CBCS SCHEME

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Data Structures and Applications

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define data structures. Explain with neat block schematic different types of data structures with examples. What are the primitive operations that can be performed? **(10 Marks)**

   b. Define sparse matrix. Express the following matrix in triplet form and find its transpose. **(10 Marks)**

$$A = \begin{bmatrix} 15 & 0 & 0 & 22 \\ 0 & 11 & 3 & 0 \\ 0 & 0 & 0 & -6 \\ 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 \end{bmatrix}$$

OR

2 a. Explain any four dynamic memory allocation functions with syntax and example. **(10 Marks)**

   b. What do you mean by pattern matching? Outline the KMP algorithm. Implement the same to find out the occurrence of following pattern.
   P:ABCDABD
   S:ABC ABCDAB ABCDABCDABDE **(10 Marks)**

Module-2

3 a. Define Recursion. Let A and B be nonnegative integers. Suppose a function GCD is recursively defined on follows:
   GCD(A, B) = GCD (B, A) if A < B
             = A if B = 0
             = GCD(B, MOD(A, B)) otherwise
   Here MOD(A, B) read as A Modulo B. Evaluate GCD(20, 28). **(04 Marks)**

   b. Write C function for push( ), pop( ) and display( ) routine of STACK. **(08 Marks)**

   c. Outline the algorithm for infix to postfix. Using the same algorithm convert following INFIX expression to equivalent POSTFIX.
   ((H * ((((A + ((B + C) * D)) * F) * G) * E)) + J) **(08 Marks)**

OR

4 a. Write a C function CQInsert( ) and CQDelete( ) operations on circular queue. **(08 Marks)**

   b. Outline the algorithm for infix to prefix. Using the same algorithm convert following INFIX to equivalent PREFIX.
   ((H * ((((A + ((B + C) * D)) * F) * G) * E)) + J) **(08 Marks)**

   c. Evaluate the following postfix expression by showing the contents of the stack.
   5 4 6 + * 4 9 3 / + * **(04 Marks)**

Module-3

5 a. Write C functions for the following operations on linked list:
    i)   Insertion at the beginning
    ii) Insertion at the end
    iii) Deletion at the beginning
    iv) Deletion at the end.   (12 Marks)

 b. Explain concept of sparse matrix representation using linked list. Represent the following sparse matrix in linked list format.   (08 Marks)

$$A = \begin{bmatrix} 0 & 0 & 3 & 0 & 4 \\ 0 & 0 & 5 & 7 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 6 & 0 & 0 \end{bmatrix}$$

OR

6 a. Write C function to add two polynomials. Show the linked list representation of below two polynomials and in addition.
    POLY 1: $5x^2 + 4x + 2$
    POLY 2: $3x^2 + 2x + 5$ (08 Marks)

 b. Write C functions for following operations on circular linked list:
    i)   Insertion at the beginning
    ii) Insertion at the end
    iii) Deletion at the beginning
    iv) Deletion at the end.   (12 Marks)

Module-4

7 a. Define Binary tree with an example. Write C recursive routine to traverse the given tree using inorder, preorder and postorder.   (08 Marks)

 b. Define binary search tree. Draw the BST for the following input:
    14 15 4 9 7 18 3 5 16 20 17 9
    Give recursive search function to search an element in that tree.   (06 Marks)

 c. Given the following traversal, draw a binary tree:
    i) Inorder : 4 2 5 1 6 7 3 8
       Postorder : 4 5 2 6 7 8 3 1
    ii) Preorder : A B C E I F J D G H K L
        Inorder : E I C F J B G D K H L A   (06 Marks)

OR

8 a. Represent the below given tree in Fig.Q.8(a), using
    i)   Linked list representation
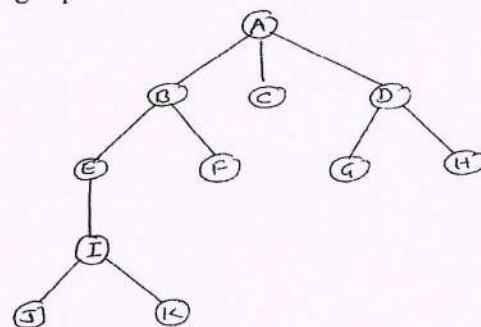   ii) Left child right sibling representation.   (08 Marks)

Fig.Q.8(a)

b. Define threaded binary tree. List its advantages and disadvantages. Draw the one way threading and two way threading of the following binary tree. (Refer Fig.Q.8(b)). **(08 Marks)**
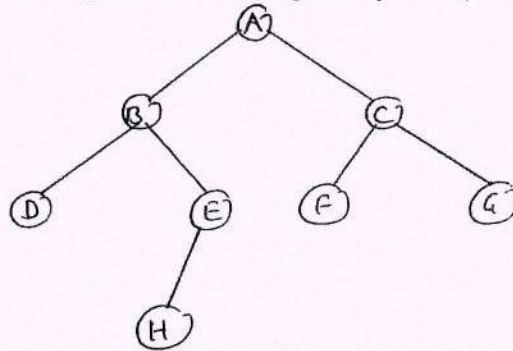

Fig.Q.8(b)

c. Write function to insert an element in a binary search tree. **(04 Marks)**

Module-5

9   a. Define the following terminologies with examples:
    i) Digraph   ii) Weighted graph   iii) Self loop   iv) Parallel edges **(08 Marks)**
    b. Give the adjacency matrix, incidence matrix and linked list representation of the following undirected graph. **(06 Marks)**
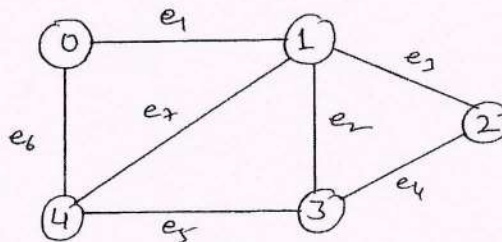

Fig.Q.9(b)

c. Arrange the following elements in ascending order using RADIX SORT
    151, 60, 875, 342, 12, 477, 689, 128, 15 **(06 Marks)**

OR

10 a. Explain different types of HASH function with example. **(10 Marks)**
    b. Explain any five file operations along with syntax and example. **(10 Marks)**

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USN | | | | | | | | | | **18CS33**

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Analog and Digital Electronics

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   Explain the working principle of opto coupler with neat diagram.   **(06 Marks)**
    b.   Derive an expression for collector current and collector emitter voltage of fixed bias circuit.   **(06 Marks)**
    c.   For the circuit shown in Fig.Q.1(c), draw DC load line, use silicon transistor with B = 50, $V_{BE} = 0.7V$.   **(08 Marks)**
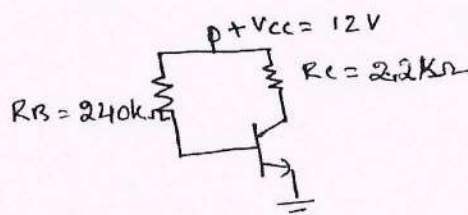

Fig.Q.1(c)

OR

2   a.   With the help of neat circuit diagram and wave form explain the working principle of relaxation oscillator.   **(10 Marks)**
    b.   Explain current to voltage converter.   **(05 Marks)**
    c.   Define voltage regulator. Explain adjustable voltage regulator.   **(05 Marks)**

Module-2

3   a.   Simplify the following function using K-map and obtain simplified Boolean expressions.
        i) $f_1(a, b, c, d) = \sum m(1, 3, 4, 5, 7, 10, 12)$
        ii) $f_2(a, b, c, d) = \sum m(5, 8, 9, 10, 11, 12, 13, 14, 15)$ **(10 Marks)**
    b.   Find all the prime implicants of function using Q-M method.
        $f(a, b, c, d) = \sum m(0, 2, 3, 4, 8, 10, 12, 13, 14)$ **(10 Marks)**

OR

4   a.   For the following function given use Q-M method and obtain simplified expression:
        $f(a, b, c, d) = \sum m(7, 9, 12, 13, 14, 15) + dc(4, 11)$ **(08 Marks)**
    b.   With an example explain Petrik's method.   **(06 Marks)**
    c.   For the given function determine minimal sum using MEV technique. Use d as MEV variable. $f(a, b, c, d) = \sum m(3, 4, 5, 7, 8, 11, 12, 13, 15)$.   **(06 Marks)**

Module-3

5   a.   Define static 1 – hazard. Explain how static 1-hazard can be detected and removed with an example.   **(08 Marks)**
    b.   What is multiplexer and explain 8 to 1 mux with the help of logic diagram and corresponding expression.   **(06 Marks)**
    c.   Explain the importance of three-state buffer.   **(06 Marks)**

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OR

6 a. Implement the following functions using 3:8 decoder

$f_1(a, b, c) = \sum m(0, 4, 6, 7)$

$f_2(a, b, c) = \sum m(1, 4, 5)$ **(06 Marks)**

b. Implement the following Boolean functions using an appropriate PLA:

$f_1(a, b, c) = \sum m(0, 4, 7)$

$f_2(a, b, c) = \sum m(4, 6)$ **(06 Marks)**

c. Realize a full adder using PAL. **(08 Marks)**

Module-4

7 a. Explain the structure of VHDL program. Write VHDL code for 4-bit parallel adder using full adder as component. **(08 Marks)**

b. With necessary diagrams, Explain switch debouncing with an S-R latch. **(06 Marks)**

c. Explain D flip-flop with the help of timing diagram. **(06 Marks)**

OR

8 a. Give the implementation of T-flip-flop from D flip-flop. **(04 Marks)**

b. Explain master-slave J-K flip-flop operation. **(08 Marks)**

c. Derive the characteristic equations for the following flip-flops:

i) S-R flip-flop

ii) D-flip flop

iii) T-flip-flop

iv) J-K flip-flop. **(08 Marks)**

Module-5

9 a. With neat sketch, explain the working principle of Serial Input Serial Output (SISO) shift register. **(06 Marks)**

b. Design 3 bit synchronous binary counter using transition table of T-flip-flop **(08 Marks)**

c. Explain how 4 bit register with data, load, clear and clock input is constructed using D-flip-flops. **(06 Marks)**

OR

10 a. With the help of state graph, state and transition table and timing diagram, explain sequential parity checker. **(06 Marks)**

b. With the help of block diagram, explain the working principle of n-bit parallel adder with accumulator. **(08 Marks)**

c. Analyze following Moore sequential circuit for an input sequence X = 01101 and draw the timing diagram. **(06 Marks)**
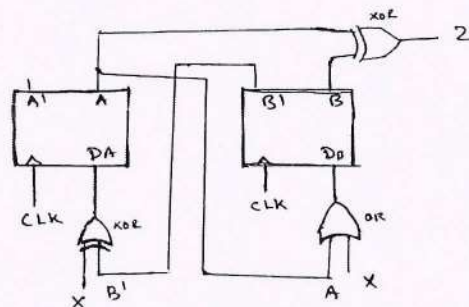

Fig.Q.10(c)

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Third Semester B.E. Degree Examination, Jan./Feb. 2021
Computer organization

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. How to measure the performance of a computer? Explain.   **(08 Marks)**
     b. Define addressing modes. Explain any five types of addressing modes with example.   **(12 Marks)**

OR

2   a. Define subroutine and parameter passing. Explain how to pass the parameter by value and by reference.   **(10 Marks)**
     b. How the input and output operations are to be performed by the processor? Write a program that reads a line of characters and displays it.   **(10 Marks)**

Module-2

3   a. Write the scenario when the interrupts are enabled.   **(06 Marks)**
     b. Explain how the I/O devices should be organized in a priority structure.   **(08 Marks)**
     c. Define exception, describe the different kinds of exceptions.   **(06 Marks)**

OR

4   a. Define bus arbitration. Explain the two approaches to bus arbitration.   **(10 Marks)**
     b. With the help of timing diagram, explain the read operation on the PCI bus.   **(10 Marks)**

Module-3

5   a. Explain the operation of a CMOS memory cell.   **(06 Marks)**
     b. With a neat figure, explain the organization of a $2M \times 32$ memory module using $512K \times 8$ static memory chips.   **(08 Marks)**
     c. Explain the internal structure of synchronous DRAM.   **(06 Marks)**

OR

6   a. What is the use of a cache memory? Explain in detail the three types of determining the cache locations to store memory blocks.   **(10 Marks)**
     b. How the parallelism is to be used as on interleaving? Explain.   **(10 Marks)**

Module-4

7   a. A half adder is a combinational logic circuit that has two inputs x and y and two outputs sum(s) and carry(c), resulting from the binary addition of x and y.
        i) Design a half adder as a two-level AND–OR circuit.
        ii) Show how to implement a full-adder using two half address and external logic gates, as necessary.   **(10 Marks)**
     b. Given, multiplicand A = + 23 and multiplier B = –10. Perform the multiplication of A and B using Booth's algorithm.   **(10 Marks)**

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OR

8   a.   Explain 4-bit carry-look ahead adder.   (10 Marks)

     b.   Perform the division of 8 ÷ 3 using restoring division.   (10 Marks)

Module-5

9   a.   Write and explain the control sequence for execution of the instruction Add(R3), R1.

                                                                              (10 Marks)

     b.   Explain the three-bus organization of the dater path.   (10 Marks)

OR

10   a.   Explain in detail the organization of control unit.   (10 Marks)

      b.   Explain the operation of 4-stage pipeline.   (10 Marks)

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Third Semester B.E. Degree Examination, Jan./Feb. 2021
Software Engineering

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. What are the attributes of good software? Explain the key challenges faced in software engineering. **(08 Marks)**
    b. With a neat diagram, explain the waterfall model of software development process. **(06 Marks)**
    c. Describe the general model of software design process. **(06 Marks)**

OR

2   a. Define and differentiate functional and non-functional requirements. **(06 Marks)**
    b. What is requirements specification? Explain various ways of writing system requirements. **(08 Marks)**
    c. What is ethnography? How ethnography is effective in discovering the types of requirements? **(06 Marks)**

Module-2

3   a. What is OO development? Explain object oriented themes briefly. **(08 Marks)**
    b. What are links and associations? Write and explain UML notation for links and association with an example. **(06 Marks)**
    c. Describe generalization and inheritance with an example. **(06 Marks)**

OR

4   a. What is object orientation? What are the important characteristics of OO approach? Explain. **(08 Marks)**
    b. Define model. Describe the relationship among three models. **(08 Marks)**
    c. With the help of a sample class model explain multiplicity and Association and names. **(04 Marks)**

Module-3

5   a. Draw and explain a contest model for patient information system. **(06 Marks)**
    b. With a diagram, explain the phases in the Rational Unified Process (RUP). **(06 Marks)**
    c. With the help of a neat state diagram, illustrate the working of a microwave oven. **(08 Marks)**

OR

6   a. What is model driven engineering? State the three types of abstract system model produced with a neat diagram. **(08 Marks)**
    b. What are the activities to the carried out in object oriented design process of a system? How the objects are identified? **(08 Marks)**
    c. What is open source development? Explain general models of open source licensing. **(04 Marks)**

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Module-4

7 a. What is list driven development? With a neat diagram, explain test driven development process. **(08 Marks)**
   b. With neat diagram, explain six stages of acceptance testing process. **(08 Marks)**
   c. What are the different types of interfaces to be tested during component testing? Explain. **(04 Marks)**

OR

8 a. Write and explain Lehman's laws related to system charge. **(08 Marks)**
   b. What is software maintenance? Draw the general model of reengineering process and explain. **(08 Marks)**
   c. What are the strategic options involved in legacy system management? Discuss. **(04 Marks)**

Module-5

9 a. For the set of tasks shown below draw the activity bar chart for the project scheduling.

Task	Duration (Days)	Dependencies
T_1	10	-
T_2	15	
T_3	15	T_1 (M1)
T_4	10	-
T_5	10	T_2, T_4 (M3)
T_6	5	T_1, T_2 (M4)
T_7	20	T_1 (M1)
T_8	25	T_4(M2)
T_9	15	T_3, T_6 (M5)
T_{10}	15	T_7, T_8 (M6)
T_{11}	10	T_9 (M7)
T_{12}	10	T_{10}, T_{11} (M8)

(08 Marks)
   b. Write and explain the factors affecting software pricing. **(05 Marks)**
   c. Explain briefly the algorithm cost modeling and write the difficulties. **(07 Marks)**

OR

10 a. With a diagram, explain the phase involved in software review process. **(08 Marks)**
    b. Explain briefly the key stages in the process of product measurement. **(08 Marks)**
    c. Write any four product and process standards. **(04 Marks)**

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Third Semester B.E. Degree Examination, Jan./Feb. 2021
Discrete Mathematical Structures

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Verify that, for any three propositions p, q, r the compound proposition.
      $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is a tautology or not.   **(06 Marks)**

   b. Test for validity of following argument.
      If Ravi goes out with friends, he will not study
      If Ravi do not study, his father becomes angry
      His father is not angry
      ─────────────────────────────
      ∴ Ravi has not gone out with friends   **(07 Marks)**

   c. Give direct and indirect proof of following statement "Product of two odd integers is an odd integer".   **(07 Marks)**

OR

2 a. For any three propositions p, q, r, prove that $[\sim p \wedge (\neg q \wedge r)] \vee [(q \wedge r) \vee (p \wedge r)] \Leftrightarrow r$ **(06 Marks)**

   b. Check for validity of following argument,
      If a triangle has two equal sides then it is isosceles. If a triangle is isoceles than it has two equal angles.
      A certain triangle ABC does not have two equal angles
      ───
      ∴The triangle ABC does not have two usual sides   **(07 Marks)**

   c. Consider the following open statement on set of all real numbers as universe:
      $p(x) : x \geq 0$ $q(x) : x^2 \geq 0$ $r(x) : x^2 - 3x - 4 = 0$ $s(x) : x^2 - 3 > 0$
      Then find truth value of i) $\exists x\, p(x) \wedge q(x)$ ii) $\forall x,\, p(x) \rightarrow q(x)$ iii) $\forall x,\, q(x) \rightarrow s(x)$
      iv) $\forall x,\, r(x) \vee s(x)$ **(07 Marks)**

Module-2

3 a. By mathematical induction prove that
      $$1^2 + 3^2 + 5^2 + \ldots\ldots + (2n-1)^2 = \frac{1}{2}\, n\, (2n-1)\, (2n+1)$$ **(06 Marks)**

   b. Find coefficient of i) $x°$ in the expansion of $\left(3x^2 - \dfrac{2}{x}\right)^{15}$
      ii) $x^{11} y^4$ in the expansion of $(2x^3 - 3xy^2 + z^2)^6$ **(07 Marks)**

   c. A total amount of Rs.1500 is to be distributed to three students A, B, C. In how many ways distribution can be done in the multiples of Rs.100 if
      i)   Every students sets at least Rs.300
      ii)   A must get at least Rs.500, B and C must set at least Rs.400 each.   **(07 Marks)**

OR

4 a. By mathematical induction prove that for any positive integer n the number $11^{n+2} + 12^{2n+1}$ is divisible by 133   **(06 Marks)**

   b. How many positive integers n can be formed from the digits 3, 4, 4, 5, 5, 6, 7 if we want n to exceed 5,000,000.   **(07 Marks)**

   c. A certain question paper has 3 parts A, B, C with four questions in Part A, Five in B and Six in C. It is required to answer seven questions by selecting at least two from each part. In how many different ways student can answer seven questions.   **(07 Marks)**

Module-3

5 a. Let A = {1, 2, 3, 4, 5, 6}, B = {6, 7, 8, 9, 10} and f be a function from A to B defined by f = {(1, 7) (2, 7), (3, 8) (4, 6) (5, 9) (6, 9)}. Then find $f^{-1}(6)$, $f^{-1}(9)$. If B_1 = {7, 8}, B_2 = {8, 9, 10} find $f^{-1}(B_1)$, $f^{-1}(B_2)$. **(06 Marks)**

b. Let A = {1, 2, 3, 4} and R be a relation on A defined by xRy if and only if x divides y. Then
i) Write R as ordered pairs   ii) Draw diagram   iii) Write matrix of R. **(07 Marks)**

c. If f, g, h are functions from R to R defined by $f(x) = x^2$, $g(x) = x + 5$, $h(x) = \sqrt{x^2 + 2}$. Then verify that f o(goh) = (fog) oh **(07 Marks)**

OR

6 a. If 30 dictionaries in a library contain total 61,327 pages then prove that at least one of the dictionaries must have at least 2045 pages. **(06 Marks)**

b. For any three nonempty sets A, B, C prove that
i) $(A \cup B) \times C = (A \times C) \cup (B \times C)$
ii) $AX (B \cap C) = (A \times B) \cap (A \times C)$ **(07 Marks)**

c. Let A = {1, 2, 3, 4, 6, 8, 12} define a partial order R on A by xRy if and only if x divides y. Draw Hasse diagram of R. **(07 Marks)**

Module-4

7 a. For the integers 1, 2, ...n, there are 11660 derangements where 1, 2, 3, 4, 5 appear in first five positions then find value of n. **(06 Marks)**

b. Determine number of integers between 1 and 300 which are i) divisible by exactly two of 5, 6, 8 ii) at least two of 5, 6, 8. **(07 Marks)**

c. Solve $a_n = 2(a_{n-1} - a_{n-2})$ for n ≥ 2 given a_6 = 1, a_1 = 2 **(07 Marks)**

OR

8 a. Out of 30 students of a hostel 15 study history, 8 study economics, 6 study geography and 3 study all the three subjects. Show that 7 or more study none of the subjects. **(06 Marks)**

b. An apple, a banana, a mango, and an orange to be distributed to 4 boys B_1, B_2, B_3 and B_4. The boys B_1 and B_2 do not wish apple, B_3 does not want banana or mango B_1 refuses orange. In how many ways distribution can be made so that all of them are happy. **(07 Marks)**

c. Solve $a_n - 3a_{n-1} = 5 \times 3^n$ for n ≥ 1 given a_0 = 2. **(07 Marks)**

Module-5

9 a. Show that following graphs in the Fig.Q.9(a)(i) and Fig.Q.9(a)(ii) are isomorphic

Fig.Q.9(a)(i)   Fig.Q.9(a)(ii)

(06 Marks)

b. Define with an example to each   i) Complement of a graph   ii) Vertex degree
iii) Rooted tree   iv) Prefix code **(07 Marks)**

c. Apply merge sort to the list
-1, 7, 4, 11, 5, -8, 15, -3, -2, 6, 10, 3 **(07 Marks)**

