UNIT-I

Number System: Binary, Octal, Hexadecimal and Decimal, 1's and 2's Complements, Inter-conversion of numbers. Codes: Weighted and Non-weighted codes, BCD Codes, Gray codes, Self-complementing codes, Error-Detecting/Correcting codes, Alphanumeric Codes, Hamming Codes, Floating Point Numbers. Binary Arithmetic: Binary Addition and Subtraction, 2's Complement Arithmetic, Booth Coding, Binary Multiplication.

Logic Design: Logic Gates, Truth Tables, Boolean Algebra, Boolean Expressions-Variables and Literals, Boolean Expressions–Equivalent and Complement, Theorems of Boolean Algebra, Simplification Techniques, SOPs & POSs Boolean Expressions.

UNIT-II

Combinational Circuits: Combinational Logic, Arithmetic Circuits– Adder and Subtractor, BCD Adder, Code Converters, Magnitude Comparator, Parity Generators/Checkers, Multiplexers, Demultiplexers, Decoders, Encoders.

Sequential Circuits: Latches, R S Flip Flop, Level Triggered and Edge Triggered Flip Flops, JK Flip-Flop, Master-Slave Flip Flops, T Flip-Flop, D Flip-Flops.

Registers and Counters: Controlled Buffer Registers, Shift Registers, Applications of Shift-registers; Ripple Counter, Synchronous Counter, Modulus Counter, Binary Ripple Counters, Up/Down Counters, Decade and BCD Counters.

UNIT-III

Basic Computer Design: Computer Instructions and types, Instruction Set, Instruction Cycle, Instruction Formats, Addressing Modes, Computer Registers, Bus System, Register Transfer Language terminology.

Programming in 8086/8088 Assembly Language: A/L program structure, segments, registers, instructions, macros, A/L directives.

CPU Design: CPU Registers, Micro-operations and its types, Design of ALU. Control Unit Design- Microprograms, Control Unit of a basic computer–Timing and Control; Hardwired and Micro-programmed controlled unit. Architectures -RISC, CISC, Scalar, Superscalar and pipelined architectures.

UNIT-IV

Input/Output Organization: Peripheral Devices, Input-output Interface, Asynchronous Data Transfer, Mode of Transfer, Priority Interrupt, Direct Memory Access, Input-output Processor, Serial Communication.

Advance Architecture: Introduction to parallel processing– Pipelining, Parallel Computer structures, Architectural classification. Pipelining & Vector processing; Instruction and Arithmetic pipelines, Principles of designing pipelined processors, Structures for array processors: SIMD Array processor, SIMD Interconnection networks. Parallel Processing Applications.

Roll No. .....

67007-N

MCA 1st Semester (MCA 2 Year Programme) w.e.f. 2020-2021 Examination – December, 2024

DIGITAL DESIGN & COMPUTER ARCHITECTURE

Paper : 20MCA21C4

Time : Three hours] *[Maximum Marks : 80*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. (a) What is a Decade Counter ? $8 \times 2 = 16$

(b) Differentiate between Edge-triggered and Level-triggered flip-flops.

(c) What is CISC architecture ?

(d) What is a bus system ?

(e) What do you mean Instruction Formats ?

UNIT – I

2. (a) What is K-map ? Using K-map, obtain the minimal expression in SOP and POS of the following expression :

$F = \Sigma_m (0, 2, 4, 6, 7, 8, 10, 12, 14, 15)$

Implement the same in using universal gate. 10

(b) What are Error-Detecting and Error-Correcting Codes ? Illustrate the significance of each. 6

3. (a) What is Booth's coding ? Perform $(-12)_{10} \times (-8)_{10}$ using this method. 5

(b) What is BCD arithmetic ? Perform the following BCD operations : 6

(i) $(678)_{10} + (432)_{10}$

(ii) $(976)_{10} - (789)_{10}$

(c) Perform the operation $(1001 \times 1110)_2 + (75.45)_8$ and find out the result in an Hexadecimal Number System. 5

UNIT – II

4. (a) What is Multiplexer (MUX) ? How will you design a 64×1 MUX using 8×1 MUX ? Illustrate. 8

   (b) What is combinational circuit ? Design a combinational circuit that receives 2-bit binary number input and produces its square at the output. 8

5. (a) What is Master-Slave flip-flop ? Discuss its working and show how the race around condition is eliminated in this flip-flop. 8

   (b) What is a counter ? Show that N-bit counter connected to $N \times 2^N$ decoder is equivalent to a ring counter with 2^N flip-flop. Illustrate it with $N = 2$. 8

UNIT – III

6. (a) What is the structure of 8086/8088 Assembly Language program ? Illustrate the purpose of all its elements/structural components. 8

