SASTRA
ENGINEERING · MANAGEMENT · LAW · SCIENCES · HUMANITIES · EDUCATION
DEEMED TO BE UNIVERSITY
(U/S 3 of the UGC Act, 1956)
THINK MERIT | THINK TRANSPARENCY | THINK SASTRA

School of Computing
First CIA Exam – Aug 2024
Course Code: INT409
Course Name: Embedded Security
Duration: 90 minutes Max Marks: 50

PART A **(10 × 2 = 20 Marks)**

1. List out any four characteristics of embedded system.
2. Develop a basic Embedded C program and define the sections.
3. Consider a variable ‘A’ has a data 0xAF2E. Construct an embedded C program to set the bit number 14 and to reset bit number 1.
4. Variable ‘X’ has an initial data of 0x12EFA. It was undergone two different operations in which the output of the 1st operation is 0xEFA12 and 2nd operation is 0x2EFA0. Find out the operations.
5. Consider a variable ‘Q’ with a data 0xA00D. Develop a logic in Embedded C to rotate the data in ‘Q’ for 8-bit positions.
6. Compare and contrast the granularity of FPGA logic blocks.
7. Differentiate the continuous assignment and procedural assignment statements with a suitable example.
8. Develop a Verilog HDL program to design a 4:1 Multiplexer using conditional select operator.
9. List any two advantages of FPGAs over Microcontrollers.
10. Consider the statement assign k4 = {b, a, 2{3’b101},c}; from Verilog HDL. Assume a = 4’b0001, b = 4’b1010, c= 4’b1111. Find the value of k4 and its bit-depth.

(PTO)

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PART B **(3 × 10 = 30 Marks)**

11. Compare and contrast the Microprocessor and FPGA with respect to its architecture and operations.
12. Explain the any one operator from the following categories with a suitable syntax example from Verilog HDL.
    a. Arithmetic operators
    b. Shifting operators
    c. Concatenation & replication operators
    d. Relational operators
    e. Logical operators
13. Imagine you're part of an ancient kingdom where secure communication is vital. The kingdom's advisor has created a simple cryptosystem to encrypt messages using a secret number between 1 and 26 as Key. To encrypt a message, shift each letter forward in the alphabet by the Key. For example, if the shift is 3, 'A' becomes 'D'. If you reach the end of the alphabet, loop back to the beginning (e.g., 'Z' becomes 'C'). To decode, shift each letter backward by the same number. Consider this schema and develop Embedded C or Verilog HDL code to perform the following tasks:
    - Choose the number of digits in your University register number as secret number (Key).
    - Encode the message "THANJAVUR BIG TEMPLE" using your chosen Key.
    - Provide the encoded message.
    - Decode a received message back to its original form.
    - Provide the decoded message.

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PART A

Q.No	Questions	CO	RBT Level
1	List out any four characteristics of embedded system.	CO1	L1
2	Develop a basic Embedded C program and define the sections.	CO1	L3
3	Consider a variable 'A' has a data 0xAF2E. Construct an embedded C program to set the bit number 14 and to reset bit number 1.	CO1	L3
4	Variable 'X' has an initial data of 0x12EFA. It was undergone two different operations in which the output of the 1st operation is 0xEFA12 and 2nd operation is 0x2EFA0. Find out the operations.	CO1	L1
5	Consider a variable 'Q' with a data 0xA00D. Develop a logic in Embedded C to rotate the data in 'Q' for 8-bit positions.	CO1	L3
6	Compare and contrast the granularity of FPGA logic blocks.	CO1	L2
7	Differentiate the continuous assignment and procedural assignment statements with a suitable example.	CO1	L2
8	Develop a Verilog HDL program to design a 4:1 Multiplexer using conditional select operator.	CO1	L3
9	List any two advantages of FPGAs over Microcontrollers.	CO1	L1
10	Consider the statement assign k4 = {b, a, 2{3'b101},c}; from Verilog HDL. Assume a = 4'b0001, b = 4'b1010, c= 4'b1111. Find the value of k4 and its bit-depth.	CO1	L1
11	Compare and contrast the Microprocessor and FPGA with respect to its architecture and operations.	CO1	L4
12	Explain the any one operator from the following categories with a suitable syntax example from Verilog HDL. a. Arithmetic operators b. Shifting operators c. Concatenation & replication operators d. Relational operators e. Logical operators	CO1	L2
13	Imagine you're part of an ancient kingdom where secure communication is vital. The kingdom's advisor has created a simple cryptosystem to encrypt messages using a secret number between 1 and 26 as Key. To encrypt a message, shift each letter forward in the alphabet by the Key. For example, if the shift is 3, 'A' becomes 'D'. If you reach the end of the alphabet, loop back to the beginning (e.g., 'Z' becomes 'C'). To decode, shift each letter backward by the same number. Consider this schema and develop Embedded C or Verilog HDL code to perform the following tasks: • Choose the number of digits in your University register number as secret number (Key). • Encode the message "THANJAVUR BIG TEMPLE" using your chosen Key. • Provide the encoded message. • Decode a received message back to its original form. • Provide the decoded message.	CO1	L6

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Answer Key

Part A

1) Each characteristic = 0.5 Mark
2) Embedded C program = 1 Mark, Identification section = 1 Mark
3) Logic: A = (A | (1 << 14)) & (~(1 << 1))
4) 1st operation: Left circular shift with 8 & 2nd operation: Left shift with 4. Each logic 1 Mark
5) Logic: Q = (Q << 8) | (Q >> 8). Code with logic = 2 Marks
6) Coarse grain & fine grain logic blocks with explanation = 2 Marks
7) Continuous assignment with assign keyword & procedural assignment with either '=' or '<='. Each logic 1 Mark
8) Logic: assign y = s1?(s0?d:c):(s0?b:a); Code with logic = 2 Marks
9) Reprogrammability, reusability, faster time to market, no fixed machine cycle = 2 Marks
10) k4 = 1010_0001_101101_1111 & size is 18 bits. Each answer 1 Mark
11) Comparison with minimum 5 points = 10 marks
12) Operator explanation, operands and example program(s) = 10 Marks
13) Finding key = 2 Marks, Encryption code = 3 Marks, Decryption code = 3 Marks & ciphertext and decrypted text = 2 Marks