OR

10 a. Prove that a tree with n vertices has (n – 1) edges. **(06 Marks)**

b. Determine number of vertices in following graph G:
i)   G has 9 edges and all vertices have degree 3
ii)   G has 10 edges with 2 vertices of degree 4 and all other have degree 3 **(07 Marks)**

c. Obtain optimal prefix code for the message ROAD IS GOOD. **(07 Marks)**

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Third Semester B.E. Degree Examination, Jan./Feb.2021
Discrete Mathematical Structures

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Prove that $(p \vee q) \wedge \neg(\neg p \wedge q) \Leftrightarrow p$, using laws of logic. **(06 Marks)**

  b. Establish the following argument by the method of proof by contradiction:
  $[(p \rightarrow (q \wedge r)) \wedge (r \rightarrow s) \wedge (\neg(q \wedge s))] \rightarrow \neg p$ **(07 Marks)**

  c. Negate and simplify : (i) $\forall x, [p(x) \rightarrow \neg q(x)]$ (ii) $\exists x, [\{p(x) \vee q(x)\} \rightarrow r(x)]$ **(07 Marks)**

OR

2 a. Verify that $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is a tautology. **(06 Marks)**

  b. Test the validity of the argument :
  "Rita is baking a cake. If Rita is baking a cake, then she is not practicing her flute. If Rita is not practicing her flute, then her father will not buy her a car. Therefore Rita's father will not buy her a car. **(07 Marks)**

  c. Prove that for all real numbers x and y, If $x + y > 100$, then $x > 50$ or $y > 50$ by direct proof and contradiction proof. **(07 Marks)**

Module-2

3 a. Prove that for every positive integer n, 5 divides $n^5 - n$. **(06 Marks)**

  b. Total of Rs 1500 is to be distributed to three students A, B and C. In how many ways the distribution can be made in multiple of Rs 100.
     (i)   If each gets at least Rs 300.
     (ii)   If A must gets at least Rs 500, B and C get at least Rs 400 each? **(07 Marks)**

  c. Find the coefficient of $a^2 b^3 c^2 d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$. **(07 Marks)**

OR

4 a. Let $a_0 = 1$, $a_1 = 2$, $a_2 = 3$ and $a_n = a_{n-1} + a_{n-2} + a_{n-3}$, for all positive integer $n \geq 3$. Then prove that $a_n \leq 3^n$ for all positive integer n. **(06 Marks)**

  b. How many ways can 10 oranges be distributed among five children if, (i) there are no restrictions (ii) each child gets at least one (iii) the oldest child gets at least two oranges. **(07 Marks)**

  c. Determine the number of integer solutions of $a + b + c + d = 32$, where
  (i) a, b, c and $d > 0$ (ii) a, b $\geq$ 5 and c, d $\geq$ 7. **(07 Marks)**

Module-3

5 a. Define one-to-one function and onto function with example. Determine whether or not the relation $\{(x, y)/x, y \in R$ and $x = y^2\}$ is a function. **(06 Marks)**

  b. Let $A = \{a, b, c, d, e\}$ and the relation $R = \{(a, a), (a, e), (b, c), (b, d), (c, c)(d, c), (e, d)(e, a)\}$, write the relation matrix and digraph of R. **(07 Marks)**

  c. Draw the Hasse diagram for the subset relation on the power set of $A = \{a, b, c\}$. **(07 Marks)**

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OR

6 a. For any sets A, B, C $\subseteq$ U, prove that $A \times (B - C) = (A \times B) - (A \times C)$. **(06 Marks)**

   b. Show that if any (n + 1) numbers from {1, 2, 3.....2n} are chosen, then two of them will have their sum equal to (2n + 1). **(07 Marks)**

   c. Let A = {1, 2, 3, 4, 5} and R be a relation on $A \times A$ defined by (a, b) R (c, d) if and only if a + d = b + c. Show that R is equivalence relation. Determine the partition induced by R and the equivalence class [(2, 5)]. **(07 Marks)**

Module-4

7 a. Determine the number of positive integers n where $1 \le n \le 100$, and n is not divisible by 2, 3 or 5. **(06 Marks)**

   b. An apple, a banana, a mango and an orange are to be distributed for four boys A, B, C, D. The boys A and B do not wish to have apple. C does not want banana or mango and D refuses orange. In how many ways the distribution can be made so that no boy is displeased? **(07 Marks)**

   c. Solve $2a_n = 7a_{n-1} - 3a_{n-2}$ for $n \ge 2$ and $a_0 = 2$, $a_1 = 5$. **(07 Marks)**

OR

8 a. Define the principle of inclusion and exclusion and generalization of the principle. **(06 Marks)**

   b. Find the rook polynomial of the chess board. (Refer Fig. Q8 (b)). **(07 Marks)**

Fig. Q8 (b)

   c. Solve $a_n = 2a_{n-1} - 2a_{n-2}$ for $n \ge 2$ and $a_0 = 1$, $a_1 = 2$. **(07 Marks)**

Module-5

9 a. Discuss the Konigsberg-bridge problem and solution. **(06 Marks)**

   b. Define Isomorphic graphs. Show that the following two graphs are isomorphic. (Refer Fig. Q9 (b)) **(07 Marks)**

Fig. Q9 (b)

   c. Construct an optimal prefix code for the symbols a, b, c, d, e, f, that occur with respective frequencies 20, 28, 4, 17, 12, 7. **(07 Marks)**

OR

10 a. Find the number of spanning sub graphs of the graph given below. How many of them are connected. How many are spanning trees? **(06 Marks)**

   b. Prove that for every tree $T \equiv (V, E)$, if $|V| \ge 2$ then T has at least two pendent vertices. **(07 Marks)**

   c. Define directed tree, rooted tree, binary rooted tree, complete binary tree, m-ary tree complete m-ary tree, leaf. **(07 Marks)**

Fig. Q10 (a)

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Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Object Oriented Concepts

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   List out the differences between Procedure Oriented Language and Object Oriented Language. **(06 Marks)**

    b.   What is friend function in C++? List out the rules to declare the friend function in C++. **(06 Marks)**

    c.   What is function overloading? Write a C++ program to define three overloaded functions area( ) to find area of circle, triangle and rectangle. **(08 Marks)**

OR

2   a.   Explain the various features of OOC. **(06 Marks)**

    b.   What is a constructor? Mention its types. Explain copy constructor with suitable code. **(08 Marks)**
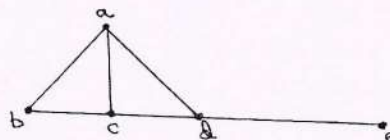
    c.   What is an inline function? Write a C++ function to find the factorial of a given number using inline function. **(06 Marks)**

Module-2

3   a.   List and explain the Java Buzzwords. **(08 Marks)**

    b.   Why Java Language is Platform Independent Language? Justify your answer. **(06 Marks)**

    c.   Write a Java program to find the average and sum of following array elements {4, 8, 12, 16, 20} using foreach in Java. **(06 Marks)**

OR

4   a.   List the different types of operators. Explain any three. **(08 Marks)**

    b.   What is an array? Write a Java program to print sum of each row of two dimensional array.

For example : $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$

O/p should be $\begin{bmatrix} 6 \\ 15 \\ 24 \end{bmatrix}$ **(08 Marks)**

    c.   Explain switch case with an example. **(04 Marks)**

Module-3

5   a.   What is an exception? Explain exception handling in Java. **(10 Marks)**

    b.   What is package in Java? How package is created and imported, explain with an example program (including Execution steps). **(10 Marks)**

OR

6 a. What is an interface? Explain how an interface can be implemented with suitable code.
                                                                                    (06 Marks)
   b. What is Inheritance? Differentiate method overloading and method overloading with suitable code.
                                                                                    (06 Marks)
   c. Explain any four Built-in exception classes with an example program.   (08 Marks)

Module-4

7 a. What are threads? Explain two ways of creation of threads with suitable code. (10 Marks)
   b. What is synchronization in Java? Explain synchronization can be implemented with producer-consumer example program.
                                                                                    (10 Marks)

OR

8 a. What is meant by deadlock? How to avoid deadlock? Give example.   (10 Marks)
   b. What is Event handling in Java? Write a Java program to demonstrate Mouse Events handling.
                                                                                    (10 Marks)

Module-5

9 a. What is an applet? Explain the life cycle of an applet?   (10 Marks)
   b. Explain passing parameters in Applets with suitable code.   (10 Marks)

OR

10   Explain the following with a suitable code:
       (i)   JLabel
       (ii) JTextField
       (iii) JList
       (iv) JTable

                                                                                    (20 Marks)

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17CS44

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Microprocessor & Microcontroller

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a.   With a neat diagram, explain the working of a 8086 microprocessor.   **(10 Marks)**
     b.   Explain the following 5 addressing modes of 8086 microprocessor:
          (i)   Register addressing mode.
          (ii)   Direct addressing mode.
          (iii) Register indirect addressing mode.
          (iv)   Base relative addressing mode.
          (v)   Based indexed addressing mode.
          with example for each.   **(10 Marks)**

OR

2   a.   Write an assembly language program to add 5 numbers present in the datasegment.
                                                                                         (06 Marks)
     b.   Explain the following 4 assembler directives of 8086 :
          (i) dup   (ii) DD   (iii) EQU   (iv) ORG
          with syntax and examples.   **(08 Marks)**
     c.   Explain all bits of a 8086 flag register.   **(06 Marks)**

Module-2

3   a.   Explain the interrupt mechanism in 8086 microprocessor.   **(08 Marks)**
     b.   Explain use of these instructions with syntax (i) DAA (ii) MUL (iii) ROR   (iv) DIV.
                                                                                         (08 Marks)
     c.   Explain the NMI interrupt.   **(04 Marks)**

OR

4   a.   Write an ALP to read a string of maximum length of 50 bytes and clear the screen and
          display the read string at location 12H, 28H on the monitor.   **(10 Marks)**
     b.   Explain the following instructions with its syntax:
          (i) CMP   (ii) DAS   (iii) CALL   (iv) XCHG   (v) SAR   **(10 Marks)**

Module-3

5   a.   Interface 4, 32 K RAM to 8086 microprocessor. You may choose the address range of your
          own. Show the memory map.   **(10 Marks)**
     b.   Explain the following string instructions:
          (i) CMPSB   (ii) SCASB   (iii) LODSB   (iv) MOVSB
          (v) STOSB   **(10 Marks)**

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OR

6   a. Interface 8086 with 8255 chip such that Port A is output port and Port B is input port. Let the addresses be 1100h, 1101h, 1102h, 1103h for Port A, Port B, Port C and control register respectively. Write a program to read from Port B and write it to Port A.   **(10 Marks)**

    b. Explain the following instructions:
        (i) IDIV   (ii) IMVL   (iii) CBW   (iv) XLAT   **(10 Marks)**

Module-4

7   a. Explain RISC design philosophy.   **(08 Marks)**

    b. Explain the instruction set for embedded systems.   **(06 Marks)**

    c. Explain the embedded system hardware.   **(06 Marks)**

OR

8   a. Explain the data flow model of a typical ARM core.   **(08 Marks)**

    b. Explain the registers in a ARM microcontroller.   **(08 Marks)**

    c. What is CPSR? Explain.   **(04 Marks)**

Module-5

9   a. Explain the role of barrel shifter in ARM processors.   **(06 Marks)**

    b. Explain the following instructions:
        (i) RSC   (ii) SBC   (iii) EOR   (iv) AND   **(08 Marks)**

    c. Explain the MLA and SMLAL instructions with example.   **(06 Marks)**

OR

10 a. Write a program to copy a block of memory to another area in the memory.   **(10 Marks)**

    b. Explain the following instruction with syntax:
        (i) STMED   (ii) SWP   (iii) SWI   (iv) CMP   **(10 Marks)**

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Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Data Communication

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain Different Forms of Data Representation.   (06 Marks)
   b. What is a Network? Explain briefly three important criteria that a network must meet.
                                                                        (06 Marks)
   c. Describe in detail TCP/IP protocol suite.   (08 Marks)

OR

2 a. Distinguish Simplex , Half Duplex and Full Duplex form of communication.   (06 Marks)
   b. What is Line coding? Discuss about NRZ – I and Manchester encoding with example.
                                                                        (06 Marks)
   c. Elucidate on Transmission Impairment.   (08 Marks)

Module-2

3 a. What is TDM? Write about inter leaving process in TDM with a schematic.   (06 Marks)
   b. Give a brief account on Datagram Network.   (06 Marks)
   c. Discuss about Quantization , Quantization levels and Quantization error. Suppose a telephone subscriber line must have an SNR_{DB} above 40. What is the minimum number of bits per sample?   (08 Marks)

OR

4 a. What is Spread Spectrum? Explain FHSS Frequency Selection mapping.   (06 Marks)
   b. What is Circuit Switched Network? Mention three phases of circuit switched network. Discuss about Delay and Efficiency in Circuit Switched Networks.   (06 Marks)
   c. Discuss about Multiplexing and Demultiplexing process in FDM. Five channels each with a 100KHz Bandwidth are to be multiplexed. What is the minimum bandwidth of the link if there is a need for a guard band of 10KHz between the channels to prevent interference?
                                                                        (08 Marks)

Module-3

5 a. What is Framing? Explain Bit Oriented Protocols.   (06 Marks)
   b. What is Forward Error Correction? How Forward error correction is done using Hamming Distance.   (06 Marks)
   c. With a outline sketch, describe about stop and wait protocol. Also give the FSM for sending and receiving node.   (08 Marks)

OR

6 a. Explain different fields of PPP frame.   (06 Marks)
   b. What is Checksum? Enumerate the procedures to calculate the traditional checksum.
                                                                        (06 Marks)
   c. What is CRC? How CRC is computed? Compute CRC bits of Data in 1001101 and generator is 1011.   (08 Marks)

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Module-4

7 a. What is Channelization? Mention different channelization techniques. Explain FDMA.
     (06 Marks)
  b. Describe about different implementations of standard Ethernet.   (06 Marks)
  c. Give architectural comparison of wired and wireless LANs. Discuss about characteristics of wireless LANs that does not apply to wired LANs.   (08 Marks)

OR

8 a. Explain CSMA/CD with a flow diagram.   (06 Marks)
  b. Explain how hidden station problem of wireless networks is resolved using CSMA/CA? What is the purpose of NAV in CSMA/CA.   (06 Marks)
  c. What are the advantages of dividing an Ethernet LAN with a Bridge? What is the relationship between a switch and a bridge?   (08 Marks)

Module-5

9 a. What is Cellular Telephony? Explain Frequency reuse principle in Cellular Telephony.
     (06 Marks)
  b. Mention three types of IPV6 addresses. Also briefly explain about special addresses.
     (06 Marks)
  c. Give an elaborate account on GSM Architectures, Features and Working.   (08 Marks)

OR

10 a. Briefly explain different fields of IP Datagram. In an IPV4 packet the value of HLEN is $(1000)_2$. How many bytes of options are being carried by this packet?   (06 Marks)
   b. Describe about different transition strategies from IPV4 to IPV6.   (06 Marks)
   c. Mention different types Satellites. Explain the working of GPS.   (08 Marks)

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Third Semester B.E. Degree Examination, Jan./Feb. 2021
Analog and Digital Electronics

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the construction and working of JEFT.   (10 Marks)
   b. Explain the opamp window comparator circuit.   (06 Marks)

OR

2 a. Explain the working of opamp Schmitt trigger.   (08 Marks)
   b. Explain 555 timer based Astable Multivibrator.   (08 Marks)

Module-2

3 a. Define hazard. Explain static 1 and static 0 hazard.   (06 Marks)
   b. Simplify the Boolean function using Quine-McClusky method:
      $Y = F(A, B, C, D) = \Sigma m(2, 3, 7, 9, 11, 13) + d(1, 10, 15)$ (10 Marks)

OR

4 a. Write the verilog code for the logic circuit given in Fig.Q4(a) using structural and behavioral models.
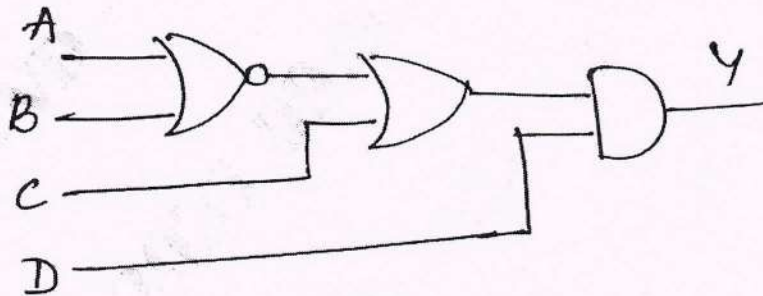

Fig.Q4(a)   (08 Marks)

   b. For the expression given below, use entered variable map technique and simplify the expression. Also draw the logic circuit using basic gates
      $f(A, B, C, D) = Y = \Sigma m(1, 5, 10, 11, 12, 13)$ (08 Marks)

Module-3

5 a. Define a multiplexer. Analyze a 32:1 multiplexer using 4:1 multiplexers. Give detailed design and connections for the logic circuit. Use one 2:1 MUX.   (10 Marks)
   b. Explain the odd parity checker and generator circuit.   (06 Marks)

OR

6 a. Implement 7-segment decoder using PLA.   (06 Marks)
   b. Explain n-bit Magnitude Comparator.   (06 Marks)
   c. Write verilog code to implement a 4:1 Multiplxer.   (04 Marks)

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Module-4

7 a. Explain with timing diagram, working of JK Master Slave flip flop. Also give the state transition diagram. **(06 Marks)**

   b. Draw the logic diagram for a 4 bit serial-in-serial-out shift register using edge triggered J-K flip flop and explain the circuit with waveform and the truth table. **(10 Marks)**

OR

8 a. Mention two differences between asynchronous and synchronous counter. With a neat block diagram, timing diagram and truth table, explain a 3 bit binary ripple down counter using negative-edge triggered JK flip flop. **(10 Marks)**

   b. Explain how a modulus 10 counter can be converted to modulus 8 counter using 7490 IC. **(06 Marks)**

Module-5

9 a. Write the verilog code to implement mod-8 up down counter. **(06 Marks)**

   b. Explain the dual slope ADC circuit. **(10 Marks)**

OR

10 a. Explain binary ladder network type DAC. **(08 Marks)**

   b. Explain the block diagram of digital clock constructed using counter cascading. **(08 Marks)**

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Third Semester B.E. Degree Examination, Jan./Feb. 2021
Data Structures and Applications

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the functions supported by C to carryout dynamic masonry allocation with example. **(06 Marks)**
   b. Summarize the advantages and disadvantages of using record oriented fixed length for storing strings. **(04 Marks)**
   c. Write a C program with structure definition and variable declaration to read and display information about 5 items using nested structures. Consider the following fields like, Itemcode, Itemname, Itemprice, Item expiring date (dd mm yy) **(06 Marks)**

OR

2 a. What is the degree of polynomial? With a C function to add 2(two) polynomials. **(08 Marks)**
   b. With a neat diagram, explain the linked representation of sparse matrix for Fig Q2(a)

$$\begin{bmatrix} 15 & 0 & 2 & 0 \\ 0 & 21 & 0 & 13 \\ 32 & 0 & 0 & 45 \\ 0 & 0 & 51 & 0 \end{bmatrix}_{4\times4}$$

Fig Q2(b) sparse matrix **(05 Marks)**
   c. Differentiate structure and version. **(03 Marks)**

Module-2

3 a. Write a C program to implement stack operation. **(08 Marks)**
   b. Convert the following infix expression to postfix form using stack
   $(A + B \uparrow D)/(E - F) + G$. **(04 Marks)**
   c. Define Ackermann function and find the value of $A(1, 3)$. **(04 Marks)**

OR

4 a. Write a C program to implement Oracular queue operations. **(08 Marks)**
   b. Evaluate the following postfix expression 3, 5, +, 6, 4 −, *, 4, 1, −,2, ↑, +. **(04 Marks)**
   c. Write a C program to implement Tower of Hanoi using recursion. **(04 Marks)**

Module-3

5 a. Write C functions to perform the following operations on singly linked list
      i)   Insert a node at the beginning of list
      ii) Delete a node at the end of list **(10 Marks)**
   b. Define the following terms with example
      i)   Doubly linked list
      ii) Circular singly linked list
      iii) Header linked list. **(06 Marks)**

OR

6 a. Write a C program to insert newnode at a specified position in a doubly linked list. **(08 Marks)**
   b. Write a C program to implement Queue operations using singly linked list. **(08 Marks)**

Module-4

7 a. Draw the Binary Search Tree (BST) for the following data and transverse the tree in
i) Inorder   ii) preorder   iii) postorder.
14, 15, 4, 9, 7, 18, 3, 5, 16, 4, 20, 17, 9, 14, 5   (05 Marks)

   b. Draw the binary tree to represent the following expression
A + (B – C) * (E – F)/G.   (04 Marks)

   c. Explain the following with example
      i)   Complete Binary tree
      ii) Height of the tree
      iii) Skewed binary tree
      iv) Binary tree.   (07 Marks)

OR

8 a. Construct the Binary Search Tree using inorder and preorder sequence :
Inorder   : Q B K C F A G P E D H R
Preorder : G B Q A C K F P D E R H
                                                                                                (06 Marks)
   b. Write a C function to construct the BST.   (07 Marks)
   c. What is the advantage of threaded binary tree over binary tree?   (03 Marks)

Module-5

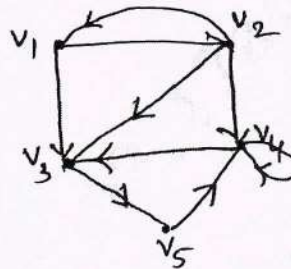9 a. For the given graphs, show Fig Q9(a) the adjacency matrix and linked representation of the
graph.