   (b) What do you mean by micro-operations ? What are its various types ? Illustrate the implementation of each category of micro-operations through its block diagram(s). 8

7. Explain the following :

   (a) Microprogrammed Control Unit 8

   (b) Addressing modes 8

UNIT – IV

8. (a) What is Pipelining ? When, where and why is it necessary ? Also differentiate between the Instruction Pipelining and Arithmetic Pipelining. 8

   (b) What are array processors ? How are these designed ? Illustrate. 8

9. (a) What is an Input/Output (I/O) module ? What are the functions performed by an I/O module ? Illustrate the general structure of an I/O module. 8

   (b) What are parallel computers ? What are their structures ? How are these classified ? Discuss. 8

67007-N

M.C.A. 1st Semester (MCA 2 Year Programme)
w.e.f. 2020-2021 Examination, November–2023
DIGITAL DESIGN & COMPUTER ARCHITECTURE
Paper–20MCA21C4

Time allowed : 3 hours] *[Maximum marks : 80*

Note: *Attempt **five** questions in all by selecting **one** question from each Unit and **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (a) What is an Encoder? 8×2=16

   (b) Differentiate between Edge-triggered and Level-triggered flip-flops.

   (c) What is a Modulo Counter?

   (d) What are Universal Gates?

   (e) Differentiate between RISC and CISC.

   (f) What are Instruction Formats? State their relevance?

   (g) Differentiate between computer organization and architecture.

   (h) What is the significance of RTL?

Unit-I

2. (a) Why is 2's complement preferred in binary arithmetic? Also perform the following operations using 2's complement arithmetic: 8

   (i) $(14)_{10} + (16)_{10}$ (ii) $(24)_{10} - (37)_{10}$

(b) What is the minimum and maximum integer and floating-point number stored in a 64-bit register assuming 1 bit as a sign-bit, 16 bits for exponent and rest of the bits for significant? Provide its complete layout indicating overflow and underflow regions. 8

3. (a) What is Boolean Expression? Simplify the following Boolean expression: 8

$F(a,b,c,d) = \Sigma_m (0,1,2, 3, 8,9,10,11) + \Sigma_d (4,5,6,7,12,14)$

in canonical SOPs and POSs and implement one of these using basic gates.

(b) What are Error-Detecting and Error-Correcting Codes? Illustrate their usefulness with suitable examples. 5

(c) What are Gray codes? Where are these useful? Illustrate. 3

Unit-II

4. (a) What is T flip-flop? How is it designed? Illustrate. 7

(b) What is a binary ripple counter? How is it different from synchronous counter? Design a ripple counter and discuss its working. 9

5. Illustrate the purpose of the following and implement their design:

   (a) Decoder and Encoder 8

   (b) BCD Adder 8

Unit-III

6. (a) What is meant by an Instruction Set? What are the elements of an instruction? How an instruction is represented? Explain. 8

   (b) What is the structure of an 8086/8088 Assembly Language program? Outline the purpose of each element. 8

7. (a) What are addressing modes? What are various types of addressing modes for 8086/8088 microprocessor? Explain. 8

   (b) What are micro-operations? What are its various types? Illustrate the implementation of each category of micro- operations through its block diagram(s). 8

Unit-IV

8. (a) Which I/O technique is used for heavy data transfer and why? Illustrate its working in details. 8

(b) What is Pipelining? When, where and why is it necessary? Also differentiate between the Instruction Pipelining and Arithmetic Pipelining. 8

9. (a) What are array processors? How are these designed? Illustrate. 8

(b) What do you mean by Vector Processing? State its significance and also enumerate certain applications that demand Vector Processing. 8

67007-N

MCA 1st Semester (MCA 2 Year Programme)
w.e.f. 2020-21 Examination,
December-2022

DIGITAL DESIGN AND COMPUTER ARCHITECTURE

Paper-20MCA21C4

Time allowed : 3 hours] *[Maximum marks : 80*

Note :
- *Attempt five questions in all by selecting one question from each unit and Q. No. 1 is compulsory.*
- *All questions carry equal marks.*

1. Answer the following questions briefly : 8×2=16

(a) What is Flynn's computer organization ?

(b) What is RISC architecture ?

(c) What are segment registers ?

(d) What is ripple counter ? State it significance.

(e) Differentiate between Level-triggering and Edge-triggering.

(f) Why 2's complement is followed in Binary Arithmetic ?

(g) What are race-conditions ?

(h) What is a Johnson-Counter ?

Unit–I

2. (a) Using K-map, obtain the minimal expression in SOP and POS of the following expression. 8

$F = \Sigma_m (0, 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 13)$

Implement the same in universal logic.

