequential order.*
6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. Addressing mode used in MOVC A,@A+DPTR. (CO1, K2) 1

(a) Register
(b) Indexed
(c) Direct
(d) Immediate

1-b. Register bank selected after setting PSW.3 and PSW.4. (CO1, K3) 1

(a) Bank 0
(b) Bank 1
(c) Bank 2
(d) Bank 3

1-c. Determine how internal pull-ups are activated on input pins. (CO2, K2) 1

(a) Clear PORTx
(b) Set DDRx=1
(c) Set PINx=1
(d) Set PORTx=1 and DDRx=0

1-d. Recall the bit responsible for enabling ADC module in ATmega32. (CO2, K1) 1

(a) ADEN
(b) ADSC
(c) ADIF
(d) ADFR

1-e. Determine final stored value in y: y = (x & 0x0F) << 2 for x = 0xB3. (CO3, K2) 1

(a) 0x0F
(b) 0x3C
(c) 0x30
(d) 0x0C

1-f. Detect rising edge using INT0: Which configuration? (CO3, K3) 1

(a) ISC00=0, ISC01=0
(b) ISC00=1, ISC01=0
(c) ISC00=0, ISC01=1
(d) ISC00=1, ISC01=1

1-g. Determine effect of RETI instruction on CPU state after ISR completes. (CO4, K2) 1

(a) SP decremented
(b) PC saved
(c) Global interrupt flag restored
(d) Timer reset

1-h. Assess how many cycles an LPM (Load Program Memory) instruction takes under normal operation. (CO4, K2) 1

(a) 1 cycle
(b) 3 cycles
(c) 4 cycles
(d) 2 cycles

1-i. UART buffer overflow due to slow polling — fix? (CO5, K4) 1

(a) Increase baud
(b) Enable RX interrupt
(c) Reduce clock
(d) Disable UDR

1-j. ACIE enabled but comparator interrupt doesn't fire — likely reason? (CO5, K4) 1

(a) ACD set
(b) ACO cleared
(c) UART mismatch
(d) Timer stopped

2. Attempt all parts:-

2.a. Write the output after executing: MOV A,#01H SETB C RRC A. (CO1, K3) 2

2.b. Demonstrate how internal pull-up resistor activation prevents floating input states in AVR ports. (CO2, K2) 2

2.c. Configure Timer0 in CTC mode so that PB0 toggles once every 500 ms. Assume XTAL = 1 MHz. (CO3, K3) 2

2.d. Explain the role of the stack in subroutine calls. (CO4, K2) 2

2.e. Evaluate consequences of incorrect baud rate configuration in USART (CO5, K4). 2

SECTION-B 30

3.a. Answer any one of the following:-

3.a.(i)	Assume RAM locations 40H–44H contain five unsigned numbers. Write a program to compute the average and store the result in 50H (ignore remainder). (CO1, K3)	6
3.a.(ii)	Write an assembly language program to generate a square wave of 1 kHz at pin P1.3 using Timer 1 in Mode 1. (CO1, K3)	6
3.b. Answer any one of the following:-		
3.b.(i)	Describe the behavioral difference between blocking and non-blocking delay implementation using timers. (CO2, K2)	6
3.b.(ii)	Interpret how pin multiplexing allows GPIO pins to perform multiple hardware functions in AVR. (CO2, K2)	6
3.c. Answer any one of the following:-		
3.c.(i)	Alternate all bits on PORTA and PORTC exactly 70 times each using delay. (CO3, K3)	6
3.c.(ii)	Control DC motor direction using L298: PD0/PD1 drive IN1/IN2; PC7 switch sets clockwise/anti-clockwise motion. Implement polling-based control. (CO3, K3)	6
3.d. Answer any one of the following:-		
3.d.(i)	Explain how the ADC subsystem is configured using ADMUX and ADCSRA registers. (CO4, K2)	6
3.d.(ii)	Explain the working of the ALU in ATmega328P and its impact on SREG after arithmetic operations. (CO4, K2)	6
3.e. Answer any one of the following:-		
3.e.(i)	Evaluate edge-trigger configurations for Input Capture in measurement applications (CO5, K4).	6
3.e.(ii)	Analyze how interrupt latency impacts real-time PWM or serial communication (CO5, K4).	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	(a) Explain the difference between MOV, MOVC, and MOVX instructions. (b) Give program examples demonstrating real use cases for each. (CO1, K3)	10
4-b.	Explain in detail how the accumulator flags are affected by logical, arithmetic, and rotate instructions. Provide examples demonstrating ZF, CF, and AC changes. (CO1, K3)	10

5. Answer any one of the following:-

5-a.	Explain the structure and working of bootloader in AVR and describe how fuse bits influence boot behavior. (CO2, K2)	10
5-b.	Explain complete SPI bus arbitration and timing control using a labeled cycle diagram including multiple slave addressing. (CO2, K2)	10

6. Answer any one of the following:-

6-a.	Send text “Divide We Fall, United We Win” to an LCD where data lines are connected to PORTB and Enable pin is PC5. Ensure proper LCD timing sequence. (CO3, K3)	10
6-b.	Send “NIET” once via UART, then continuously perform two tasks: (a) read switches on PORTB and transmit their value via UART, (b) display received UART characters on PORTC LEDs. Baud=9600, XTAL=8 MHz. (CO3, K3)	10

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7. Answer any <u>one</u> of the following:-

7-a.	Derive the formula for calculating Timer0 overflow delay and compute the delay for prescaler=64, clock=16MHz. (CO4, K2)	10
7-b.	Write an assembly program to detect rising edges on PD2 (INT0 pin) and increment a counter stored at memory location 0x220. (CO4, K2)	10

8. Answer any <u>one</u> of the following:-

8-a.	Evaluate system behavior when stack pointer overflows during nested interrupts (CO5, K4).	10
8-b.	Write a fully working program to read PIND and send result to PORTC repeatedly (CO5, K4).	10