Fig Q9(a)   (06 Marks)

   b. Explain hashing with an example. How do you resolve collision?   (06 Marks)
   c. How does an append mode in a file opening differ from the write mode?   (04 Marks)

OR

10 a. Draw the graph G, for information stored in memory as shown below :

NODE	A	B		E		D	C		Start = 1
NEXT	7	4	0	6	8	0	2	3	Avail = 5
ADJ	1	2		5		7	9		
	1	2	3	4	5	6	7	8	

Dest	2	6	4		6	7	4		4	6	
Link	10	3	6	0	0	0	0	4	0	0	Avail = 8
	1	2	3	4	5	6	7	8	9	10	

                                                                                                (06 Marks)
   b. Sort the following list of numbers using Radix sort
366, 3481, 1432, 3618, 4235, 5380, 1289, 3211, 5437   (05 Marks)
   c. Summarize the features of relative file organization.   (05 Marks)

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USN | | | | | | | | | | | **15CS34**

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Computer Organization

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a.   Explain with a neat diagram, the different functional units of a digital computer. **(08 Marks)**
    b.   Explain the basic operational concepts between the processor and memory, with a neat diagram. **(08 Marks)**

OR

2   a.   Explain the following : i) Byte addressability   ii) Big – endian assignment
         iii) Little – endian assignment   iv) Word alignment of a machine. **(08 Marks)**
    b.   Registers R_1 and R_2 of a computer contain the decimal value 1200 and 4600, what is the effective address of the source operand in each of the following instruction :
      [R_1, R_2 and R_5 are registers]
      Load $20(R_1)$, R_5
      Move   # 3000, R_5
      Store R_5, $30(R_1, R_2)$
      Add $- (R_2)$, R_5. **(08 Marks)**

Module-2

3   a.   What is Interrupt? With example, explain the concept of interrupts. **(08 Marks)**
    b.   What are the different methods of DMA transfer? Explain any one. **(08 Marks)**

OR

4   a.   Why is bus arbitration required? Explain with block diagram, bus arbitration using Daisy – Chain. **(08 Marks)**
    b.   Explain Serial port and a Serial interface. **(08 Marks)**

Module-3

5   a.   Define and explain the following :   i)   Memory access time   ii) Memory cycle time
         iii)   Random Access Memory (RAM)   iv)   Read Only Memory (ROM). **(08 Marks)**
    b.   Discuss the Internal organization of a $2M \times 8$ asynchronous DRAM chip. **(08 Marks)**

OR

6   a.   Draw a neat block diagram of memory hierarchy in a contemporary computer system. Also indicate relative variation of size, speed and cost per bit, in the hierarchy. **(08 Marks)**
    b.   Explain Associative mapping technique and Set Associative mapping technique, with a neat diagram. **(08 Marks)**

Module-4

7   a.   Design a 4 – bit binary adder / subtractor and explain its functions. **(08 Marks)**
    b.   Explain with diagram, Look – ahead Carry generator. **(08 Marks)**

OR

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8 a. Perform Multiplication for (-13) and (+09) using Booth's Algorithm.   (08 Marks)
   b. Perform Multiplication of (+13) and (-6) using Bit Pair recoding method.   (08 Marks)

Module-5

9 a. With a diagram, explain typical single bus processor data path.   (08 Marks)
   b. Write the control sequence for an unconditional branch instruction.   (08 Marks)

OR

10 a. Explain the 3 – bus organization of the data path with a neat diagram and write the control
      sequence for the instruction ADD R_4, R_5, R_6 for the 3 – bus organization.   (08 Marks)
   b. Draw and explain typical hard wired control unit.   (08 Marks)

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Third Semester B.E. Degree Examination, Jan./Feb.2021
Unix and Shell Programming

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. Discuss the salient features of UNIX operating system.   **(08 Marks)**
    b. Explain the following commands, with suitable examples:
       (i)   apropros
       (ii)   whatis.   **(04 Marks)**
    c. Write a note on MAN command.   **(04 Marks)**

OR

2   a. With a neat diagram, explain the architecture of UNIX operating system.   **(08 Marks)**
    b. Differentiate between external and internal commands in UNIX with suitable example.
                                                                                 (04 Marks)
    c. Explain the following commands with syntax and example:
       (i) stty   (ii) Echo   (iii) date   (iv) uname   **(04 Marks)**

Module-2

3   a. Which command is used for listing file attributes? Explain significance of each field in output obtained with above command.   **(08 Marks)**
    b. Files current permissions are rw_ _w_ _ r_ _ . Write chmod expressions required to change them for the following:
       (i)   r_ _ r _ _ _ _ x
       (ii)   rw × rw × _ _ x
       (iii)   r _ xr _ xr_x
       (iv)   rw × rwxr_ _
       Using both relative and absolute methods of assigning permissions.   **(08 Marks)**

OR

4   a. Illustrate with a diagram typical unix file system and explain different types of file supported in UNIX.   **(08 Marks)**
    b. Explain absolute and relative path names with suitable examples.   **(04 Marks)**
    c. Explain following commands with examples:
       (i) mkdir   (ii) HOME   (iii) rmdir   (iv) cd   **(04 Marks)**

Module-3

5   a. Explain 3 standard files supported by UNIX. Also give details about special files used for output redirection in UNIX.   **(08 Marks)**
    b. Explain Shell's interpretive life cycle.   **(04 Marks)**
    c. Explain three modes of Vi and explain how you can switch from one mode to another.
                                                                                 (04 Marks)

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OR

6 a. Write UNIX commands for the following:
   (i)   Find and replace all the occurrances of unix with UNIX in the textfile after confirming the user (vi editor command)
   (ii)   List all the files in PDW which all having exactly five characters in their filename, any number of characters in their extensions.
   (iii) To copy all files stored in /home/vtu with ·c, ·cpp and ·java extensions to progs directory in current directory.
   (iv)   To delete all filenames containing * in their filenames.
   (v)   To delete all files with three character extensions except ·out from current directory.
   (vi)   To display (List) contents of current directory and its subdirectories.
   (vii) Searching for a pattern in backward direction.
   (viii) Writing the first 50 lines to another files.   **(08 Marks)**
   b. With suitable examples explain grep command and its options.   **(04 Marks)**
   c. Briefly explain the extended regular expressions with an example.   **(04 Marks)**

Module-4

7 a. What is shell programming? Write a shell program to create a menu and execute a given options based on user's choice. Options include
   (i) List of users   (ii) List of processes   (iii) Content of files
   (iv) Quit to UNIX   (v) Current date   **(10 Marks)**
   b. Explain with an example set and shift commands in UNIX to manipulate positional parameter with example.   **(06 Marks)**

OR

8 a. Explain the following statements with syntax and example:
   (i) if   (ii) for   (iii) while   (iv) case.   **(10 Marks)**
   b. Explain use of test and [ ] to evaluate expression in shell.   **(06 Marks)**

Module-5

9 a. Write a perl program that prompt user to input string and a number and print string those many times on different lines to standard output.   **(08 Marks)**
   b. Explain with example the string handling function supported by perl.   **(08 Marks)**

OR

10 a. Explain lists, Arrays and Associative arrays with respect to perl.   **(08 Marks)**
   b. Write a perl script to convert decimal number to binary numbers.   **(08 Marks)**

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Third Semester B.E. Degree Examination, Jan./Feb. 2021
Discrete Mathematical Structures

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define the following terms with an example : i) Conjunction   ii) Tautology   iii) Quantifiers   iv) Proposition   v) Conditional or Implication   vi) Dual of statement. **(06 Marks)**

b. Prove the validity of the following arguments :

     i)
$$p \rightarrow r$$
$$\neg p \rightarrow q$$
$$\underline{q \rightarrow s}$$
$$\therefore \neg r \rightarrow s$$

     ii)
$$(\neg p \vee \neg q) \rightarrow (r \wedge s)$$
$$r \rightarrow t$$
$$\underline{\neg t}$$
$$\therefore p$$

(06 Marks)

c. Find the negation of each of the following quantified statements :
   i) $\forall x, \forall y \ [(x > y) \rightarrow ((x - y) > 0)]$
   ii) $\forall x, \exists y \ [(p(x, y) \wedge q(x, y)) \rightarrow r(x, y)]$. **(04 Marks)**

OR

2 a. Prove that the following compound propositions are tautologies :
   i) $[p \wedge (p \rightarrow q)] \rightarrow q$ ii) $\{ p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$. **(05 Marks)**

b. Prove the following by using laws of logic :
   i) $[(p \rightarrow q) \wedge (\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg (q \vee p)$
   ii) $[p \vee q \vee (\neg p \wedge \neg q \wedge r)] \Leftrightarrow (p \vee q \vee r)$. **(05 Marks)**

c. Show that "If n is an odd integer then n + 11 is an even integer" by   i) Direct proof   ii) An indirect proof   iii) Proof by contradiction. **(06 Marks)**

Module-2

3 a. Prove the following by Mathematical Induction :
$$1^3 + 2^3 + 3^3 + \ldots + n^3 = \left[\frac{n(n+1)}{2} \right]^2.$$
(05 Marks)

b. i) How many arrangements are possible for all the letters in the word SOCIOLOGICAL?
   ii) In how many of these arrangements A & G are adjacent?
   iii) In how many of these arrangements all the vowels are adjacent? **(06 Marks)**

c. A sequence $\{a_n\}$ is defined recursively by $a_1 = 4$, $a_n = a_{n-1} + n$ for $n \geq 2$. Find a_n in explicit form. **(05 Marks)**

OR

4 a. If Fi's are the Fibonacci numbers and Li's are the Lucas numbers, prove that
$L_{n+4} - L_n = 5 F_{n+2}$ for all integers $n \geq 0$. **(06 Marks)**

b. A certain college question paper contains 3 parts A, B and C with 4 questions in part A, 5 questions in part B & 6 questions in part C. It is required to answer 7 questions by selecting atleast 2 questions from each part. In how many different ways can a student solve the question paper? **(06 Marks)**

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c. Find the coefficient of :
   i) $x^2 y^2 z^3$ in the expansion of $(x + y + z)^7$.
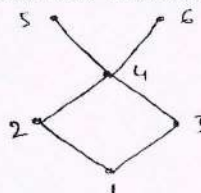   ii) $v^2 w^3 x^2 y^5 z^4$ in the expansion of $(v + w + x + y + z)^{16}$. **(04 Marks)**

Module-3

5 a. Let A = {a, b, c, d} and B = {2, 4, 5, 7}. Determine the following :
   i) $|A \times B|$.
   ii)   Number of relations from A to B.
   iii) Number of relations from A to B that contain (a, 4) and (c, 7).
   iv)   Number of relations from A to B that contain exactly six ordered pairs.
   v)   Number of binary relations on A that contain atleast Fourteen ordered pairs. **(06 Marks)**

   b. Let f, g, h be functions from z to z, define by $f(x) = x^2$, $g(x) = x + 5$ and $h(x) = \sqrt{x^2 + 2}$.
      Determine $(h \circ (g \circ f))(x)$ and $((h \circ g) \circ f)(x)$. Verify that $h \circ (g \circ f) = (h \circ g) \circ f$. **(05 Marks)**

   c. Let A = {1, 2, 3, 4} and
      R = {(1, 1) , (1, 2), (2, 1) , (2, 2) , (3, 1) , (3, 3) , (1, 3) , (4, 1) , (1, 4) , (4, 4)}. Is R is an
      equivalence relation? Find the corresponding partition on A. **(05 Marks)**

OR

6 a. Prove that if $f : A \to B$, $g : B \to C$ are invertible functions, the $g \circ f : A \to C$ is invertible
      and $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$. **(05 Marks)**

   b. Let A = {1, 2, 3, 4} and R = {(1, 1) ,(1, 2), (2, 3), (3, 4)} , S = {(3, 1), (4, 4), (2, 4), (1, 4)}
      be relations on A. Determine the relations $R \circ S$, $S \circ R$, R^2 and S^2. Write down their
      matrices. **(05 Marks)**

   c. Consider the Hasse diagram of a POSET (A, R) given in Fig. Q6(c).
      i)   Determine the relation matrix R   ii)   Construct the digraph for R
      iii) Write maximal , minimal , greatest and least elements. **(06 Marks)**

   Fig. Q6(c)

Module-4

7 a. How many integers between 1 and 300 (inclusive) are i) divisible by atleast one of 5, 6, 8?
      ii) divisible by none of 5, 6, 8? **(05 Marks)**

   b. Determine in how many ways can the letters in the work ARRANGEMENT be arranged so
      that there are exactly two pairs of consecutive identical letters. **(06 Marks)**

   c. Find the Rook polynomial for 3 × 3 board by using the expansion formula. **(05 Marks)**

OR

8 a. A person invests Rs 100,000 at 12% interest compounded annually : i) Find the amount at
      the end of 1st , 2nd , 3rd year   ii) Write the general explicit formula   iii) How long will it
      take to double the investment. **(06 Marks)**

   b. Solve the recurrence relation $a_{n+2} - 8a_{n+1} + 16a_n = 8(5^n) + 6(4^n)$, where $n \ge 0$ and $a_0 = 12$,
      $a_1 = 5$. **(05 Marks)**

   c. An apple , a banana , a mango and an orange are to be distributed to four boys B_1, B_2, B_3 and
      B_4. The Boys B_1 and B_2 do not wish to have apple, B_3 does not want banana or mango and
      B_4 refuses orange. In how many ways the distribution can be made so that no boy is
      displeased? **(05 Marks)**

Module-5

9 a. Define the following : i) Complete Graph   ii) Bipartite Graph   iii) Isolated Vertex
      iv) Regular Graph   v) Subgraph. **(05 Marks)**
   b. Let $G = (V, E)$ be simple graph of order $|V| = n$ and size $|E| = m$. If G is a bipartite graph, prove that $4m \leq n^2$. **(05 Marks)**
   c. Construct an optimal prefix code for the symbols a , o, p, u, y, z that occur with frequencies 20, 28, 4, 17, 12, 7 respectively. **(06 Marks)**

OR

10 a. Prove the following :
      i)   A path with n vertices is of length n-1.
      ii) If a cycle has n vertices, it has n edges.
      iii) The degree of every vertex in a cycle is two. **(06 Marks)**
   b. Define Isomorphism. Verify the two graphs are Isomorphic. (Refer Fig. 10(b(i),(ii))
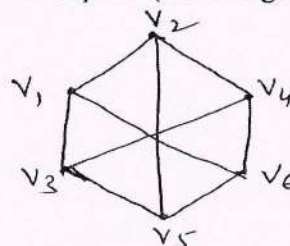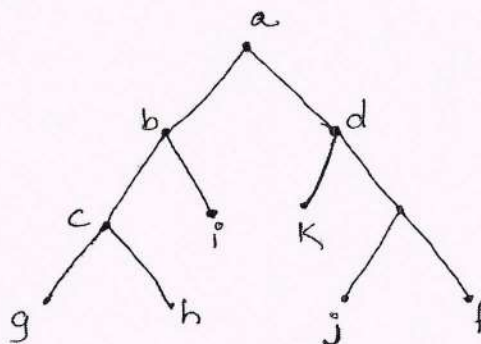

Fig. Q10(b (i))   Fig. Q10(b (ii)) **(04 Marks)**

   c. List the vertices in the tree given in Fig. Q10(c), when they are visited in :
      i) Preorder   ii) Postorder   iii) Inorder Traversal. **(06 Marks)**

Fig. Q10(c)

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15CS42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Software Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Define software engineering. Explain the different types of software product. **(06 Marks)**
    b. Explain the waterfall software process model. **(06 Marks)**
    c. With a neat diagram, explain the types of non-functional requirement. **(04 Marks)**

OR

2   a. Explain the essential attributes of good software. **(06 Marks)**
    b. Explain software controlled Insulin pump with neat diagram. **(06 Marks)**
    c. Explain the requirements elicitation and analysis process. **(04 Marks)**

Module-2

3   a. Explain the context model of Mental Health Care Patient Management System (MHC-PMS). **(06 Marks)**
    b. With neat diagram, explain phases of Rational Unified Process (RUP) and also list best practices of RUP. **(06 Marks)**
    c. Explain the different levels of reuse in implementation issues. **(04 Marks)**

OR

4   a. Explain the classes and associations in structural models with reference to MHC-PMS. **(06 Marks)**
    b. Define pattern. Explain the four essential elements of design pattern. **(06 Marks)**
    c. Explain open source licensing models. **(04 Marks)**

Module-3

5   a. Explain two distinct goals of software testing and also explain a model of software testing process. **(08 Marks)**
    b. Discuss the Lehman's laws for program evolution dynamics. **(08 Marks)**

OR

6   a. Explain various types of interface errors and also discuss three classes of interface errors. **(08 Marks)**
    b. Explain three different types of software maintenance. Why it is more expensive to add functionality after a system is in operation than its development? **(08 Marks)**

Module-4

7   a. Define Milestones and Deliverables. Explain the project scheduling process with neat diagram. **(08 Marks)**
    b. With a neat diagram, explain the review process in software quality management. **(08 Marks)**

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OR

8 a. Explain factors affecting software pricing. List the different types of project plan supplements. **(08 Marks)**

  b. With a neat diagram, explain ISO 9001 core process for quality management. **(08 Marks)**

Module-5

9 a. With a neat diagram explain the system evolution. **(08 Marks)**

  b. Discuss various principles used in Agile method and also explain why it is difficult to realize Agile method principles. **(08 Marks)**

OR

10 a. Define SCRUM and also explain its principles along with its advantages and disadvantages. **(08 Marks)**

  b. With a neat diagram, explain plan-driven and agile approaches to system specification. **(08 Marks)**

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Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Design and Analysis of Algorithms

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the worst case, best case and average case efficiencies of an algorithm, with an example each case.   **(08 Marks)**
   b. Explain the method of comparing the order of growth of two functions using limits, compute the order of growth of: (i) $\log_2 n$ and $\sqrt{n}$ (ii) 2^n and $n!$ **(08 Marks)**

OR

2 a. Define Big Oh notation. Prove that if $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$ **(08 Marks)**
   b. Explain the general plan for analyzing the efficiency of a recursive algorithm by considering Tower of Honoi problem as an example.   **(08 Marks)**

Module-2

3 a. Explain the concept of divide and conquer. Design and algorithm for merge sort.   **(08 Marks)**
   b. Apply Stressen's matrix multiplication algorithm to compute product of following two matrices: $\begin{bmatrix} 4 & 5 \\ 5 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 3 \\ 4 & 5 \end{bmatrix}$ **(08 Marks)**

OR

4 a. Discuss how Quick sort works to sort an array. Trace Quick sort algorithm for the following data set: 2, −4, 1, 0, 3, 5, −7. Also derive the worst case time complexity of Quick sort.   **(08 Marks)**
   b. Design and analyse an algorithm for findings the maximum and minimum of an elements using Divide and Conquer Approach.   **(08 Marks)**

Module-3

5 a. Write the algorithm to find optimal solution for job sequencing problem with deadline. Apply the same algorithm for the following dataset and find an optimal solution.
   n = 4, Profit (p_1, p_2, p_3, p_4) = (100, 10, 15, 27),
   Deadlines: (d_1, d_2, d_3, d_4) = (2, 1, 2, 1)   **(08 Marks)**
   b. Write a Kruskal's algorithm to find minimum cost spanning tree and obtain minimum spanning tree for the graph shown in Fig.Q5(b).
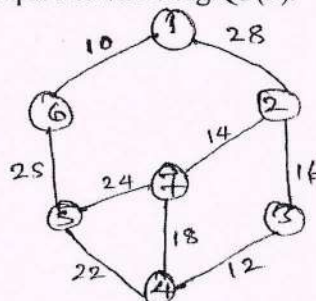

Fig.Q5(b)   **(08 Marks)**

OR

6 a. What is an Heap? Write an algorithm to sort the elements using Heap Sort. **(08 Marks)**
   b. Obtain the shortest distance cost and paths from node 5 to other nodes from the graph shown in Fig.Q6(b).
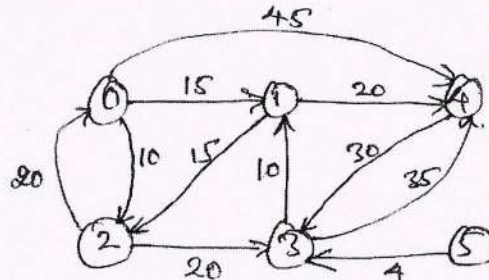

Fig.Q6(b) **(08 Marks)**

Module-4

7 a. Write Warshall's algorithm and find the transitive closure of the matrix given below:

$$R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

(08 Marks)

   b. Explain multistage graphs with example. Write multistage graph algorithm using forward approach. **(08 Marks)**

OR

8 a. Using dynamic programming, solve the following knapsack instance:
       $n = 4$, $[w_1, w_2, w_3, w_4] = [2, 1, 3, 2]$,
       $[p_1, p_2, p_3, p_4] = [12, 10, 20, 15]$ and $M = 5$ **(08 Marks)**
   b. Solve the following traveling sales person problem using dynamic programming.

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$ starting city 1.

(08 Marks)

Module-5

9 a. Discuss the general backtracking algorithm. Draw the state space tree for 4 – Queen's problem. **(08 Marks)**
   b. Solve the following instance of Knapsack problem using Branch and Bound Approach,
       $n = 4$, $[w_1, w_2, w_3, w_4] = [4, 7, 5, 3]$, $[v_1, v_2, v_3, v_4] = [40, 42, 25, 12]$
       The knapsack's capacity w is 10. **(08 Marks)**

OR

10 a. Define P, NP, NP – complete and NP – Hard classes. **(08 Marks)**
    b. Solve the following instances of assignment problem using Branch and Bound.

	Job 1	Job 2	Job 3	Job 4	
$C =$	9	2	7	8	person a
	6	4	3	7	person b
	5	8	1	8	person c
	7	6	9	4	person d

(08 Marks)

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15CS44

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Microprocessors and Microcontrollers

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain architecture of 8086, with neat diagram. **(08 Marks)**
   b. Explain following Assembler directives with example:
      ORG, EQU, DUP, DD, SEGMENT & ENDS **(05 Marks)**
   c. Assume that SP = FF2EH, AX = 3291H, BX = F43CH, CX = 09. Show the contents of stack and SP after execution of the following instructions:
      PUSH AX
      PUSH BX
      PUSH CX **(03 Marks)**

OR

2 a. Identify the addressing modes in the following instructions:
      i)   MOV [SI], AL
      ii) MOV Arr [SI], AX
      iii) MOV [BX + 6], AX
      iv) MOV [BP] [SI] + 10, BX
      v)   MOV [3600], AX **(05 Marks)**
   b. Explain IBM PC memory map, with neat diagram. **(05 Marks)**
   c. Explain the process of executing assembling ALP with steps and neat diagram. **(06 Marks)**

Module-2

3 a. Write an assembly code to multiply 2378H with 2F79H and store the result in RES. **(04 Marks)**
   b. Write an assembly program to convert packed BCD to ASCII value. **(06 Marks)**
   c. Explain rotate instructions with example. **(06 Marks)**

OR

4 a. Write a program to read a string from keyboard and convert it to upper case. **(06 Marks)**
   b. Explain difference between INT and CALL instructions. **(04 Marks)**
   c. Write a program to: i) Clear screen   ii) Set cursor at row-20 column 50   iii) Display message "Microprocessor and Microcontroller". **(06 Marks)**

Module-3

5 a. Explain the following instructions with example:
      i) SCASB   ii) CMPSB   iii) CBW   iv) IMUL   v) XLAT **(08 Marks)**
   b. Assume that we have 4 bytes of hexadecimal data: 25H, 62H, 3FH and 52H.
      i)   Find the check sum byte
      ii) Perform the checksum operation to ensure data integrity
      iii) If the second byte 62H had been changed to 22H. Show how checksum detects the error. **(08 Marks)**

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OR

6 a. Explain control word format of 8255 with neat diagram. (06 Marks)

  b. 8255 is configured as follows: (Refer Fig.Q.6(b))

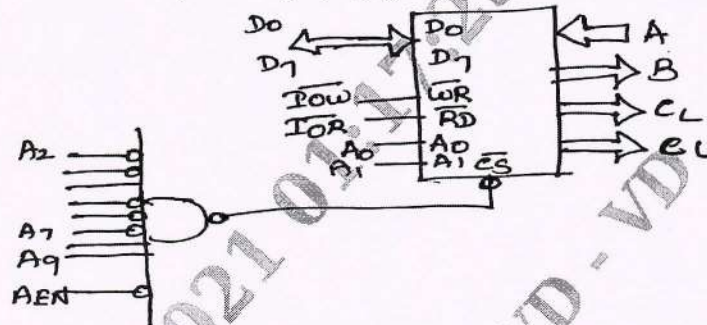Fig.Q.6(b)

  i) Find control word for port A as input, B as output all bits of port C as output.
  ii) Find the port addresses assigned to A, B, C and control byte for this configuration.
  iii) Program the ports to input data from port A and send it to both ports B and C.