(b) Perform the operation

$(101 \times 1101)_2 + (ABC.8)_{16} - (75.875)_{10}$ and find out the result in and Octal Number System. 8

3. (a) What is the minimum and minimum floating-point number stored in a 32-bit register assuming 1 bit as sign-bit, 11 bits for exponent and rest for significand ? Provide the complete layout indicating overflow and underflow regions. 8

(b) What are Universal Gates ? How Universal gates are realized into basic gates ? Illustrate. 4

(c) What are Excess-3 codes ? Where and how are these helpful ? Illustrate. 4

Unit-II

4. (a) What are the characteristics of a good shift register? Design a 4-bit shift register with

capabilities of storing, shifting (left and right) and parallel load. 8

(b) What is BCD counter ? How will you implement it using T flip-flops ? Illustrate. 8

(a) What is a Ring Counter ? Show that a 3-bit binary counter connected to a 3 × 8 decoder is equivalent to a ring counter with 8 flip-flops. 8

(b) Design a circuit that compares two bit number X and Y to check if they are equal. The circuit has one output F so that

$F = 1$ if $X = Y$ and $X = 0$ if $X \neq Y$ 8

Unit-III

(a) What is Instruction Cycle ? What are various sub-cycles in an Instruction Cycle ? Also outline the steps performed during each of these sub-cycles. 8

(b) What are 8086 / 8088 Assembly Instructions ? Classify these instructions and give two examples of each. 8

7. (a) What is mean by an Instruction Set ? What are the elements of an instruction ? How an instruction is represented ? Explain. 8

(b) What is a control unit ? What is microprogrammed control unit ? Illustrate its working. 8

Unit-IV

8. (a) What is Pipelining ? When, where and why is it necessary ? Also differentiate between the Instruction pipelining and Arithmetic Pipelining. 8

(b) What do you understand by Vector Processing ? State its significance and also enumerate certain applications that demand Vector Processing. 8

9. Explain the following :

(a) DMA I/O Technique and its working 8

(b) Array Processors 8

Roll No. : .....

Total No. of Questions : **9**] [Total No. of Pages : **4**

67007–N

M.C.A. (Regular) 1st Semester (2 Year Programme) Examination, April-2021

(w.e.f. 2020-2021)

DIGITAL DESIGN AND COMPUTER ARCHITECTURE

Paper-20MCA21C4

Time : ***Three*** *Hours]* *[Maximum Marks :* ***80***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note :- Question No. **1** is compulsory with eight parts, of 2 marks each. In addition to Q. No. 1, attempt *four* more questions by selecting at least *one* question from each Unit. All questions carry equal marks.

1. (i) What do you mean by radix of the number system ? Mention different components of a number in any number system.

(ii) What is the importance of Alphanumeric Codes in Digital Processing ?

(iii) Write down the procedure (various steps) to design a combinational circuit.

(iv) What important role does Excitation table plays in designing the digital circuit ?

(v) Differentiate between instruction code and operation code.

(vi) List down various applications of superscalar architecture (any *four*).

(vii) Why usage of interface becomes mandatory while working with peripherals ?

(viii) Discuss how IOP can be used to improvise the efficiency of a computer.

Unit-I

2. (i) Perform the following subtractions using 2's complement method :

(a) 0011.1001–0001.1110

(b) 01100–00011

(ii) Explain in detail the register configuration required for the Floating Point arithmetic Operations.

3. (i) What do you mean by realization of a digital circuit ? Realize the following logical expression by using only NAND gates :

$$AB' + A'B$$

(ii) Define SOP and POS simplification methods and simplify the following Boolean Function in both SOP and POS format :

$f(a, b, c, d) = \Sigma(0, 1, 2, 5, 8, 9, 10)$

Unit-II

4. (i) Elaborate the working of Parity Generator/ Comparator with the help of labelled diagram.

(ii) How edge triggered flip-flops work differently from level triggered flip-flops ?

5. (i) Explain the working and importance of shift registers. Also discuss any two applications of shift registers.

(ii) What are the specific features of a Binary Counter ? Explain how a binary counter works with a parallel load with an apt diagram.

Unit-III

6. (i) Demonstrate the concept of direct and indirect address with the help of appropriate example and diagram.

(ii) Explain the following in the context of RTL : Selective Clear, Selective Complement, Mask and Selective Set.

(i) Define microprogram and micro-instruction. Discuss how computer instruction code is mapped into microinstruction code.

(ii) By using different performance evaluators, compare the performance of Scalar and Pipeline architecture.

Unit-IV

(i) Demonstrate how by using Strobe and Handshaking can be helpful in transferring data asynchronously (with the help diagram). https://www.rsbatudy.com

(ii) How interrupt initiated I/O is more efficient than programmed I/O ?

(i) How pipeline architecture supports parallel processing ? Explain the working and implementation of arithmetic pipeline to support your answer.

(ii) Detail out how serial communication is carried out while using character oriented protocol for transferring data in computer