

SUBJECT: - PROGRAMMABLE LOGIC & MICROCONTROLLER

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

PART I

Answer any *THREE* questions and TWO Marks are reserved for neatness.

1. a. Using a diode-based AND matrix and transistorized OR matrix, draw a complete circuit to implement a full-adder block. Explain your solution. 10
b. What is a JTAG cable? What is its role in context with device programming? Write the pin details of a JTAG cable. 6
2. a. Draw and explain a circuit diagram to implement the logic function $f = ab + \bar{c}$ using transistor pair logic in FPGA. 10
b. What are the advantages of FPGAs over CPLDs? 6
3. a. Describe the working principle of an EPROM device. 8
b. How does a transistorized switch driven by SRAM Cell work to interconnect row and column wires? 8
4. a. Describe with neat circuit diagram, the functionality of a commercially available FPGA chip. 10
b. Why has *In-System Programming* become popular over *out-of-board programming*? 6
5. Give a comparative study between: 4 x 4
 - a. SRAM cell and Antifuse;
 - b. PLA and PAL;
 - c. ASIC and Programmable IC;
 - d. CPLD and FPGA.

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) THIRD YEAR SECOND SEMESTER EXAMINATION, 2024

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No. of Questions	<u>PART II</u>	Marks
	<p align="center">Answer any Three. <i>Two marks reserved for neatness.</i></p>	
1.	<p>Compare between (any four):</p> <p>a) General purpose and special purpose processor</p> <p>b) EPROM and E²PROM</p> <p>c) Interfacing LEDs in common anode and common cathode configuration</p> <p>d) 8-bit Timer and 16-bit Timer in AVR microcontroller</p> <p>e) Princeton and Harvard Architecture</p>	4x4=16
2.	<p>a) An LED is connected to bit-7 of PORTC. Without modifying rest of the bits, write a program to blink the LED with a frequency and duty cycle of 5Hz and 70%, respectively. State assumptions, if any.</p> <p>b) Read pin-2 and pin-3 of PORTB. Issue ASCII characters 'A', 'B', 'C' and 'D' when the two pins carry '00', '01', '10' and '11', respectively.</p>	8 8
3.	<p>Write short notes on (any <i>two</i>):</p> <p>a) Programming methods of in-built timer of microcontroller</p> <p>b) Functional blocks and features of ATmega2560</p> <p>c) Registers for programming I/O Ports</p>	8+8=16
4.	<p>Write a segment of program to</p> <p>i) Set bit-3 and reset bit-7 of PORTA without modifying rest of the bits.</p>	4x4=16

5.	<p>ii) Check bit-4 and bit-7 of PORTB. If they are equal, set bit-2 of PORTC.</p> <p>iii) Shift contents of a variable 'v' right by 3-positions.</p> <p>iv) Exchange the contents of two integer variables 'u' and 'v'.</p> <p>a) Using in-built timer of the microcontroller, write a program to generate a delay of 0.5s. Use it to toggle one LED at a frequency of 0.5Hz.</p> <p>b) Write the names of all the registers associated with Timers / Counters of AVR microcontroller. Mention whether they are 8-bit or 16-bit.</p>	10 6
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