  (10 Marks)

Module-4

7 a. Differentiate between Microcontroller and Microprocessor. (04 Marks)

  b. Explain ARM core data flow model with neat diagram. (06 Marks)

  c. Explain interrupt handling in ARM processor. (04 Marks)

OR

8 a. Explain ARM processors execution modes along with complete register set. (08 Marks)

  b. Explain pipelining mechanism of ARM architecture. (04 Marks)

  c. Explain RISC design principle. (04 Marks)

Module-5

9 a. Explain the use of barrel shifter in ARM processor with diagram. (06 Marks)

  b. Explain the following instruction with suitable example:
    i) BIC   ii) QADD   iii) BLX   iv) SMULL   v) SWI (10 Marks)

OR

10 a. Write an ALP to copy a block of data (BLOCK1) to another block (BLOCK2) using ARM instruction. (08 Marks)

  b. What are the salient features of ARM instruction set? (05 Marks)

  c. If $r_5 = 5$, $r_7 = 8$ and using the following instruction, write values of r_5, r_7 after execution MOV r_7, r_5, LSL # 2. (03 Marks)

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USN ☐☐☐☐☐☐☐☐☐☐ **15CS45**

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Object Oriented Concepts

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. Explain features of OOPs.   (06 Marks)
    b. Define class and object with syntax of class.   (04 Marks)
    c. Define function overloading? Explain with an example.   (06 Marks)

OR

2   a. Define constructor. Write a program demonstrating the use of constructors and destructor.
                                                                              (06 Marks)
    b. Describe the nested classes with examples.   (04 Marks)
    c. Write C++ program to find smallest of 3 numbers.   (06 Marks)

Module-2

3   a. List and explain the Java Buzzwords.   (08 Marks)
    b. Discuss Bitwise and relational operators in Java.   (02 Marks)
    c. Write a Java program to find largest of 3 numbers.   (06 Marks)

OR

4   a. Discuss Java's iteration statements for, while and do-while with example.   (06 Marks)
    b. Explain the concept of arrays in Java with examples. Write a Java program that creates and initializes a five integer elements array. Find the sum and average of its values.   (08 Marks)
    c. Define Bytecode.   (02 Marks)

Module-3

5   a. With examples, give two uses of super.   (08 Marks)
    b. Discuss about nested try statements and how such program may be executed.   (08 Marks)

OR

6   a. Explain Java's built in exceptions.   (08 Marks)
    b. Write general form of interface. How interfaces can be extended and implemented.
                                                                              (08 Marks)

Module-4

7   a. What is multithreading? Explain with an example the implementation of multithreading in java.   (08 Marks)
    b. What is the need of synchronization? Explain with an example how synchronization is implemented in java.   (08 Marks)

OR

8   a. Define adapter class. Explain the significance of adapter class with example.   (08 Marks)
    b. Explain inner class with example.   (04 Marks)
    c. Explain the mechanism of Delegation Event model.   (04 Marks)

Module-5

9 a. What are the two types of applets? Explain the skeleton of an applet with five methods init( ), start( ), stop( ), destroy( ) and paint ( ) methods.   (08 Marks)
   b. Write syntax of APPLET tag with possible attributes and explain.   (04 Marks)
   c. Explain parameter passing to applet with an example.   (04 Marks)

OR

10 a. Define Tree Write steps to create JTree. Also write a program to demonstrate the same.   (08 Marks)
   b. Explain the components and containers used in swings.   (03 Marks)
   c. Write steps to create JTable, also write a program to demonstrate the same.   (05 Marks)

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15CS46

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Data Communication

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1. a. Define Topology. Explain four basic topologies. **(08 Marks)**
   b. What are the factors that determine whether a communication system is a LAN or WAN? **(04 Marks)**
   c. Differentiate between Packet switched network and Circuit switched network. **(04 Marks)**

OR

2. a. With a neat diagram of TCP/IP protocol suite, discuss each layer of the suite. **(08 Marks)**
   b. A line has a signal – to – noise ratio of 1000 and a bandwidth of 4000 KHz. What is the maximum data rate supported by the line? **(04 Marks)**
   c. For the given data : 0 1 1 0 0 1, plot the waveform for NRZ – L , NRZ– I , RZ and Manchester line coding schemes. **(04 Marks)**

Module-2

3. a. Explain the process of Pulse Code Modulation (PCM), with illustrations in each process. **(08 Marks)**
   b. We have sampled a low pass signal with a bandwidth of 200 KHz, using 1024 levels of quantization :
      i) Calculate the bit rate of the digitized signal
      ii) Calculate SNR_{dB} for this signal
      iii) Calculate PCM bandwidth of this signal. **(08 Marks)**

OR

4. a. Discuss the following digital to analog conversion mechanisms :
      i) ASK   ii) FSK   iii) PSK. **(08 Marks)**
   b. Write the taxonomy of switched networks and their presence in the TCP / IP protocol suite layers. And explain circuit switched network and packet switched network with respect to delay. **(08 Marks)**

Module-3

5. a. Given the data {1001} and the divisor {1011}, simulate Cycle Redundancy Code (CRC) using   i) Paper – and – Pencil division process   ii) Polynomials. **(06 Marks)**
   b. Suppose the message is {7, 11, 12, 0, 6} each of 4 bit. Calculate the checksum and simulate for error free and error example. **(06 Marks)**
   c. What is the Hamming distance for i) Error detection   ii) Error correction? Explain. **(04 Marks)**

OR

6. a. Using an example, explain Stop – and - Wait protocol with Piggy backing. **(08 Marks)**
   b. Explain HDLC framing types. **(08 Marks)**

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Module-4

7. a. What is Controlled access? Discuss three Controlled access methods. (06 Marks)
   b. Explain Ethernet frame format. (06 Marks)
   c. Define the following destination addresses :
      i) 4A : 30 : 10 : 21 : 10 : 1A
      ii) 47 : 20 : 1B : 2E : 08 : EE
      iii) FF : FF : FF : FF : FF : FF. (04 Marks)

OR

8. a. Compare three Fast Ethernet implementation. (06 Marks)
   b. Discuss the hidden and exposed terminal / station problem in IEEE 802.11. (04 Marks)
   c. Write a short note on Bluetooth layers. (06 Marks)

Module-5

9. a. Compare two services of WiMAX. (04 Marks)
   b. Discuss the following operations of cellular telephones :
      i) Frequency reuse principle   ii) Handoff. (04 Marks)
   c. Explain IPV4 datagram format. (08 Marks)

OR

10. a. Write a short note on Messages of ICMPV4 protocol. (06 Marks)
    b. Explain the following ICMPV4 debugging tools :
       i) Ping   ii) Trace route. (06 Marks)
    c. Discuss IPV6 extension headers. (04 Marks)

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USN ☐☐☐☐☐☐☐☐☐☐ **18CS32**

Third Semester B.E. Degree Examination, July/August 2021
Data Structures and Applications

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. Write the drawback of static memory allocation. Explain in detail the different functions of dynamic memory allocation. **(08 Marks)**
   b. Write a program to search for key element in an array using binary search. **(07 Marks)**
   c. Write the difference between structure and union. **(05 Marks)**

2 a. Write a program to sort integers in increasing order using selection sort algorithm. **(06 Marks)**
   b. Write a function: (i) to find out the length of the string (ii) string concatenation, without using built-in function. **(08 Marks)**
   c. Write a program to search for an element in the sparse matrix. **(06 Marks)**

3 a. What is stack? Write a program to implement push, pop and display operations for stacks using arrays. **(08 Marks)**
   b. Convert the following infix expression to post fix expression:
   (i) $((A + (B - C) * D) \wedge E + F)$ (ii) $X\$Y\$Z - M + N + P/Q$ **(06 Marks)**
   c. Write a program to evaluate the postfix expression. **(06 Marks)**

4 a. Explain the drawback of ordinary queue. Write a program to implement push, pop and display operations for circular queue using array. **(08 Marks)**
   b. Write a recursive program to find out the GCD of two numbers. **(05 Marks)**
   c. What is double ended queue? Write a program to implement the same with required functions. **(07 Marks)**

5 a. Write a program to implement queue using singly linked list. **(08 Marks)**
   b. Write a function to search for key element in a list using Singly Linked List. **(06 Marks)**
   c. Write a function to delete a node based on information field using doubly Linked List. **(06 Marks)**

6 a. Write a function to count the number of nodes in the List. **(04 Marks)**
   b. Write a function to perform the following using circular doubly Linked List with header node.
   (i) insert_front → insert element at front end
   (ii) delete_rear → delete element from rear end **(08 Marks)**
   c. Write a function to add two polynomial using Linked List. **(08 Marks)**

7 a. Explain the following with suitable example:
   (i) Binary tree
   (ii) Binary search tree
   (iii) Complete binary tree
   (iv) Skewed tree **(08 Marks)**

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b. Construct a tree using the given tree traversals:
in-order : GDHBAEICF
post-order : GHDBIEFCA **(04 Marks)**

c. Write a function to create and search for an element in binary search tree. **(08 Marks)**

8 a. Write a program to insert an element in to binary tree. **(08 Marks)**

b. Write a function to traverse the tree using
(i) pre-order
(ii) post-order
(iii) in-order traversal **(06 Marks)**

c. Explain Threaded Binary Tree in detail. **(06 Marks)**

9 a. Explain the different functions for file operations. **(06 Marks)**

b. Write a program to sort the array elements using radix sort. Show tracing to sort the given array elements increasing order using radix sort. 52, 43, 24, 67, 78, 96, 81, 63, 27. **(08 Marks)**

c. Write a function to sort the array elements in increasing order using insertion sort. **(06 Marks)**

10 a. Write a program to print the reachable nodes of a graph from the source node using BFS method. **(06 Marks)**

b. Write the adjacency matrix and adjacency. List representation for the given graph in Fig.Q10(b).

Fig.Q10(b) **(06 Marks)**

c. Explain hashing in detail. **(08 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐   **18CS33**

Third Semester B.E. Degree Examination, July/August 2021
Analog and Digital Electronics

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. With a neat sketch, explain the construction and working of Light Emitting Diode (LED).
(06 Marks)

   b. For the given circuit in Fig.Q.1(b) Si transistor with $\beta = 50$, calculate the I_B, I_C and V_{CE}. Draw the DC load line and determine the operating point. **(06 Marks)**
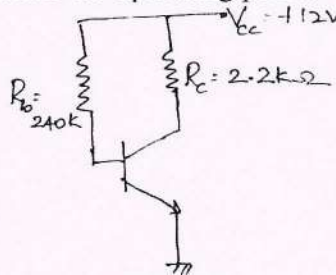

Fig.Q.1(b)

   c. With a neat circuit diagram and waveform, explain the working of Astable multivibrator.
(08 Marks)

2 a. What is a filter? Compare between active filters and passive filters.   **(06 Marks)**
   b. With a neat diagram and waveform, explain working of relaxation oscillator.   **(08 Marks)**
   c. Explain the different components of regulated power supply.   **(06 Marks)**

3 a. Simply the given expression using K-map
$F(A, B, C, D) = \Sigma m(0, 1, 4, 8, 9, 10) + \Sigma d(2, 11)$ **(08 Marks)**
   b. Using a prime-implicant charts, find all minimum SOP solution using Quine-Mc-Clusky method for $f(w, x, y, z) = \Sigma m(1, 3, 4, 5, 6, 7, 10, 12, 13) + \Sigma d(2, 9, 15)$.   **(12 Marks)**

4 a. Find all prime implicants of the following given function and find all minimum solutions using Petrick method.
$F(A, B, C, D) = \Sigma m(7, 12, 14, 15) + \Sigma d(1, 3, 5, 8, 10, 11, 13)$ **(12 Marks)**
   b. Using the map-entered variable, use 4 variable maps to find the minimum SOP expression for the function
$G(A, B, C, D, E, F) = m_0 + m_2 + m_3 + Em_5 + Em_7 + Em_9 + m_{11} + m_{15} + d(1, 10, 13)$
(08 Marks)

5 a. Write the truth table for the AND-OR functions for four valued simulations.   **(06 Marks)**
   b. With a suitable assumption, explain the timing diagram of an AND-OR circuit.   **(06 Marks)**
   c. What is hazard? Explain the different type of hazard with an example.   **(08 Marks)**

6 a. Explain multiplexer with an example. Realize the 8:1 multiplexer using 2:1 and 4:1 multiplexer.   **(08 Marks)**
   b. With a neat diagram, explain the 3 to 8 decoder.   **(06 Marks)**
   c. With a neat sketch, explain the structure of PLA.   **(06 Marks)**

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7   a.   Explain the structure of an VHDL module. Write a VHDL code for 4:1 multiplexer.
                                                                                (08 Marks)
     b.   Write a program for the implementation of full-Adder using VHDL.   (06 Marks)
     c.   With a neat diagram, explain switch debouncing circuit using an S-R latch.   (06 Marks)

8   a.   What is a flip flop? Explain the gated D-latch, with a neat diagram.   (06 Marks)
     b.   Explain the Master-Slave J-K flip-flop with a neat diagram, using NAND gates.   (10 Marks)
     c.   Explain T-flip flop with a diagram.   (04 Marks)

9   a.   What is Register? With a neat diagram, explain the register with data, load, clear and clock
          inputs.   (08 Marks)
     b.   With a neat sketch, explain the working of Serial In Serial Out (SISO) Right shift register.
                                                                                (06 Marks)
     c.   What are the difference between the synchronous and Asynchronous counters?   (06 Marks)

10   a.   Design a synchronous counter for the sequence $0 \rightarrow 3 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 7 \rightarrow 0 \rightarrow 3$ using
          J-K flip-flop.   (10 Marks)
     b.   Design a counter using S-R flip-flop for the following given count
          $0 \rightarrow 4 \rightarrow 7 \rightarrow 2 \rightarrow 3 \rightarrow 0$.   (10 Marks)

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18CS34

Third Semester B.E. Degree Examination, July/August 2021
Computer Organization

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. With neat block diagram, explain the basic operational concepts of a computer. **(05 Marks)**
  b. Write basic performance equation and explain and define the terms involved in it. **(05 Marks)**
  c. What is an Addressing mode? Explain the following addressing modes with one example for each : i) Absolute   ii) Immediate   iii) Indirect   iv) Auto increment. **(10 Marks)**

2 a. Explain Big – Endian and Little – Endian assignment. Consider a computer that has a byte addressable memory organized in 32 words, according to Little – Endian scheme. A program reads ASCII characters entered at a keyboard and store them in successive byte location starting at 2000. Show how the contents of the three memory words at locations 2000, 2004 and 2008 after the string "VTU BELAGAVI" has been entered. (ASCII codes : V = 56H , T = 54H , U = 55H , "   " = 20H , B = 42H , E = 45H , L = 4 CH , A = 41H , G = 47H , I = 49H). **(05 Marks)**
  b. Register R_1 and R_2 of computer contain the decimal values 1200 and 4600. What is Effective Address (EA) of the memory operand in each of the following instructions?
  i) Load 20 (R_1), R_5 ii) Move # 3000 , R_5 iii) Store 30 (R_1, R_2) , R_5
  iv) Add $– (R_2)$, R_5 v) Subtract (R_1) + , R_5. **(05 Marks)**
  c. Explain Logical shift and Rotate instructions with examples. **(10 Marks)**

3 a. Explain Memory mapped I/O and I/O mapped I/O. **(06 Marks)**
  b. With neat diagram, explain Centralized bus arbitration and distributed bus arbitration. **(08 Marks)**
  c. What is DMA? Explain the registers in a DMA interface. **(06 Marks)**

4 a. Define Interrupt. With example, explain the concept of interrupt. What are the overheads incurred in handling interrupt? **(06 Marks)**
  b. With neat diagram, explain the synchronous bus transfer during an input operation. **(08 Marks)**
  c. Explain the tree structure of USB with split bus operation. **(06 Marks)**

5 a. Define i) Memory latency ii) Memory Bandwidth   iii) Hit – rate   iv) Miss penalty. **(04 Marks)**
  b. With a neat diagram, explain the internal organisation of a 2M × 8 dynamic memory chip. **(10 Marks)**
  c. With a neat diagram, explain the memory hierarchy with respect to speed, size and cost. **(06 Marks)**

6 a. With neat diagrams, explain internal structure of i) Static RAM, cell and   ii) ROM cell. **(08 Marks)**
  b. What is Memory Mapping? With neat diagram explain
  i) Direct mapping   ii) Set Associative mapping. **(12 Marks)**

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7 a. Perform following operations on the 5 – bit signed numbers using 2's complement representation system. Also indicate whether the overflow has occurred.

   i) (-9) + (-7)   ii) (+7) – (-8). **(04 Marks)**

   b. With neat diagram, explain 4 – bit carry – look ahead adder. **(08 Marks)**

   c. Perform multiplication for -13 and + 9. Using Booth's Algorithm. **(08 Marks)**

8 a. Design a logic circuit to perform addition / subtraction of two 'n' bit numbers X and Y. **(04 Marks)**

   b. Perform the division of numbers 8 by 3 (8÷3) using Restoration Division method. **(08 Marks)**

   c. With neat diagram, explain Register configuration for sequential multiplication. **(08 Marks)**

9 a. With a neat diagram, explain Single bus organisation of data path inside a processor. **(10 Marks)**

   b. What are the actions required to Excuse a complete instruction. Add (R_3), R_1. Give the control sequence for execution of instruction Add (R_3), R_1. **(10 Marks)**

10 a. With neat diagram, explain the Microprogrammed Control method for design of control unit and write the micro – routine for the instruction Branch < 0. **(10 Marks)**

   b. Bring out the difference between Microprogrammed control and Hard – wired control. **(04 Marks)**

   c. With neat diagram, explain 4 – Stage pipeline. **(06 Marks)**

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18CS35

Third Semester B.E. Degree Examination, July/August 2021
Software Engineering

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. What is software engineering? Explain its key challenges facing.   **(06 Marks)**
   b. Explain the software process activities.   **(06 Marks)**
   c. Explain software increment process model for software development.   **(08 Marks)**

2 a. Mention and explain important categories of software products.   **(04 Marks)**
   b. Discuss essential attributes of good software.   **(06 Marks)**
   c. Explain the water fall process model and discuss the problem with water fall process model.
                                                                                          (10 Marks)

3 a. What is object orientation? Explain the concepts of object orientation.   **(10 Marks)**
   b. What is Object Oriented Development (OOD) and Object Oriented Modeling (OOM)?
                                                                                          (10 Marks)

4 a. Explain the OOM – class, state and interaction models in detail.   **(10 Marks)**
   b. Mention Object Orientation (OO) themes.   **(04 Marks)**
   c. Explain the three models describe a system in OOM/OOD.   **(06 Marks)**

5 a. What is system modeling? Mention its advantages.   **(04 Marks)**
   b. Mention the various UML diagrams used in system modeling.   **(06 Marks)**
   c. Draw Classes/Associations in the MHC-PMS.   **(10 Marks)**

6 a. Explain what is generalization is system modeling.   **(04 Marks)**
   b. Draw the generalization hierarchy for Doctor, Hospital doctor and general practioner.
                                                                                          (06 Marks)
   c. Draw state diagram of a microwave oven.   **(10 Marks)**

7 a. Mention the important program testing goals.   **(06 Marks)**
   b. Explain the I/O model of program testing.   **(06 Marks)**
   c. Explain the software testing process.   **(08 Marks)**

8 a. What is inspections and testing? Explain.   **(06 Marks)**
   b. Explain the stages of testing.   **(08 Marks)**
   c. Explain testing strategies-partitions (equivalence).   **(06 Marks)**

9 a. What is project planning? Mention the project planning stages.   **(04 Marks)**
   b. What is plan-driven development and mention its – pros and cons?   **(06 Marks)**
   c. What is project planning process? Explain with diagram in detail.   **(10 Marks)**

10 a. What is software pricing? Mention the factors affecting software pricing.   **(04 Marks)**
   b. Explain the project scheduling process.   **(10 Marks)**
   c. What is project scheduling and its activities. Also explain the milestones and deliverable in project scheduling.   **(06 Marks)**

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18CS36

Third Semester B.E. Degree Examination, July/August 2021
Discrete Mathematical Structures

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Define the following with an example for each i) Proposition   ii) Tautology
       iii) Contradiction.   **(06 Marks)**
   b. Establish the validity of the argument:
       $p \rightarrow q$
       $q \rightarrow (r \wedge s)$
       $\neg r \vee (\neg t \vee u)$
       $\neg r \vee (\neg t \vee u)$
       $\underline{p \wedge t}$
       $\therefore U$
                                                                             (09 Marks)
   c. Determine the truth value of the following statements if the universe comprises of all non zero integers:
       i) $\exists_x \exists_y [xy = 2]$
       ii) $\exists_x \forall_y [xy = 2]$
       iii) $\forall_x \exists_y [xy = 2]$
       iv) $\exists_x \exists_y [(3x + y = 8) \wedge (2x - y) = 7]$
       v) $\exists_x \exists_y [(4x + 2y = 3) \wedge (x - y = 1)]$ **(05 Marks)**

2 a. Using truth table, prove that for any three propositions p, q, r $[p \rightarrow (q \wedge r)] \Leftrightarrow [(p \rightarrow q) \wedge (p \rightarrow r)]$.   **(08 Marks)**
   b. Prove that for all integers 'k' and '*l*', if k and *l* both odd, then k + *l* is even and k*l* is odd by direct proof.   **(06 Marks)**
   c. If a proposition has truth value 1, determine all truth values arguments for the primitive propositions p, r, s for which the truth value of the following compound proposition is 1.
       $[q \rightarrow \{ (\neg p \vee r) \wedge \neg s\}] \wedge \{\neg s \rightarrow (\neg r \wedge q)\}$ **(06 Marks)**

3 a. Prove by mathematical induction for every positive integer 8 divides $5^n + 2 \cdot 3^{n-1} + 1$.
                                                                             (06 Marks)
   b. For the Fibonacci sequences $F_0, F_1, F_2 \ldots$ Prove that $F_n = \dfrac{1}{\sqrt{5}}\left[\left(\dfrac{1+\sqrt{5}}{2}\right) - \left(\dfrac{1-\sqrt{5}}{2}\right)^n\right]$.
                                                                             (06 Marks)
   c. Find the coefficient of :
       i) $x^9 y^3$ in the expansion of $(2x - 3y)^{12}$
       ii) x^{12} in the expansion $x^3(1 - 2x)^{10}$ **(08 Marks)**

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4   a.   Prove that $4n < (n^2 - 7)$ for all positive integers $n \geq 6$.   (06 Marks)
    b.   How many positive integers 'n' can we form using the digits 3, 4, 4, 5, 5, 6, 7 if we want 'n' to exceed 5,000,000.   (08 Marks)
    c.   Find the number of distinct terms in the expansion of $(w + x + y + z)^{12}$.   (06 Marks)

5   a.   i) Let f: R $\to$ R be defined by

$$f(x) = \begin{cases} 3x - 5, & \text{for } x > 0 \\ -3x + 1, & \text{for } x \leq 0 \end{cases}$$

Determine: $f\left(\dfrac{5}{3}\right)$, $f^{-1}(3)$, $f^{-1}([-5, 5])$ (04 Marks)

ii) Prove that if 30 dictionaries contain a total of 61,327 pages, then at least one of the dictionary must have at least 2045 pages.   (02 Marks)
    b.   Prove that if $f : A \to B$ and $g : B \to C$ are invertible functions then $gof : A \to C$ is an invertible function and $(gof)^{-1} = f^{-1} o\ g^{-1}$.   (06 Marks)
    c.   Let A = {1, 2, 3, 4, 5}. Define a relation R on A $\times$ A by $(x_1, y_1) R(x_2, y_2)$ if and only if $x_1 + y_1 = x_2 + y_2$.
         i)   Determine whether R is in equivalence relation on A $\times$ A.
         ii)   Determine equivalence classes [(1, 3)], [(2, 4)].   (08 Marks)

6   a.   Let A = {a, b, c, d} and B = {1, 2, 3, 4, 5, 6}
         i)   How many functions are there from A to B? How many of these are one-to-one? How many are onto?
         ii)   How many functions are there from B to A? How many of these are one-to-one? How many are onto?   (06 Marks)
    b.   Let A = {1, 2, 3, 4, 6, 12}. On A define the relation R by aRb if and only if "a divides b".
         i)   Prove that R is a partial order on A
         ii)   Draw the Hasse diagram
         iii) Write down the matrix of relation.   (08 Marks)
    c.   Define partition of a set. Give one example Let A = {a, b, c, d, e}. Consider the partition P = {{a, b}, {c, d} {e}} of A. Find the equivalent relation inducing this partition.   (06 Marks)

7   a.   Out of 30 students in a hostel; 15 study History, 8 study Economics and 6 study Geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these subjects.   (06 Marks)
    b.   Five teachers T_1, T_2, T_3, T_4, T_5 are to made class teachers for five classes C_1, C_2, C_3, C_4, C_5 one teacher for each class. T_1 and T_2 do not wish to become the class teachers for C_1 or C_2, T_3 and T_4 for C_4 or C_5 and T_5 for C_3 or C_4 or C_5. In how many ways can the teachers be assigned work without displeasing any teacher?   (08 Marks)
    c.   Solve the recurrence relation $a_n - 6a_{n-1} + 9a_{n-2} = 0$ for $n \geq 2$.   (06 Marks)

8   a.   Solve the recurrence relation $a_0 - 3a_{n-1} = 5 \times 3^n$ for $n \geq 1$ given that $a_0 = 2$.   (06 Marks)
    b.   Let a_n denote the number of n-letter sequences that can be formed using letters A, B and C, such that non terminal A has to be immediately followed by B. Find the recurrence relation for a_n and solve it.   (06 Marks)
    c.   Find the number of permutations of English letters which contain exactly two of the pattern car, dog, pun, byte.   (08 Marks)

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9 a. Define a complement of a simple graph. Let G be a simple graph of order n. If the size of G is 56 and size of $\overline{G}$ is 80, what is n? **(06 Marks)**

b. Prove that is every graph, the number of vertices of odd degree is even. **(08 Marks)**

c. Prove that a connected graph G remains connected after removing an edge e from G if and only if e is a part of some cycle in G. **(06 Marks)**

10 a. Define graph isomorphism and isomorphic graphs. Determine whether the following graphs are isomorphic or not. **(06 Marks)**
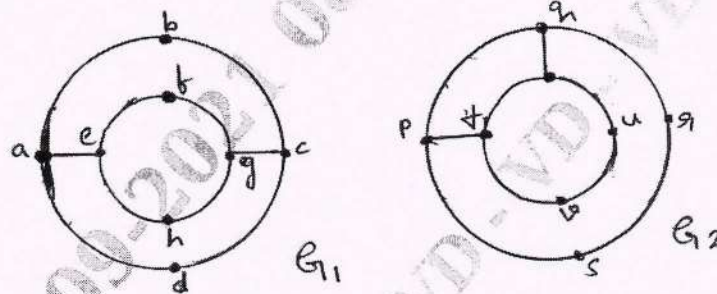
Fig.Q.10(a)

b. Prove that a tree with 'n' vertices has n – 1 edges. **(06 Marks)**

c. Define optimal prefix code. Obtain the optimal prefix code for the string ROAD is GOOD. Indicate the code. **(08 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ 17CS36

Third Semester B.E. Degree Examination, July/August 2021
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Write all the logical connectives with truth table. **(06 Marks)**

b. Prove that for any proposition p, q, r the compound proposition $[(p \vee q) \rightarrow r] \Leftrightarrow [\neg r \rightarrow \neg(p \vee q)]$ is logically equivalent. **(08 Marks)**

c. Prove that for any proposition p, q, r the compound proposition $\{p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$ is tautology. **(06 Marks)**

2 a. Prove the logical equivalences using laws of logic
  i) $[(p \vee q) \wedge (p \vee \neg q)] \vee q \Leftrightarrow p \vee q$
  ii) $(p \rightarrow q) \wedge [\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg(q \vee p)$ **(08 Marks)**

b. Test the validity of the following argument
  If I study, I will not fail in the examination
  If I don't watch TV in the evening, I will study
  I failed in the examination
  _____
  ∴ I must have watched TV in the evenings **(06 Marks)**

c. Establish the validity of the following argument
  $\forall x, \{p(x) \vee q(x)\}$
  $\forall x, \{\{\neg p(x) \wedge q(x)\} \rightarrow r(x)\}$
  _____
  ∴ $\forall x, \{\neg r(x) \rightarrow p(x)\}$ **(06 Marks)**

3 a. Prove that mathematical induction that
  $1^2 + 3^2 + 5^2 + \ldots\ldots\ldots + (2n-1)^2 = \dfrac{1}{3}n(2n-1)(2n+1)$ **(06 Marks)**

b. For the Fibonacci sequence $F_0, F_1, F_2 \ldots\ldots \ldots$ Prove that
  $F_n = \dfrac{1}{\sqrt{5}}\left[\left(\dfrac{1+\sqrt{5}}{2}\right)^n - \left(\dfrac{1-\sqrt{5}}{2}\right)^n\right]$. **(08 Marks)**

c. Find the coefficients of
  i) $x^9 y^3$ in the expansion of $(2x - 3y)^{12}$
  ii) x^{12} in the expansion of $x^3(1 - 2x)^{10}$. **(06 Marks)**

4 a. In how many ways can 10 identical pencils be distributed among 5 children in the following cases?
  i) There are no restrictions
  ii) Each child gets atleast one pencil
  iii) The youngest child gets atleast two pencils. **(06 Marks)**

b. Prove the following identities :
  i) $C(n, r-1) + C(n, r) \equiv C(n+1, r)$
  ii) $C(m, 2) + C(n, 2) \equiv C(m+n, 2) - mn$ **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

c. In how many ways one can distribute eight identical balls into four distinct containers so that
   i) No container is left empty
   ii) The fourth container gets an odd number of balls. **(06 Marks)**

5 a. Consider the function f and g defined by $f(x) = x^3$ and $g(x) = x^2 + 1$, $\forall x \in R$. Find gof, fog, f^2 and g^2. **(06 Marks)**

b. Let A = {1, 2, 3, 4, 6, 12}. On A define the relation R by aRb if and only if a divides b. Prove R is partial order on A. Draw the Hasse diagram for this relation. **(07 Marks)**

c. Let A = {1 2 3 4} and f and g be functions from A to A given by f = {(1, 4) (2, 1), (3, 2), (4, 3)}, g = {(1, 2), (2, 3), (3, 4), (4, 1)}.Prove that f and g are inverse of each other. **(07 Marks)**

6 a. Define an equivalence relation with example. **(08 Marks)**

b. Draw the Hasse diagram representing the positive divisors of 36. **(06 Marks)**

c. Let f : R →R be defined by

$$f(x) = \begin{cases} 3x - 5 & \text{for } x > 0 \\ -3x + 1 & \text{for } x \le 0 \end{cases}$$

   i) Determine : f(0), f(−1), f(5/3), f(−5/3)
   ii) Find $f^1(0)$, $f^1(1)$, $f^1(3)$, $f^1(6)$ **(06 Marks)**

7 a. Out of 30 students in hostel, 15 study History, 8 study Economics and 6 study Geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these subjects. **(07 Marks)**

b. Find the rook polynomial for the 3×3 board using expansion formula. **(07 Marks)**

c. Solve the recurrence relation $a_n + a_{n-1} - 6a_{n-2} = 0$ $n \ge 2$ given $a_0 = -1$ $a_1 = 8$. **(06 Marks)**

8 a. An apple, a banana, a mango and an orange are to be distributed among 4 boys B_1, B_2, B_3, B_4. The boys B_1 and B_2 do not wish to have an apple. The boy B_3 does not want banana or mango, B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased. **(08 Marks)**

b. How many permutations of 1 2 3 4 5 6 7 8 are not derangements? **(05 Marks)**

c. The number of virus affected files in a system is 1000 (to start with) and this increases 250%, every two hours. Use recurrence relation to determine the number of virus affected files in the system after one day. **(07 Marks)**

9 a. Define : i) Graph   ii) Simple graph   iii) Complete graph   iv) Order of graph v) Size of graph   vi) Bipertite graph   vii) General graph. **(07 Marks)**

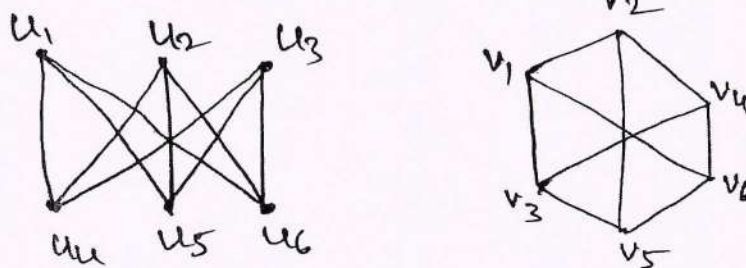b. Show that the following two graphs are isomorphic (Fig Q9(b))

Fig Q9(b) **(06 Marks)**

c. Find the prefix codes for the letters B, E, I, K, L, T, P, S, if the coding scheme is as shown in Fig Q9(c).
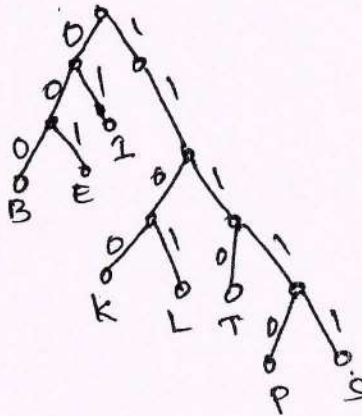

Fig Q9(c)

1) Find the codes for the words PIPE and BEST
2) Decode the string i) 000011100001 ii) 11111111101101011110 **(07 Marks)**

10 a. Obtain an optimal prefix code for the message LETTER RECEIVED. Indicate the code. **(08 Marks)**

b. Apply the merge sort to following list of elements.
   $\{-1, 0, 2, -2, 3, 6, -3, 5, 1, 4\}$. **(06 Marks)**

c. Let $T_1 = (V_1 \ E_1)$ and $T_2 = (V_2 \ E_2)$ be two trees. If $|E_1| = 19$ and $|V_2| = 3|V_1|$ determine $|V_1|$, $|V_2|$ & $|E^2|$. **(06 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐   **17CS42**

Fourth Semester B.E. Degree Examination, July/August 2021
Object Oriented Concepts

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions.

1   a.   Bring out the differences between procedure oriented programming and object oriented programming.   **(05 Marks)**
    b.   Define function polymorphism. Write a program in C++ using function overloading area( ) to calculate area of circle (area = πr^2), area of triangle (1/2 * base * height) and area of rectangle (area = base * height)   **(08 Marks)**
    c.   What are static members of a class? Write and explain program to count the number of objects created.   **(07 Marks)**

2   a.   How do you space helps in preventing pollution of global namespace.   **(06 Marks)**
    b.   Write a C++ program that has a class names 'student' with data members name, USN and average and two member function read( ) to read students data and write( ) to display record on screen. Write main( ) function to read and display three students data.   **(07 Marks)**
    c.   What is reference variable? Write a C++ program to swap two integer numbers and display values before and after swapping.   **(07 Marks)**

3   a.   List and explain Java buzzword.   **(08 Marks)**
    b.   Explain (i) >>>   (ii) for each   (iii) Short circuit operator.   **(06 Marks)**
    c.   Write a Java program to find biggest and smallest element in an array of 'n' elements.   **(06 Marks)**

4   a.   Discuss with example how arrays are declared and initialized in Java. Write a Java program to demonstrate the use of array.   **(08 Marks)**
    b.   Write a Java program to perform arithmetic operation (+, −, *, /) based on user choice and display the result on screen.   **(06 Marks)**
    c.   Explain briefly type casting in Java.   **(06 Marks)**

5   a.   Explain the concept of inheritance and its classification.   **(08 Marks)**
    b.   What is an exception? Explain the usage of throw keyword with an example.   **(06 Marks)**
    c.   Discuss use of interface. Give its syntax with example in Java.   **(06 Marks)**

6   a.   Can constructor be overloaded in Java? Justify your answer.   **(08 Marks)**
    b.   With example program, explain two uses of super in Java inheritance.   **(08 Marks)**
    c.   Write a note on Garbage Collection.   **(04 Marks)**

7   a.   Define a thread. List the differences between multiprocess and multithreaded concepts.   **(06 Marks)**
    b.   Illustrate with an example, the use of isAlive( ) and join( ) method.   **(08 Marks)**
    c.   Discuss delegation event model with example.   **(06 Marks)**

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8 a. Write a Java program to implement producer consumer problem using thread.   (08 Marks)
   b. What is synchronization? Explain with an example how synchronization is implemented in Java.   (06 Marks)
   c. Write a note on :
      (i) adapter class   (ii) inner class.   (06 Marks)

9 a. List and explain two types of applet? Explain the skeleton of an applet.   (06 Marks)
   b. Describe the steps to create JTable. Write a program to create a table with the column heading Name, USN, Marks, Grade and insert 5 records into the table and display on screen.   (10 Marks)
   c. Write a note on components and containers.   (04 Marks)

10 a. Demonstrate how to pass parameters for font name and font size in applet.   (06 Marks)
   b. List and explain different forms of repaint method.   (07 Marks)
   c. Create a swing applet that has two buttons named "Outline class" and "Offline class". When either of the button is pressed it should print "Online class is scheduled" or "Offline class is scheduled".   (07 Marks)

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USN ☐☐☐☐☐☐☐☐☐☐   **18CS32**

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Data Structures and Applications

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   Define data structures. Explain with neat block schematic different types of data structures with examples. What are the primitive operations that can be performed?   **(10 Marks)**
    b.   Define sparse matrix. Express the following matrix in triplet form and find its transpose.   **(10 Marks)**

$$A = \begin{bmatrix} 15 & 0 & 0 & 22 \\ 0 & 11 & 3 & 0 \\ 0 & 0 & 0 & -6 \\ 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 \end{bmatrix}$$

OR

2   a.   Explain any four dynamic memory allocation functions with syntax and example.   **(10 Marks)**
    b.   What do you mean by pattern matching? Outline the KMP algorithm. Implement the same to find out the occurrence of following pattern.
         P:ABCDABD
         S:ABC ABCDAB ABCDABCDABDE   **(10 Marks)**

Module-2

3   a.   Define Recursion. Let A and B be nonnegative integers. Suppose a function GCD is recursively defined on follows:
         GCD(A, B) = GCD (B, A) if A < B
                   = A if B = 0
                   = GCD(B, MOD(A, B)) otherwise
         Here MOD(A, B) read as A Modulo B. Evaluate GCD(20, 28).   **(04 Marks)**
    b.   Write C function for push( ), pop( ) and display( ) routine of STACK.   **(08 Marks)**
    c.   Outline the algorithm for infix to postfix. Using the same algorithm convert following INFIX expression to equivalent POSTFIX.
         ((H * ((((A + ((B + C) * D)) * F) * G) * E)) + J)   **(08 Marks)**

OR

4   a.   Write a C function CQInsert( ) and CQDelete( ) operations on circular queue.   **(08 Marks)**
    b.   Outline the algorithm for infix to prefix. Using the same algorithm convert following INFIX to equivalent PREFIX.
         ((H * (((A + ((B + C) * D)) * F) * G) * E)) + J)   **(08 Marks)**
    c.   Evaluate the following postfix expression by showing the contents of the stack.
         5 4 6 + * 4 9 3 / + *   **(04 Marks)**

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Module-3

5   a.   Write C functions for the following operations on linked list:
        i)   Insertion at the beginning
        ii)   Insertion at the end
        iii)   Deletion at the beginning
        iv)   Deletion at the end.   **(12 Marks)**

    b.   Explain concept of sparse matrix representation using linked list. Represent the following
        sparse matrix in linked list format.   **(08 Marks)**

$$A = \begin{bmatrix} 0 & 0 & 3 & 0 & 4 \\ 0 & 0 & 5 & 7 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 6 & 0 & 0 \end{bmatrix}$$

OR

6   a.   Write C function to add two polynomials. Show the linked list representation of below two
        polynomials and in addition.
        POLY 1: $5x^2 + 4x + 2$
        POLY 2: $3x^2 + 2x + 5$ **(08 Marks)**

    b.   Write C functions for following operations on circular linked list:
        i)   Insertion at the beginning
        ii)   Insertion at the end
        iii)   Deletion at the beginning
        iv)   Deletion at the end.   **(12 Marks)**

Module-4

7   a.   Define Binary tree with an example. Write C recursive routine to traverse the given tree
        using inorder, preorder and postorder.   **(08 Marks)**

    b.   Define binary search tree. Draw the BST for the following input:
        14 15 4 9 7 18 3 5 16 20 17 9
        Give recursive search function to search an element in that tree.   **(06 Marks)**

    c.   Given the following traversal, draw a binary tree:
        i)   Inorder : 4 2 5 1 6 7 3 8
             Postorder : 4 5 2 6 7 8 3 1
        ii) Preorder : A B C E I F J D G H K L
             Inorder : E I C F J B G D K H L A   **(06 Marks)**

OR

8   a.   Represent the below given tree in Fig.Q.8(a), using
        i)   Linked list representation
        ii)   Left child right sibling representation.   **(08 Marks)**
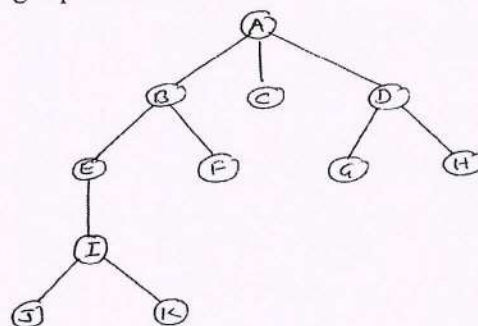

Fig.Q.8(a)

b. Define threaded binary tree. List its advantages and disadvantages. Draw the one way threading and two way threading of the following binary tree. (Refer Fig.Q.8(b)). **(08 Marks)**
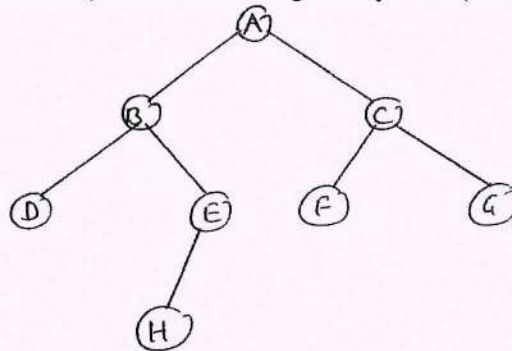

Fig.Q.8(b)

c. Write function to insert an element in a binary search tree. **(04 Marks)**

Module-5

9 a. Define the following terminologies with examples:
   i) Digraph   ii) Weighted graph   iii) Self loop   iv) Parallel edges **(08 Marks)**

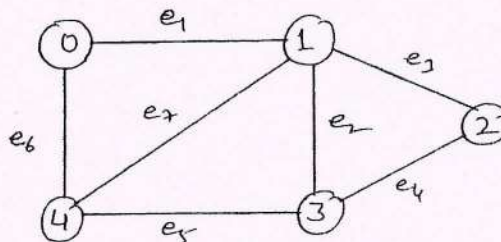b. Give the adjacency matrix, incidence matrix and linked list representation of the following undirected graph. **(06 Marks)**

Fig.Q.9(b)

c. Arrange the following elements in ascending order using RADIX SORT
   151, 60, 875, 342, 12, 477, 689, 128, 15 **(06 Marks)**

OR

10 a. Explain different types of HASH function with example. **(10 Marks)**

b. Explain any five file operations along with syntax and example. **(10 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐ 18CS33

Third Semester B.E. Degree Examination, Jan./Feb. 2021
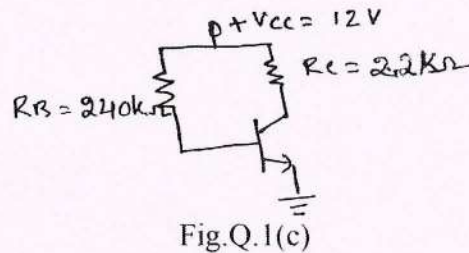## Analog and Digital Electronics

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the working principle of opto coupler with neat diagram. **(06 Marks)**
   b. Derive an expression for collector current and collector emitter voltage of fixed bias circuit. **(06 Marks)**
   c. For the circuit shown in Fig.Q.1(c), draw DC load line, use silicon transistor with B = 50, $V_{BE} = 0.7V$. **(08 Marks)**

Fig.Q.1(c)

OR

2 a. With the help of neat circuit diagram and wave form explain the working principle of relaxation oscillator. **(10 Marks)**
   b. Explain current to voltage converter. **(05 Marks)**
   c. Define voltage regulator. Explain adjustable voltage regulator. **(05 Marks)**

Module-2

3 a. Simplify the following function using K-map and obtain simplified Boolean expressions.
   i) $f_1(a, b, c, d) = \sum m(1, 3, 4, 5, 7, 10, 12)$
   ii) $f_2(a, b, c, d) = \sum m(5, 8, 9, 10, 11, 12, 13, 14, 15)$ **(10 Marks)**
   b. Find all the prime implicants of function using Q-M method.
   $f(a, b, c, d) = \sum m(0, 2, 3, 4, 8, 10, 12, 13, 14)$ **(10 Marks)**

OR

4 a. For the following function given use Q-M method and obtain simplified expression:
   $f(a, b, c, d) = \sum m(7, 9, 12, 13, 14, 15) + dc(4, 11)$ **(08 Marks)**
   b. With an example explain Petrik's method. **(06 Marks)**
   c. For the given function determine minimal sum using MEV technique. Use d as MEV variable. $f(a, b, c, d) = \sum m(3, 4, 5, 7, 8, 11, 12, 13, 15)$. **(06 Marks)**

Module-3

5 a. Define static 1 – hazard. Explain how static 1-hazard can be detected and removed with an example. **(08 Marks)**
   b. What is multiplexer and explain 8 to 1 mux with the help of logic diagram and corresponding expression. **(06 Marks)**
   c. Explain the importance of three-state buffer. **(06 Marks)**

OR

6 a. Implement the following functions using 3:8 decoder
$f_1(a, b, c) = \sum m(0, 4, 6, 7)$
$f_2(a, b, c) = \sum m(1, 4, 5)$ (06 Marks)
   b. Implement the following Boolean functions using an appropriate PLA:
$f_1(a, b, c) = \sum m(0, 4, 7)$
$f_2(a, b, c) = \sum m(4, 6)$ (06 Marks)
   c. Realize a full adder using PAL. (08 Marks)

Module-4

7 a. Explain the structure of VHDL program. Write VHDL code for 4-bit parallel adder using full adder as component. (08 Marks)
   b. With necessary diagrams, Explain switch debouncing with an S-R latch. (06 Marks)
   c. Explain D flip-flop with the help of timing diagram. (06 Marks)

OR

8 a. Give the implementation of T-flip-flop from D flip-flop. (04 Marks)
   b. Explain master-slave J-K flip-flop operation. (08 Marks)
   c. Derive the characteristic equations for the following flip-flops:
   i)   S-R flip-flop
   ii)   D-flip flop
   iii) T-flip-flop
   iv)   J-K flip-flop. (08 Marks)

Module-5

9 a. With neat sketch, explain the working principle of Serial Input Serial Output (SISO) shift register. (06 Marks)
   b. Design 3 bit synchronous binary counter using transition table of T-flip-flop (08 Marks)
   c. Explain how 4 bit register with data, load, clear and clock input is constructed using D-flip-flops. (06 Marks)

OR

10 a. With the help of state graph, state and transition table and timing diagram, explain sequential parity checker. (06 Marks)
    b. With the help of block diagram, explain the working principle of n-bit parallel adder with accumulator. (08 Marks)
    c. Analyze following Moore sequential circuit for an input sequence X = 01101 and draw the timing diagram. (06 Marks)
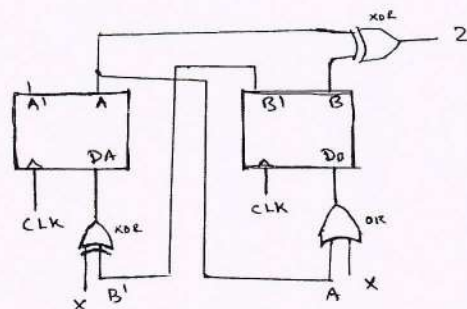

Fig.Q.10(c)

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

18CS34

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Computer organization

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. How to measure the performance of a computer? Explain. (08 Marks)
    b. Define addressing modes. Explain any five types of addressing modes with example. (12 Marks)

OR

2 a. Define subroutine and parameter passing. Explain how to pass the parameter by value and by reference. (10 Marks)
    b. How the input and output operations are to be performed by the processor? Write a program that reads a line of characters and displays it. (10 Marks)

Module-2

3 a. Write the scenario when the interrupts are enabled. (06 Marks)
    b. Explain how the I/O devices should be organized in a priority structure. (08 Marks)
    c. Define exception, describe the different kinds of exceptions. (06 Marks)

OR

4 a. Define bus arbitration. Explain the two approaches to bus arbitration. (10 Marks)
    b. With the help of timing diagram, explain the read operation on the PCI bus. (10 Marks)

Module-3

5 a. Explain the operation of a CMOS memory cell. (06 Marks)
    b. With a neat figure, explain the organization of a $2M \times 32$ memory module using $512K \times 8$ static memory chips. (08 Marks)
    c. Explain the internal structure of synchronous DRAM. (06 Marks)

OR

6 a. What is the use of a cache memory? Explain in detail the three types of determining the cache locations to store memory blocks. (10 Marks)
    b. How the parallelism is to be used as on interleaving? Explain. (10 Marks)

Module-4

7 a. A half adder is a combinational logic circuit that has two inputs x and y and two outputs sum(s) and carry(c), resulting from the binary addition of x and y.
      i) Design a half adder as a two-level AND–OR circuit.
      ii) Show how to implement a full-adder using two half address and external logic gates, as necessary. (10 Marks)
    b. Given, multiplicand A = + 23 and multiplier B = –10. Perform the multiplication of A and B using Booth's algorithm. (10 Marks)

1 of 2

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<center>**OR**</center>

8   a.   Explain 4-bit carry-look ahead adder.   **(10 Marks)**
      b.   Perform the division of $8 \div 3$ using restoring division.   **(10 Marks)**

<center>## Module-5</center>

9   a.   Write and explain the control sequence for execution of the instruction Add(R3), R1.
                                                                 (10 Marks)
      b.   Explain the three-bus organization of the dater path.   **(10 Marks)**

<center>**OR**</center>

10   a.   Explain in detail the organization of control unit.   **(10 Marks)**
       b.   Explain the operation of 4-stage pipeline.   **(10 Marks)**

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USN | | | | | | | | | | 18CS35

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Software Engineering

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. What are the attributes of good software? Explain the key challenges faced in software engineering. **(08 Marks)**
    b. With a neat diagram, explain the waterfall model of software development process. **(06 Marks)**
    c. Describe the general model of software design process. **(06 Marks)**

OR

2   a. Define and differentiate functional and non-functional requirements. **(06 Marks)**
    b. What is requirements specification? Explain various ways of writing system requirements. **(08 Marks)**
    c. What is ethnography? How ethnography is effective in discovering the types of requirements? **(06 Marks)**

Module-2

3   a. What is OO development? Explain object oriented themes briefly. **(08 Marks)**
    b. What are links and associations? Write and explain UML notation for links and association with an example. **(06 Marks)**
    c. Describe generalization and inheritance with an example. **(06 Marks)**

OR

4   a. What is object orientation? What are the important characteristics of OO approach? Explain. **(08 Marks)**
    b. Define model. Describe the relationship among three models. **(08 Marks)**
    c. With the help of a sample class model explain multiplicity and Association and names. **(04 Marks)**

Module-3

5   a. Draw and explain a contest model for patient information system. **(06 Marks)**
    b. With a diagram, explain the phases in the Rational Unified Process (RUP). **(06 Marks)**
    c. With the help of a neat state diagram, illustrate the working of a microwave oven. **(08 Marks)**

OR

6   a. What is model driven engineering? State the three types of abstract system model produced with a neat diagram. **(08 Marks)**
    b. What are the activities to the carried out in object oriented design process of a system? How the objects are identified? **(08 Marks)**
    c. What is open source development? Explain general models of open source licensing. **(04 Marks)**

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Module-4

7 a. What is list driven development? With a neat diagram, explain test driven development process. **(08 Marks)**

   b. With neat diagram, explain six stages of acceptance testing process. **(08 Marks)**

   c. What are the different types of interfaces to be tested during component testing? Explain. **(04 Marks)**

OR

8 a. Write and explain Lehman's laws related to system charge. **(08 Marks)**

   b. What is software maintenance? Draw the general model of reengineering process and explain. **(08 Marks)**

   c. What are the strategic options involved in legacy system management? Discuss. **(04 Marks)**

Module-5

9 a. For the set of tasks shown below draw the activity bar chart for the project scheduling.

Task	Duration (Days)	Dependencies
T_1	10	-
T_2	15	
T_3	15	T_1 (M1)
T_4	10	-
T_5	10	T_2, T_4 (M3)
T_6	5	T_1, T_2 (M4)
T_7	20	T_1 (M1)
T_8	25	T_4 (M2)
T_9	15	T_3, T_6 (M5)
T_{10}	15	T_7, T_8 (M6)
T_{11}	10	T_9 (M7)
T_{12}	10	T_{10}, T_{11} (M8)

(08 Marks)

   b. Write and explain the factors affecting software pricing. **(05 Marks)**

   c. Explain briefly the algorithm cost modeling and write the difficulties. **(07 Marks)**

OR

10 a. With a diagram, explain the phase involved in software review process. **(08 Marks)**

   b. Explain briefly the key stages in the process of product measurement. **(08 Marks)**

   c. Write any four product and process standards. **(04 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐ 18CS36

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Verify that, for any three propositions p, q, r the compound proposition.
$[p \to (q \to r)] \to [(p \to q) \to (p \to r)]$ is a tautology or not. **(06 Marks)**

b. Test for validity of following argument.
If Ravi goes out with friends, he will not study
If Ravi do not study, his father becomes angry
His father is not angry
∴ Ravi has not gone out with friends **(07 Marks)**

c. Give direct and indirect proof of following statement "Product of two odd integers is an odd integer". **(07 Marks)**

OR

2 a. For any three propositions p, q, r, prove that $[\sim p \wedge (\neg q \wedge r)] \vee [(q \wedge r) \vee (p \wedge r)] \Leftrightarrow r$ **(06 Marks)**

b. Check for validity of following argument,
If a triangle has two equal sides then it is isosceles. If a triangle is isoceles than it has two equal angles.
A certain triangle ABC does not have two equal angles
∴ The triangle ABC does not have two usual sides **(07 Marks)**

c. Consider the following open statement on set of all real numbers as universe:
$p(x) : x \geq 0$ $q(x) : x^2 \geq 0$ $r(x) : x^2 - 3x - 4 = 0$ $s(x) : x^2 - 3 > 0$
Then find truth value of i) $\exists x\, p(x) \wedge q(x)$ ii) $\forall x, p(x) \to q(x)$ iii) $\forall x, q(x) \to s(x)$
iv) $\forall x, r(x) \vee s(x)$ **(07 Marks)**

Module-2

3 a. By mathematical induction prove that
$$1^2 + 3^2 + 5^2 + \ldots\ldots + (2n - 1)^2 = \frac{1}{2}\, n\, (2n - 1)\, (2n + 1)$$ **(06 Marks)**

b. Find coefficient of i) x° in the expansion of $\left(3x^2 - \dfrac{2}{x}\right)^{15}$
ii) $x^{11}\, y^4$ in the expansion of $(2x^3 - 3xy^2 + z^2)^6$ **(07 Marks)**

c. A total amount of Rs.1500 is to be distributed to three students A, B, C. In how many ways distribution can be done in the multiples of Rs.100 if
i) Every students sets at least Rs.300
ii) A must get at least Rs.500, B and C must set at least Rs.400 each. **(07 Marks)**

OR

4 a. By mathematical induction prove that for any positive integer n the number $11^{n+2} + 12^{2n+1}$ is divisible by 133 **(06 Marks)**

b. How many positive integers n can be formed from the digits 3, 4, 4, 5, 5, 6, 7 if we want n to exceed 5,000,000. **(07 Marks)**

c. A certain question paper has 3 parts A, B, C with four questions in Part A, Five in B and Six in C. It is required to answer seven questions by selecting at least two from each part. In how many different ways student can answer seven questions. **(07 Marks)**

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Module-3

5 a. Let A = {1, 2, 3, 4, 5, 6}, B = {6, 7, 8, 9, 10} and f be a function from A to B defined by f = {(1, 7) (2, 7), (3, 8) (4, 6) (5, 9) (6, 9)}. Then find $f^{-1}(6)$, $f^{-1}(9)$. If B_1 = {7, 8}, B_2 = {8, 9, 10) find $f^{-1}(B_1)$, $f^{-1}(B_2)$. **(06 Marks)**

   b. Let A = {1, 2, 3, 4} and R be a relation on A defined by xRy if and only if x divides y. Then
      i) Write R as ordered pairs   ii) Draw diagram   iii) Write matrix of R. **(07 Marks)**

   c. If f, g, h are functions from R to R defined by $f(x) = x^2$, $g(x) = x + 5$, $h(x) = \sqrt{x^2 + 2}$. Then verify that f o(goh) = (fog) oh **(07 Marks)**

OR

6 a. If 30 dictionaries in a library contain total 61,327 pages then prove that at least one of the dictionaries must have at least 2045 pages. **(06 Marks)**

   b. For any three nonempty sets A, B, C prove that
      i) $(A \cup B) \times C = (A \times C) \cup (B \times C)$
      ii) $A \times (B \cap C) = (A \times B) \cap (A \times C)$ **(07 Marks)**

   c. Let A = {1, 2, 3, 4, 6, 8, 12} define a partial order R on A by xRy if and only if x divides y. Draw Hasse diagram of R. **(07 Marks)**

Module-4

7 a. For the integers 1, 2, ...n, there are 11660 derangements where 1, 2, 3, 4, 5 appear in first five positions then find value of n. **(06 Marks)**

   b. Determine number of integers between 1 and 300 which are i) divisible by exactly two of 5, 6, 8 ii) at least two of 5, 6, 8. **(07 Marks)**

   c. Solve $a_n = 2(a_{n-1} - a_{n-2})$ for $n \geq 2$ given $a_6 = 1$, $a_1 = 2$ **(07 Marks)**

OR

8 a. Out of 30 students of a hostel 15 study history, 8 study economics, 6 study geography and 3 study all the three subjects. Show that 7 or more study none of the subjects. **(06 Marks)**

   b. An apple, a banana, a mango, and an orange to be distributed to 4 boys B_1, B_2, B_3 and B_4. The boys B_1 and B_2 do not wish apple, B_3 does not want banana or mango B_1 refuses orange. In how many ways distribution can be made so that all of them are happy. **(07 Marks)**

   c. Solve $a_n - 3a_{n-1} = 5 \times 3^n$ for $n \geq 1$ given $a_0 = 2$. **(07 Marks)**

Module-5

9 a. Show that following graphs in the Fig.Q.9(a)(i) and Fig.Q.9(a)(ii) are isomorphic

Fig.Q.9(a)(i)   Fig.Q.9(a)(ii)

(06 Marks)

   b. Define with an example to each   i) Complement of a graph   ii) Vertex degree
      iii) Rooted tree   iv) Prefix code **(07 Marks)**

   c. Apply merge sort to the list
      -1, 7, 4, 11, 5, -8, 15, -3, -2, 6, 10, 3 **(07 Marks)**

OR

10 a. Prove that a tree with n vertices has (n – 1) edges. **(06 Marks)**

    b. Determine number of vertices in following graph G:
       i)   G has 9 edges and all vertices have degree 3
       ii)   G has 10 edges with 2 vertices of degree 4 and all other have degree 3 **(07 Marks)**

    c. Obtain optimal prefix code for the message ROAD IS GOOD. **(07 Marks)**

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USN | | | | | | | | | | 17CS36

Third Semester B.E. Degree Examination, Jan./Feb.2021
Discrete Mathematical Structures

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Prove that $(p \vee q) \wedge \neg(\neg p \wedge q) \Leftrightarrow p$, using laws of logic. **(06 Marks)**

   b. Establish the following argument by the method of proof by contradiction:
      $[(p \to (q \wedge r)) \wedge (r \to s) \wedge (\neg(q \wedge s))] \to \neg p$ **(07 Marks)**

   c. Negate and simplify : (i) $\forall x, [p(x) \to \neg q(x)]$ (ii) $\exists x, [\{p(x) \vee q(x)\} \to r(x)]$ **(07 Marks)**

OR

2 a. Verify that $[p \to (q \to r)] \to [(p \to q) \to (p \to r)]$ is a tautology. **(06 Marks)**

   b. Test the validity of the argument :
      "Rita is baking a cake. If Rita is baking a cake, then she is not practicing her flute. If Rita is not practicing her flute, then her father will not buy her a car. Therefore Rita's father will not buy her a car. **(07 Marks)**

   c. Prove that for all real numbers x and y, If $x + y > 100$, then $x > 50$ or $y > 50$ by direct proof and contradiction proof. **(07 Marks)**

Module-2

3 a. Prove that for every positive integer n, 5 divides $n^5 - n$. **(06 Marks)**

   b. Total of Rs 1500 is to be distributed to three students A, B and C. In how many ways the distribution can be made in multiple of Rs 100.
      (i)   If each gets at least Rs 300.
      (ii)   If A must gets at least Rs 500, B and C get at least Rs 400 each? **(07 Marks)**

   c. Find the coefficient of $a^2 b^3 c^2 d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$. **(07 Marks)**

OR

4 a. Let $a_0 = 1$, $a_1 = 2$, $a_2 = 3$ and $a_n = a_{n-1} + a_{n-2} + a_{n-3}$, for all positive integer $n \geq 3$. Then prove that $a_n \leq 3^n$ for all positive integer n. **(06 Marks)**

   b. How many ways can 10 oranges be distributed among five children if, (i) there are no restrictions (ii) each child gets at least one (iii) the oldest child gets at least two oranges. **(07 Marks)**

   c. Determine the number of integer solutions of $a + b + c + d = 32$, where
      (i) a, b, c and d > 0   (ii) a, b $\geq$ 5 and c, d $\geq$ 7. **(07 Marks)**

Module-3

5 a. Define one-to-one function and onto function with example. Determine whether or not the relation $\{(x, y)/x, y \in R$ and $x = y^2\}$ is a function. **(06 Marks)**

   b. Let $A = \{a, b, c, d, e\}$ and the relation $R = \{(a, a), (a, e), (b, c), (b, d), (c, c)(d, c), (e, d)(e, a)\}$, write the relation matrix and digraph of R. **(07 Marks)**

   c. Draw the Hasse diagram for the subset relation on the power set of $A = \{a, b, c\}$. **(07 Marks)**

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OR

6   a.   For any sets A, B, C $\subseteq$ U, prove that $A \times (B - C) = (A \times B) - (A \times C)$.   **(06 Marks)**
    b.   Show that if any (n + 1) numbers from {1, 2, 3…..2n} are chosen, then two of them will have their sum equal to (2n + 1).   **(07 Marks)**
    c.   Let $A = \{1, 2, 3, 4, 5\}$ and R be a relation on $A \times A$ defined by (a, b) R (c, d) if and only if $a + d = b + c$. Show that R is equivalence relation. Determine the partition induced by R and the equivalence class [(2, 5)].   **(07 Marks)**

Module-4

7   a.   Determine the number of positive integers n where $1 \le n \le 100$, and n is not divisible by 2, 3 or 5.   **(06 Marks)**
    b.   An apple, a banana, a mango and an orange are to be distributed for four boys A, B, C, D. The boys A and B do not wish to have apple. C does not want banana or mango and D refuses orange. In how many ways the distribution can be made so that no boy is displeased?   **(07 Marks)**
    c.   Solve $2a_n = 7a_{n-1} - 3a_{n-2}$ for $n \ge 2$ and $a_0 = 2$, $a_1 = 5$.   **(07 Marks)**

OR

8   a.   Define the principle of inclusion and exclusion and generalization of the principle.   **(06 Marks)**
    b.   Find the rook polynomial of the chess board. (Refer Fig. Q8 (b)).   **(07 Marks)**

Fig. Q8 (b)

    c.   Solve $a_n = 2a_{n-1} - 2a_{n-2}$ for $n \ge 2$ and $a_0 = 1$, $a_1 = 2$.   **(07 Marks)**

Module-5

9   a.   Discuss the Konigsberg-bridge problem and solution.   **(06 Marks)**
    b.   Define Isomorphic graphs. Show that the following two graphs are isomorphic. (Refer Fig. Q9 (b))   **(07 Marks)**

Fig. Q9 (b)

    c.   Construct an optimal prefix code for the symbols a, b, c, d, e, f, that occur with respective frequencies 20, 28, 4, 17, 12, 7.   **(07 Marks)**

OR

10   a.   Find the number of spanning sub graphs of the graph given below. How many of them are connected. How many are spanning trees?   **(06 Marks)**
     b.   Prove that for every tree $T \equiv (V, E)$, if $|V| \ge 2$ then T has at least two pendent vertices.   **(07 Marks)**
     c.   Define directed tree, rooted tree, binary rooted tree, complete binary tree, m-ary tree complete m-ary tree, leaf.   **(07 Marks)**

Fig. Q10 (a)
* * * 2 of 2 * * *

USN | | | | | | | | | | **17CS42**

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Object Oriented Concepts

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. List out the differences between Procedure Oriented Language and Object Oriented Language. **(06 Marks)**
   b. What is friend function in C++? List out the rules to declare the friend function in C++. **(06 Marks)**
   c. What is function overloading? Write a C++ program to define three overloaded functions area( ) to find area of circle, triangle and rectangle. **(08 Marks)**

OR

2   a. Explain the various features of OOC. **(06 Marks)**
   b. What is a constructor? Mention its types. Explain copy constructor with suitable code. **(08 Marks)**
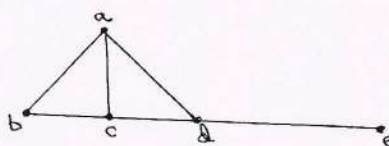   c. What is an inline function? Write a C++ function to find the factorial of a given number using inline function. **(06 Marks)**

Module-2

3   a. List and explain the Java Buzzwords. **(08 Marks)**
   b. Why Java Language is Platform Independent Language? Justify your answer. **(06 Marks)**
   c. Write a Java program to find the average and sum of following array elements {4, 8, 12, 16, 20} using foreach in Java. **(06 Marks)**

OR

4   a. List the different types of operators. Explain any three. **(08 Marks)**
   b. What is an array? Write a Java program to print sum of each row of two dimensional array.

For example : $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$

O/p should be $\begin{bmatrix} 6 \\ 15 \\ 24 \end{bmatrix}$ **(08 Marks)**

   c. Explain switch case with an example. **(04 Marks)**

Module-3

5   a. What is an exception? Explain exception handling in Java. **(10 Marks)**
   b. What is package in Java? How package is created and imported, explain with an example program (including Execution steps). **(10 Marks)**

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OR

6 a. What is an interface? Explain how an interface can be implemented with suitable code.
(06 Marks)

   b. What is Inheritance? Differentiate method overloading and method overloading with suitable code.
(06 Marks)

   c. Explain any four Built-in exception classes with an example program.
(08 Marks)

Module-4

7 a. What are threads? Explain two ways of creation of threads with suitable code. (10 Marks)

   b. What is synchronization in Java? Explain synchronization can be implemented with producer-consumer example program.
(10 Marks)

OR

8 a. What is meant by deadlock? How to avoid deadlock? Give example. (10 Marks)

   b. What is Event handling in Java? Write a Java program to demonstrate Mouse Events handling.
(10 Marks)

Module-5

9 a. What is an applet? Explain the life cycle of an applet? (10 Marks)

   b. Explain passing parameters in Applets with suitable code. (10 Marks)

OR

10 Explain the following with a suitable code:
    (i)   JLabel
    (ii) JTextField
    (iii) JList
    (iv) JTable
(20 Marks)

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17CS44

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Microprocessor & Microcontroller

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. With a neat diagram, explain the working of a 8086 microprocessor. **(10 Marks)**
  b. Explain the following 5 addressing modes of 8086 microprocessor:
  (i) Register addressing mode.
  (ii) Direct addressing mode.
  (iii) Register indirect addressing mode.
  (iv) Base relative addressing mode.
  (v) Based indexed addressing mode.
  with example for each. **(10 Marks)**

OR

2 a. Write an assembly language program to add 5 numbers present in the datasegment. **(06 Marks)**
  b. Explain the following 4 assembler directives of 8086 :
  (i) dup   (ii) DD   (iii) EQU   (iv) ORG
  with syntax and examples. **(08 Marks)**
  c. Explain all bits of a 8086 flag register. **(06 Marks)**

Module-2

3 a. Explain the interrupt mechanism in 8086 microprocessor. **(08 Marks)**
  b. Explain use of these instructions with syntax (i) DAA (ii) MUL (iii) ROR (iv) DIV. **(08 Marks)**
  c. Explain the NMI interrupt. **(04 Marks)**

OR

4 a. Write an ALP to read a string of maximum length of 50 bytes and clear the screen and display the read string at location 12H, 28H on the monitor. **(10 Marks)**
  b. Explain the following instructions with its syntax:
  (i) CMP   (ii) DAS   (iii) CALL   (iv) XCHG   (v) SAR **(10 Marks)**

Module-3

5 a. Interface 4, 32 K RAM to 8086 microprocessor. You may choose the address range of your own. Show the memory map. **(10 Marks)**
  b. Explain the following string instructions:
  (i) CMPSB   (ii) SCASB   (iii) LODSB   (iv) MOVSB
  (v) STOSB **(10 Marks)**

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OR

6 a. Interface 8086 with 8255 chip such that Port A is output port and Port B is input port. Let the addresses be 1100h, 1101h, 1102h, 1103h for Port A, Port B, Port C and control register respectively. Write a program to read from Port B and write it to Port A. **(10 Marks)**

   b. Explain the following instructions:
        (i)   IDIV   (ii) IMVL   (iii) CBW   (iv) XLAT   **(10 Marks)**

Module-4

7 a. Explain RISC design philosophy. **(08 Marks)**
   b. Explain the instruction set for embedded systems. **(06 Marks)**
   c. Explain the embedded system hardware. **(06 Marks)**

OR

8 a. Explain the data flow model of a typical ARM core. **(08 Marks)**
   b. Explain the registers in a ARM microcontroller. **(08 Marks)**
   c. What is CPSR? Explain. **(04 Marks)**

Module-5

9 a. Explain the role of barrel shifter in ARM processors. **(06 Marks)**
   b. Explain the following instructions:
      (i) RSC   (ii) SBC   (iii) EOR   (iv) AND   **(08 Marks)**
   c. Explain the MLA and SMLAL instructions with example. **(06 Marks)**

OR

10 a. Write a program to copy a block of memory to another area in the memory. **(10 Marks)**
   b. Explain the following instruction with syntax:
      (i) STMED   (ii) SWP   (iii) SWI   (iv) CMP   **(10 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐   **17CS46**

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Data Communication

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain Different Forms of Data Representation.   (06 Marks)
   b. What is a Network? Explain briefly three important criteria that a network must meet.
                                                                               (06 Marks)
   c. Describe in detail TCP/IP protocol suite.   (08 Marks)

OR

2 a. Distinguish Simplex , Half Duplex and Full Duplex form of communication. (06 Marks)
   b. What is Line coding? Discuss about NRZ – I and Manchester encoding with example.
                                                                               (06 Marks)
   c. Elucidate on Transmission Impairment.   (08 Marks)

Module-2

3 a. What is TDM? Write about inter leaving process in TDM with a schematic. (06 Marks)
   b. Give a brief account on Datagram Network.   (06 Marks)
   c. Discuss about Quantization , Quantization levels and Quantization error. Suppose a telephone subscriber line must have an SNR_{DB} above 40. What is the minimum number of bits per sample?   (08 Marks)

OR

4 a. What is Spread Spectrum? Explain FHSS Frequency Selection mapping.   (06 Marks)
   b. What is Circuit Switched Network? Mention three phases of circuit switched network. Discuss about Delay and Efficiency in Circuit Switched Networks.   (06 Marks)
   c. Discuss about Multiplexing and Demultiplexing process in FDM. Five channels each with a 100KHz Bandwidth are to be multiplexed. What is the minimum bandwidth of the link if there is a need for a guard band of 10KHz between the channels to prevent interference?
                                                                               (08 Marks)

Module-3

5 a. What is Framing? Explain Bit Oriented Protocols.   (06 Marks)
   b. What is Forward Error Correction? How Forward error correction is done using Hamming Distance.   (06 Marks)
   c. With a outline sketch, describe about stop and wait protocol. Also give the FSM for sending and receiving node.   (08 Marks)

OR

6 a. Explain different fields of PPP frame.   (06 Marks)
   b. What is Checksum? Enumerate the procedures to calculate the traditional checksum.
                                                                               (06 Marks)
   c. What is CRC? How CRC is computed? Compute CRC bits of Data in 1001101 and generator is 1011.   (08 Marks)

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Module-4

7   a. What is Channelization? Mention different channelization techniques. Explain FDMA.
    (06 Marks)
    b. Describe about different implementations of standard Ethernet.   **(06 Marks)**
    c. Give architectural comparison of wired and wireless LANs. Discuss about characteristics of wireless LANs that does not apply to wired LANs.   **(08 Marks)**

OR

8   a. Explain CSMA/CD with a flow diagram.   **(06 Marks)**
    b. Explain how hidden station problem of wireless networks is resolved using CSMA/CA? What is the purpose of NAV in CSMA/CA.   **(06 Marks)**
    c. What are the advantages of dividing an Ethernet LAN with a Bridge? What is the relationship between a switch and a bridge?   **(08 Marks)**

Module-5

9   a. What is Cellular Telephony? Explain Frequency reuse principle in Cellular Telephony.
    (06 Marks)
    b. Mention three types of IPV6 addresses. Also briefly explain about special addresses.
    (06 Marks)
    c. Give an elaborate account on GSM Architectures, Features and Working.   **(08 Marks)**

OR

10 a. Briefly explain different fields of IP Datagram. In an IPV4 packet the value of HLEN is $(1000)_2$. How many bytes of options are being carried by this packet?   **(06 Marks)**
    b. Describe about different transition strategies from IPV4 to IPV6.   **(06 Marks)**
    c. Mention different types Satellites. Explain the working of GPS.   **(08 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   **15CS32**

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Analog and Digital Electronics

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the construction and working of JEFT.   (10 Marks)
   b. Explain the opamp window comparator circuit.   (06 Marks)

OR

2 a. Explain the working of opamp Schmitt trigger.   (08 Marks)
   b. Explain 555 timer based Astable Multivibrator.   (08 Marks)

Module-2

3 a. Define hazard. Explain static1 and static 0 hazard.   (06 Marks)
   b. Simplify the Boolean function using Quine-McClusky method:
     $Y = F(A, B, C, D) = \Sigma m(2, 3, 7, 9, 11, 13) + d(1, 10, 15)$ (10 Marks)

OR

4 a. Write the verilog code for the logic circuit given in Fig.Q4(a) using structural and behavioral models.

Fig.Q4(a)   (08 Marks)

   b. For the expression given below, use entered variable map technique and simplify the expression. Also draw the logic circuit using basic gates
     $f(A, B, C, D) = Y = \Sigma m (1, 5, 10, 11, 12, 13)$ (08 Marks)

Module-3

5 a. Define a multiplexer. Analyze a 32:1 multiplexer using 4:1 multiplexers. Give detailed design and connections for the logic circuit. Use one 2:1 MUX.   (10 Marks)
   b. Explain the odd parity checker and generator circuit.   (06 Marks)

OR

6 a. Implement 7-segment decoder using PLA.   (06 Marks)
   b. Explain n-bit Magnitude Comparator.   (06 Marks)
   c. Write verilog code to implement a 4:1 Multiplxer.   (04 Marks)

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Module-4

7 a. Explain with timing diagram, working of JK Master Slave flip flop. Also give the state transition diagram. **(06 Marks)**

   b. Draw the logic diagram for a 4 bit serial-in-serial-out shift register using edge triggered J-K flip flop and explain the circuit with waveform and the truth table. **(10 Marks)**

OR

8 a. Mention two differences between asynchronous and synchronous counter. With a neat block diagram, timing diagram and truth table, explain a 3 bit binary ripple down counter using negative-edge triggered JK flip flop. **(10 Marks)**

   b. Explain how a modulus 10 counter can be converted to modulus 8 counter using 7490 IC. **(06 Marks)**

Module-5

9 a. Write the verilog code to implement mod-8 up down counter. **(06 Marks)**

   b. Explain the dual slope ADC circuit. **(10 Marks)**

OR

10 a. Explain binary ladder network type DAC. **(08 Marks)**

   b. Explain the block diagram of digital clock constructed using counter cascading. **(08 Marks)**

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Third Semester B.E. Degree Examination, Jan./Feb. 2021
Data Structures and Applications

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the functions supported by C to carryout dynamic masonry allocation with example. **(06 Marks)**

   b. Summarize the advantages and disadvantages of using record oriented fixed length for storing strings. **(04 Marks)**

   c. Write a C program with structure definition and variable declaration to read and display information about 5 items using nested structures. Consider the following fields like, Itemcode, Itemname, Itemprice, Item expiring date (dd mm yy) **(06 Marks)**

OR

2 a. What is the degree of polynomial? With a C function to add 2(two) polynomials. **(08 Marks)**

   b. With a neat diagram, explain the linked representation of sparse matrix for Fig Q2(a)

$$\begin{bmatrix} 15 & 0 & 2 & 0 \\ 0 & 21 & 0 & 13 \\ 32 & 0 & 0 & 45 \\ 0 & 0 & 51 & 0 \end{bmatrix}_{4\times4}$$

   Fig Q2(b) sparse matrix **(05 Marks)**

   c. Differentiate structure and version. **(03 Marks)**

Module-2

3 a. Write a C program to implement stack operation. **(08 Marks)**

   b. Convert the following infix expression to postfix form using stack
   $(A + B \uparrow D)/(E - F) + G$. **(04 Marks)**

   c. Define Ackermann function and find the value of A(1, 3). **(04 Marks)**

OR

4 a. Write a C program to implement Oracular queue operations. **(08 Marks)**

   b. Evaluate the following postfix expression 3, 5, +, 6, 4 −, *, 4, 1, −,2, ↑, +. **(04 Marks)**

   c. Write a C program to implement Tower of Hanoi using recursion. **(04 Marks)**

Module-3

5 a. Write C functions to perform the following operations on singly linked list
   i) Insert a node at the beginning of list
   ii) Delete a node at the end of list **(10 Marks)**

   b. Define the following terms with example
   i) Doubly linked list
   ii) Circular singly linked list
   iii) Header linked list. **(06 Marks)**

OR

6 a. Write a C program to insert newnode at a specified position in a doubly linked list. **(08 Marks)**

   b. Write a C program to implement Queue operations using singly linked list. **(08 Marks)**

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Module-4

7 a. Draw the Binary Search Tree (BST) for the following data and transverse the tree in
      i) Inorder   ii) preorder   iii) postorder.
      14, 15, 4, 9, 7, 18, 3, 5, 16, 4, 20, 17, 9, 14, 5   **(05 Marks)**

   b. Draw the binary tree to represent the following expression
      A + (B – C) * (E – F)/G.   **(04 Marks)**

   c. Explain the following with example
        i)   Complete Binary tree
        ii) Height of the tree
        iii) Skewed binary tree
        iv) Binary tree.   **(07 Marks)**

OR

8 a. Construct the Binary Search Tree using inorder and preorder sequence :
      Inorder   : Q B K C F A G P E D H R
      Preorder : G B Q A C K F P D E R H
                                                                                   (06 Marks)

   b. Write a C function to construct the BST.   **(07 Marks)**

   c. What is the advantage of threaded binary tree over binary tree?   **(03 Marks)**

Module-5

9 a. For the given graphs, show Fig Q9(a) the adjacency matrix and linked representation of the
      graph.

Fig Q9(a)   **(06 Marks)**

   b. Explain hashing with an example. How do you resolve collision?   **(06 Marks)**

   c. How does an append mode in a file opening differ from the write mode?   **(04 Marks)**

OR

10 a. Draw the graph G, for information stored in memory as shown below :

NODE	A	B		E		D	C		Start = 1
NEXT	7	4	0	6	8	0	2	3	Avail = 5
ADJ	1	2		5		7	9		
	1	2	3	4	5	6	7	8	

Dest	2	6	4		6	7	4		4	6	
Link	10	3	6	0	0	0	0	4	0	0	Avail = 8
	1	2	3	4	5	6	7	8	9	10	

                                                                                   (06 Marks)

   b. Sort the following list of numbers using Radix sort
      366, 3481, 1432, 3618, 4235, 5380, 1289, 3211, 5437   **(05 Marks)**

   c. Summarize the features of relative file organization.   **(05 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐   **15CS34**

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Computer Organization

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain with a neat diagram, the different functional units of a digital computer. **(08 Marks)**
   b. Explain the basic operational concepts between the processor and memory, with a neat diagram. **(08 Marks)**

OR

2 a. Explain the following : i) Byte addressability   ii) Big – endian assignment
      iii) Little – endian assignment   iv) Word alignment of a machine. **(08 Marks)**
   b. Registers R_1 and R_2 of a computer contain the decimal value 1200 and 4600, what is the effective address of the source operand in each of the following instruction :
      [R_1, R_2 and R_5 are registers]
      Load $20(R_1)$, R_5
      Move # 3000, R_5
      Store R_5, $30(R_1, R_2)$
      Add   - (R_2), R_5. **(08 Marks)**

Module-2

3 a. What is Interrupt? With example, explain the concept of interrupts. **(08 Marks)**
   b. What are the different methods of DMA transfer? Explain any one. **(08 Marks)**

OR

4 a. Why is bus arbitration required? Explain with block diagram, bus arbitration using Daisy – Chain. **(08 Marks)**
   b. Explain Serial port and a Serial interface. **(08 Marks)**

Module-3

5 a. Define and explain the following :   i)   Memory access time   ii) Memory cycle time
      iii)   Random Access Memory (RAM)   iv) Read Only Memory (ROM). **(08 Marks)**
   b. Discuss the Internal organization of a 2M × 8 asynchronous DRAM chip. **(08 Marks)**

OR

6 a. Draw a neat block diagram of memory hierarchy in a contemporary computer system. Also indicate relative variation of size, speed and cost per bit, in the hierarchy. **(08 Marks)**
   b. Explain Associative mapping technique and Set Associative mapping technique, with a neat diagram. **(08 Marks)**

Module-4

7 a. Design a 4 – bit binary adder / subtractor and explain its functions. **(08 Marks)**
   b. Explain with diagram, Look – ahead Carry generator. **(08 Marks)**

OR

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8 a. Perform Multiplication for (-13) and (+09) using Booth's Algorithm. (08 Marks)
   b. Perform Multiplication of (+13) and (-6) using Bit Pair recoding method. (08 Marks)

Module-5

9 a. With a diagram, explain typical single bus processor data path. (08 Marks)
   b. Write the control sequence for an unconditional branch instruction. (08 Marks)

OR

10 a. Explain the 3 – bus organization of the data path with a neat diagram and write the control sequence for the instruction ADD R_4, R_5, R_6 for the 3 – bus organization. (08 Marks)
   b. Draw and explain typical hard wired control unit. (08 Marks)

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   **15CS35**

Third Semester B.E. Degree Examination, Jan./Feb.2021
Unix and Shell Programming

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Discuss the salient features of UNIX operating system.   **(08 Marks)**
   b. Explain the following commands, with suitable examples:
       (i)   apropros
       (ii)   whatis.   **(04 Marks)**
   c. Write a note on MAN command.   **(04 Marks)**

OR

2 a. With a neat diagram, explain the architecture of UNIX operating system.   **(08 Marks)**
   b. Differentiate between external and internal commands in UNIX with suitable example.
                                                                                 (04 Marks)
   c. Explain the following commands with syntax and example:
       (i) stty   (ii) Echo   (iii) date   (iv) uname   **(04 Marks)**

Module-2

3 a. Which command is used for listing file attributes? Explain significance of each field in
       output obtained with above command.   **(08 Marks)**
   b. Files current permissions are rw_ _w_ _ r_ _ . Write chmod expressions required to change
       them for the following:
       (i)   r_ _ r _ _ _ _ x
       (ii)   rw × rw × _ _ x
       (iii)   r _ xr _ xr_x
       (iv)   rw × rwxr _ _
       Using both relative and absolute methods of assigning permissions.   **(08 Marks)**

OR

4 a. Illustrate with a diagram typical unix file system and explain different types of file supported
       in UNIX.   **(08 Marks)**
   b. Explain absolute and relative path names with suitable examples.   **(04 Marks)**
   c. Explain following commands with examples:
       (i) mkdir   (ii) HOME   (iii) rmdir   (iv) cd   **(04 Marks)**

Module-3

5 a. Explain 3 standard files supported by UNIX. Also give details about special files used for
       output redirection in UNIX.   **(08 Marks)**
   b. Explain Shell's interpretive life cycle.   **(04 Marks)**
   c. Explain three modes of Vi and explain how you can switch from one mode to another.
                                                                                 (04 Marks)

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OR

6 a. Write UNIX commands for the following:
   (i)   Find and replace all the occurrances of unix with UNIX in the textfile after confirming the user (vi editor command)
   (ii)   List all the files in PDW which all having exactly five characters in their filename, any number of characters in their extensions.
   (iii) To copy all files stored in /home/vtu with ·c, ·cpp and ·java extensions to progs directory in current directory.
   (iv)   To delete all filenames containing * in their filenames.
   (v)   To delete all files with three character extensions except ·out from current directory.
   (vi)   To display (List) contents of current directory and its subdirectories.
   (vii) Searching for a pattern in backward direction.
   (viii) Writing the first 50 lines to another files.   **(08 Marks)**
   b. With suitable examples explain grep command and its options.   **(04 Marks)**
   c. Briefly explain the extended regular expressions with an example.   **(04 Marks)**

Module-4

7 a. What is shell programming? Write a shell program to create a menu and execute a given options based on user's choice. Options include
   (i) List of users   (ii) List of processes   (iii) Content of files
   (iv) Quit to UNIX   (v) Current date   **(10 Marks)**
   b. Explain with an example set and shift commands in UNIX to manipulate positional parameter with example.   **(06 Marks)**

OR

8 a. Explain the following statements with syntax and example:
   (i) if   (ii) for   (iii) while   (iv) case.   **(10 Marks)**
   b. Explain use of test and [ ] to evaluate expression in shell.   **(06 Marks)**

Module-5

9 a. Write a perl program that prompt user to input string and a number and print string those many times on different lines to standard output.   **(08 Marks)**
   b. Explain with example the string handling function supported by perl.   **(08 Marks)**

OR

10 a. Explain lists, Arrays and Associative arrays with respect to perl.   **(08 Marks)**
   b. Write a perl script to convert decimal number to binary numbers.   **(08 Marks)**

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15CS36

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Discrete Mathematical Structures

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define the following terms with an example : i) Conjunction   ii) Tautology
      iii) Quantifiers   iv) Proposition   v) Conditional or Implication
      vi) Dual of statement.   **(06 Marks)**

   b. Prove the validity of the following arguments :

   i) $p \to r$
       $\neg p \to q$
       $q \to s$
       $\overline{\therefore \ \neg r \to s}$

   ii) $(\neg p \vee \neg q) \to (r \wedge s)$
       $r \to t$
       $\neg t$
       $\overline{\therefore \ \ p}$
                                                                                     (06 Marks)

   c. Find the negation of each of the following quantified statements :
      i) $\forall x , \forall y \ [(x > y) \to ((x - y) > 0)]$
      ii) $\forall x , \exists y \ [(p(x, y) \wedge q(x, y)) \to r(x, y)]$.   **(04 Marks)**

OR

2 a. Prove that the following compound propositions are tautologies :
      i) $[p \wedge (p \to q)] \to q$ ii) $\{ p \to (q \to r)\} \to \{(p \to q) \to (p \to r)\}$.   **(05 Marks)**

   b. Prove the following by using laws of logic :
      i) $[(p \to q) \wedge (\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg (q \vee p)$
      ii) $[p \vee q \vee (\neg p \wedge \neg q \wedge r)] \Leftrightarrow (p \vee q \vee r)$.   **(05 Marks)**

   c. Show that "If n is an odd integer then n + 11 is an even integer" by i) Direct proof
      ii) An indirect proof   iii) Proof by contradiction.   **(06 Marks)**

Module-2

3 a. Prove the following by Mathematical Induction :

   $$1^3 + 2^3 + 3^3 + \ldots + n^3 = \left[\frac{n(n+1)}{2}\right]^2.$$ **(05 Marks)**

   b. i) How many arrangements are possible for all the letters in the word SOCIOLOGICAL?
      ii) In how many of these arrangements A & G are adjacent?
      iii) In how many of these arrangements all the vowels are adjacent?   **(06 Marks)**

   c. A sequence $\{a_n\}$ is defined recursively by $a_1 = 4$, $a_n = a_{n-1} + n$ for $n \geq 2$. Find a_n in explicit
      form.   **(05 Marks)**

OR

4 a. If Fi's are the Fibonacci numbers and Li's are the Lucas numbers, prove that
      $L_{n+4} - L_n = 5 F_{n+2}$ for all integers $n \geq 0$.   **(06 Marks)**

   b. A certain college question paper contains 3 parts A, B and C with 4 questions in part A, 5
      questions in part B & 6 questions in part C. It is required to answer 7 questions by selecting
      atleast 2 questions from each part. In how many different ways can a student solve the
      question paper?   **(06 Marks)**

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c. Find the coefficient of :
   i) $x^2 y^2 z^3$ in the expansion of $(x + y + z)^7$.
   ii) $v^2 w^3 x^2 y^5 z^4$ in the expansion of $(v + w + x + y + z)^{16}$. **(04 Marks)**

Module-3

5 a. Let A = {a, b, c, d} and B = {2, 4, 5, 7}. Determine the following :
   i) $1 A \times B 1$.
   ii) Number of relations from A to B.
   iii) Number of relations from A to B that contain (a, 4) and (c, 7).
   iv) Number of relations from A to B that contain exactly six ordered pairs.
   v)   Number of binary relations on A that contain atleast Fourteen ordered pairs. **(06 Marks)**

   b. Let f, g, h be functions from z to z, define by $f(x) = x^2$, $g(x) = x + 5$ and $h(x) = \sqrt{x^2 + 2}$.
      Determine $(h \circ (g \circ f))(x)$ and $((h \circ g) \circ f)(x)$. Verify that $h \circ (g \circ f) = (h \circ g) \circ f$. **(05 Marks)**

   c. Let A = {1, 2, 3, 4} and
      R = {(1, 1) , (1, 2) , (2, 1) , (2, 2) , (3, 1) , (3, 3) , (1, 3) , (4, 1) , (1, 4) , (4, 4)}. Is R is an
      equivalence relation? Find the corresponding partition on A. **(05 Marks)**

OR

6 a. Prove that if f : A → B, g : B → C are invertible functions, the g ∘ f : A → C is invertible
      and $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$. **(05 Marks)**
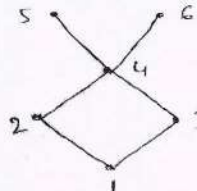
   b. Let A = {1, 2, 3, 4} and R = {(1, 1) ,(1, 2) , (2, 3), (3, 4)} , S = {(3, 1), (4, 4), (2, 4), (1, 4)}
      be relations on A. Determine the relations R ∘ S , S ∘ R, R^2 and S^2. Write down their
      matrices. **(05 Marks)**

   c. Consider the Hasse diagram of a POSET (A, R) given in Fig. Q6(c).
      i)   Determine the relation matrix R   ii) Construct the digraph for R
      iii) Write maximal , minimal , greatest and least elements. **(06 Marks)**

   Fig. Q6(c)

Module-4

7 a. How many integers between 1 and 300 (inclusive) are i) divisible by atleast one of 5, 6, 8?
      ii) divisible by none of 5, 6, 8? **(05 Marks)**

   b. Determine in how many ways can the letters in the work ARRANGEMENT be arranged so
      that there are exactly two pairs of consecutive identical letters. **(06 Marks)**

   c. Find the Rook polynomial for 3 × 3 board by using the expansion formula. **(05 Marks)**

OR

8 a. A person invests Rs 100,000 at 12% interest compounded annually : i) Find the amount at
      the end of 1st , 2nd , 3rd year   ii) Write the general explicit formula   iii) How long will it
      take to double the investment. **(06 Marks)**

   b. Solve the recurrence relation $a_{n+2} - 8a_{n+1} + 16a_n = 8(5^n) + 6(4^n)$, where $n \geq 0$ and $a_0 = 12$,
      $a_1 = 5$. **(05 Marks)**

   c. An apple , a banana , a mango and an orange are to be distributed to four boys B_1, B_2, B_3 and
      B_4. The Boys B_1 and B_2 do not wish to have apple, B_3 does not want banana or mango and
      B_4 refuses orange. In how many ways the distribution can be made so that no boy is
      displeased? **(05 Marks)**

2 of 3

Module-5

9   a.   Define the following : i) Complete Graph   ii) Bipartite Graph   iii) Isolated Vertex
         iv) Regular Graph   v) Subgraph. **(05 Marks)**
    b.   Let $G = (V, E)$ be simple graph of order $|V| = n$ and size $|E| = m$. If G is a bipartite graph,
         prove that $4m \leq n^2$. **(05 Marks)**
    c.   Construct an optimal prefix code for the symbols a , o, p, u, y, z that occur with frequencies
         20, 28, 4, 17, 12, 7 respectively. **(06 Marks)**

OR

10 a.   Prove the following :
         i)   A path with n vertices is of length n-1.
         ii)   If a cycle has n vertices, it has n edges.
         iii) The degree of every vertex in a cycle is two. **(06 Marks)**
    b.   Define Isomorphism. Verify the two graphs are Isomorphic. (Refer Fig. 10(b(i),(ii))
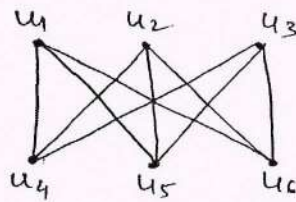

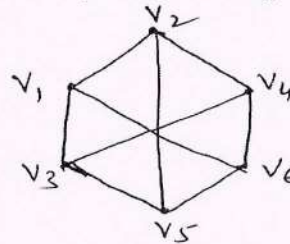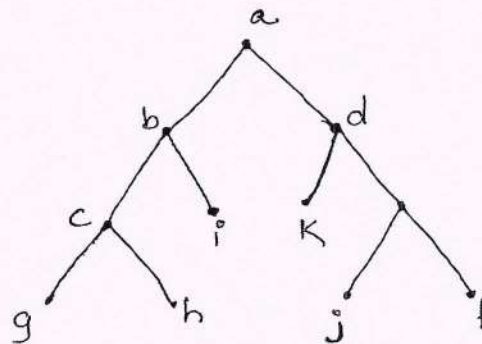Fig. Q10(b (i))   Fig. Q10(b (ii))

(04 Marks)

    c.   List the vertices in the tree given in Fig. Q10(c), when they are visited in :
         i) Preorder   ii) Postorder   iii) Inorder Traversal. **(06 Marks)**

Fig. Q10(c)

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Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Software Engineering

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define software engineering. Explain the different types of software product. **(06 Marks)**
   b. Explain the waterfall software process model. **(06 Marks)**
   c. With a neat diagram, explain the types of non-functional requirement. **(04 Marks)**

OR

2 a. Explain the essential attributes of good software. **(06 Marks)**
   b. Explain software controlled Insulin pump with neat diagram. **(06 Marks)**
   c. Explain the requirements elicitation and analysis process. **(04 Marks)**

Module-2

3 a. Explain the context model of Mental Health Care Patient Management System (MHC-PMS). **(06 Marks)**
   b. With neat diagram, explain phases of Rational Unified Process (RUP) and also list best practices of RUP. **(06 Marks)**
   c. Explain the different levels of reuse in implementation issues. **(04 Marks)**

OR

4 a. Explain the classes and associations in structural models with reference to MHC-PMS. **(06 Marks)**
   b. Define pattern. Explain the four essential elements of design pattern. **(06 Marks)**
   c. Explain open source licensing models. **(04 Marks)**

Module-3

5 a. Explain two distinct goals of software testing and also explain a model of software testing process. **(08 Marks)**
   b. Discuss the Lehman's laws for program evolution dynamics. **(08 Marks)**

OR

6 a. Explain various types of interface errors and also discuss three classes of interface errors. **(08 Marks)**
   b. Explain three different types of software maintenance. Why it is more expensive to add functionality after a system is in operation than its development? **(08 Marks)**

Module-4

7 a. Define Milestones and Deliverables. Explain the project scheduling process with neat diagram. **(08 Marks)**
   b. With a neat diagram, explain the review process in software quality management. **(08 Marks)**

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OR

8 a. Explain factors affecting software pricing. List the different types of project plan supplements. **(08 Marks)**

   b. With a neat diagram, explain ISO 9001 core process for quality management. **(08 Marks)**

Module-5

9 a. With a neat diagram explain the system evolution. **(08 Marks)**

   b. Discuss various principles used in Agile method and also explain why it is difficult to realize Agile method principles. **(08 Marks)**

OR

10 a. Define SCRUM and also explain its principles along with its advantages and disadvantages. **(08 Marks)**

   b. With a neat diagram, explain plan-driven and agile approaches to system specification. **(08 Marks)**

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15CS43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Design and Analysis of Algorithms

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Explain the worst case, best case and average case efficiencies of an algorithm, with an example each case. **(08 Marks)**

  b. Explain the method of comparing the order of growth of two functions using limits, compute the order of growth of: **(i)** $\log_2 n$ and $\sqrt{n}$ **(ii)** 2^n and $n!$ **(08 Marks)**

OR

2   a. Define Big Oh notation. Prove that if $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$ **(08 Marks)**

  b. Explain the general plan for analyzing the efficiency of a recursive algorithm by considering Tower of Honoi problem as an example. **(08 Marks)**

Module-2

3   a. Explain the concept of divide and conquer. Design and algorithm for merge sort. **(08 Marks)**

  b. Apply Stressen's matrix multiplication algorithm to compute product of following two matrices: $\begin{bmatrix} 4 & 5 \\ 5 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 3 \\ 4 & 5 \end{bmatrix}$ **(08 Marks)**

OR

4   a. Discuss how Quick sort works to sort an array. Trace Quick sort algorithm for the following data set: 2, −4, 1, 0, 3, 5, −7. Also derive the worst case time complexity of Quick sort. **(08 Marks)**

  b. Design and analyse an algorithm for findings the maximum and minimum of an elements using Divide and Conquer Approach. **(08 Marks)**

Module-3

5   a. Write the algorithm to find optimal solution for job sequencing problem with deadline. Apply the same algorithm for the following dataset and find an optimal solution.
  $n = 4$, Profit $(p_1, p_2, p_3, p_4) = (100, 10, 15, 27)$,
  Deadlines: $(d_1, d_2, d_3, d_4) = (2, 1, 2, 1)$ **(08 Marks)**

  b. Write a Kruskal's algorithm to find minimum cost spanning tree and obtain minimum spanning tree for the graph shown in Fig.Q5(b).
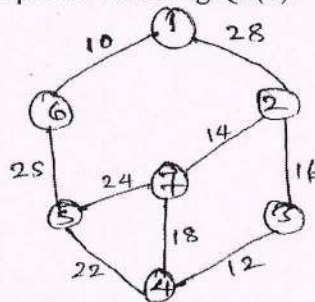

Fig.Q5(b) **(08 Marks)**

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OR

6 a. What is an Heap? Write an algorithm to sort the elements using Heap Sort. **(08 Marks)**
   b. Obtain the shortest distance cost and paths from node 5 to other nodes from the graph shown in Fig.Q6(b).
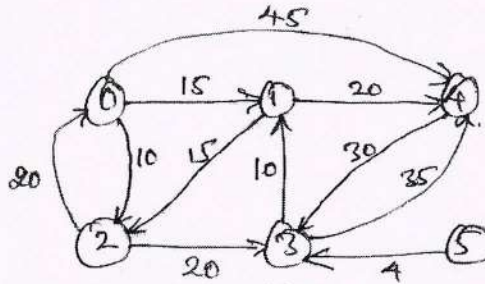

Fig.Q6(b)   **(08 Marks)**

Module-4

7 a. Write Warshall's algorithm and find the transitive closure of the matrix given below:

$$R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$ **(08 Marks)**

   b. Explain multistage graphs with example. Write multistage graph algorithm using forward approach.   **(08 Marks)**

OR

8 a. Using dynamic programming, solve the following knapsack instance:
       $n = 4$, $[w_1, w_2, w_3, w_4] = [2, 1, 3, 2]$,
       $[p_1, p_2, p_3, p_4] = [12, 10, 20, 15]$ and $M = 5$ **(08 Marks)**
   b. Solve the following traveling sales person problem using dynamic programming.

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$ starting city 1.   **(08 Marks)**

Module-5

9 a. Discuss the general backtracking algorithm. Draw the state space tree for 4 – Queen's problem.   **(08 Marks)**
   b. Solve the following instance of Knapsack problem using Branch and Bound Approach,
       $n = 4$, $[w_1, w_2, w_3, w_4] = [4, 7, 5, 3]$, $[v_1, v_2, v_3, v_4] = [40, 42, 25, 12]$
       The knapsack's capacity w is 10.   **(08 Marks)**

OR

10 a. Define P, NP, NP – complete and NP – Hard classes.   **(08 Marks)**
   b. Solve the following instances of assignment problem using Branch and Bound.

	Job 1	Job 2	Job 3	Job 4	
	9	2	7	8	person a
C =	6	4	3	7	person b
	5	8	1	8	person c
	7	6	9	4	person d

(08 Marks)

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15CS44

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Microprocessors and Microcontrollers

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain architecture of 8086, with neat diagram. **(08 Marks)**

   b. Explain following Assembler directives with example:
   ORG, EQU, DUP, DD, SEGMENT & ENDS **(05 Marks)**

   c. Assume that SP = FF2EH, AX = 3291H, BX = F43CH, CX = 09. Show the contents of stack and SP after execution of the following instructions:
   PUSH AX
   PUSH BX
   PUSH CX **(03 Marks)**

OR

2 a. Identify the addressing modes in the following instructions:
   i)   MOV [SI], AL
   ii) MOV Arr [SI], AX
   iii) MOV [BX + 6], AX
   iv) MOV [BP] [SI] + 10, BX
   v)   MOV [3600], AX **(05 Marks)**

   b. Explain IBM PC memory map, with neat diagram. **(05 Marks)**

   c. Explain the process of executing assembling ALP with steps and neat diagram. **(06 Marks)**

Module-2

3 a. Write an assembly code to multiply 2378H with 2F79H and store the result in RES. **(04 Marks)**

   b. Write an assembly program to convert packed BCD to ASCII value. **(06 Marks)**

   c. Explain rotate instructions with example. **(06 Marks)**

OR

4 a. Write a program to read a string from keyboard and convert it to upper case. **(06 Marks)**

   b. Explain difference between INT and CALL instructions. **(04 Marks)**

   c. Write a program to i) Clear screen   ii) Set cursor at row-20 column 50   iii) Display message "Microprocessor and Microcontroller". **(06 Marks)**

Module-3

5 a. Explain the following instructions with example:
   i) SCASB   ii) CMPSB   iii) CBW   iv) IMUL   v) XLAT **(08 Marks)**

   b. Assume that we have 4 bytes of hexadecimal data: 25H, 62H, 3FH and 52H.
   i)   Find the check sum byte
   ii) Perform the checksum operation to ensure data integrity
   iii) If the second byte 62H had been changed to 22H. Show how checksum detects the error. **(08 Marks)**

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OR

6 a. Explain control word format of 8255 with neat diagram.   (06 Marks)
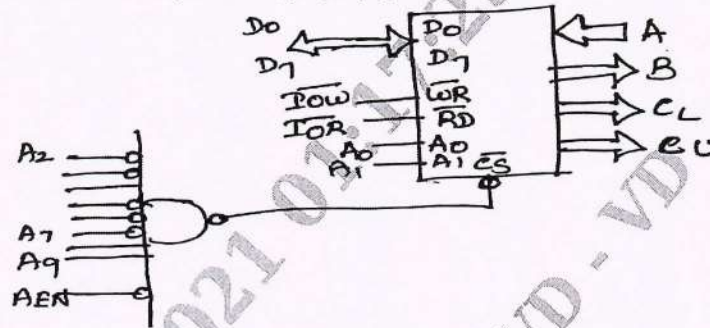   b. 8255 is configured as follows: (Refer Fig.Q.6(b))

Fig.Q.6(b)

i)   Find control word for port A as input, B as output all bits of port C as output.
ii)   Find the port addresses assigned to A, B, C and control byte for this configuration.
iii) Program the ports to input data from port A and send it to both ports B and C.
                                                                              (10 Marks)

Module-4

7 a. Differentiate between Microcontroller and Microprocessor.   (04 Marks)
   b. Explain ARM core data flow model with neat diagram.   (06 Marks)
   c. Explain interrupt handling in ARM processor.   (04 Marks)

OR

8 a. Explain ARM processors execution modes along with complete register set. (08 Marks)
   b. Explain pipelining mechanism of ARM architecture.   (04 Marks)
   c. Explain RISC design principle.   (04 Marks)

Module-5

9 a. Explain the use of barrel shifter in ARM processor with diagram.   (06 Marks)
   b. Explain the following instruction with suitable example:
       i) BIC   ii) QADD   iii) BLX   iv) SMULL   v) SWI   (10 Marks)

OR

10 a. Write an ALP to copy a block of data (BLOCK1) to another block (BLOCK2) using ARM instruction.   (08 Marks)
   b. What are the salient features of ARM instruction set?   (05 Marks)
   c. If $r_5 = 5$, $r_7 = 8$ and using the following instruction, write values of r_5, r_7 after execution
       MOV r_7, r_5, LSL # 2.   (03 Marks)

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15CS45

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Object Oriented Concepts

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. Explain features of OOPs.   (06 Marks)
    b. Define class and object with syntax of class.   (04 Marks)
    c. Define function overloading? Explain with an example.   (06 Marks)

OR

2   a. Define constructor. Write a program demonstrating the use of constructors and destructor.
                                                                                           (06 Marks)
    b. Describe the nested classes with examples.   (04 Marks)
    c. Write C++ program to find smallest of 3 numbers.   (06 Marks)

Module-2

3   a. List and explain the Java Buzzwords.   (08 Marks)
    b. Discuss Bitwise and relational operators in Java.   (02 Marks)
    c. Write a Java program to find largest of 3 numbers.   (06 Marks)

OR

4   a. Discuss Java's iteration statements for, while and do-while with example.   (06 Marks)
    b. Explain the concept of arrays in Java with examples. Write a Java program that creates and
        initializes a five integer elements array. Find the sum and average of its values. (08 Marks)
    c. Define Bytecode.   (02 Marks)

Module-3

5   a. With examples, give two uses of super.   (08 Marks)
    b. Discuss about nested try statements and how such program may be executed.   (08 Marks)

OR

6   a. Explain Java's built in exceptions.   (08 Marks)
    b. Write general form of interface. How interfaces can be extended and implemented.
                                                                                           (08 Marks)

Module-4

7   a. What is multithreading? Explain with an example the implementation of multithreading in
        java.   (08 Marks)
    b. What is the need of synchronization? Explain with an example how synchronization is
        implemented in java.   (08 Marks)

OR

8   a. Define adapter class. Explain the significance of adapter class with example.   (08 Marks)
    b. Explain inner class with example.   (04 Marks)
    c. Explain the mechanism of Delegation Event model.   (04 Marks)

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Module-5

9 a. What are the two types of applets? Explain the skeleton of an applet with five methods init( ), start( ), stop( ), destroy( ) and paint ( ) methods. **(08 Marks)**

   b. Write syntax of APPLET tag with possible attributes and explain. **(04 Marks)**

   c. Explain parameter passing to applet with an example. **(04 Marks)**

OR

10 a. Define Tree Write steps to create JTree. Also write a program to demonstrate the same. **(08 Marks)**

   b. Explain the components and containers used in swings. **(03 Marks)**

   c. Write steps to create JTable, also write a program to demonstrate the same. **(05 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ 15CS46

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Data Communication

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define Topology. Explain four basic topologies. **(08 Marks)**
   b. What are the factors that determine whether a communication system is a LAN or WAN? **(04 Marks)**
   c. Differentiate between Packet switched network and Circuit switched network. **(04 Marks)**

OR

2 a. With a neat diagram of TCP/IP protocol suite, discuss each layer of the suite. **(08 Marks)**
   b. A line has a signal – to – noise ratio of 1000 and a bandwidth of 4000 KHz. What is the maximum data rate supported by the line? **(04 Marks)**
   c. For the given data : 0 1 1 0 0 1, plot the waveform for NRZ – L , NRZ– I , RZ and Manchester line coding schemes. **(04 Marks)**

Module-2

3 a. Explain the process of Pulse Code Modulation (PCM), with illustrations in each process. **(08 Marks)**
   b. We have sampled a low pass signal with a bandwidth of 200 KHz, using 1024 levels of quantization :
      i) Calculate the bit rate of the digitized signal
      ii) Calculate SNR_{dB} for this signal
      iii) Calculate PCM bandwidth of this signal. **(08 Marks)**

OR

4 a. Discuss the following digital to analog conversion mechanisms :
      i) ASK   ii) FSK   iii) PSK. **(08 Marks)**
   b. Write the taxonomy of switched networks and their presence in the TCP / IP protocol suite layers. And explain circuit switched network and packet switched network with respect to delay. **(08 Marks)**

Module-3

5 a. Given the data {1001} and the divisor {1011}, simulate Cycle Redundancy Code (CRC) using i) Paper – and – Pencil division process   ii) Polynomials. **(06 Marks)**
   b. Suppose the message is {7, 11, 12, 0, 6} each of 4 bit. Calculate the checksum and simulate for error free and error example. **(06 Marks)**
   c. What is the Hamming distance for i) Error detection   ii) Error correction? Explain. **(04 Marks)**

OR

6 a. Using an example, explain Stop – and - Wait protocol with Piggy backing. **(08 Marks)**
   b. Explain HDLC framing types. **(08 Marks)**

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Module-4

7 a. What is Controlled access? Discuss three Controlled access methods. **(06 Marks)**
   b. Explain Ethernet frame format. **(06 Marks)**
   c. Define the following destination addresses :
      i)   4A : 30 : 10 : 21 : 10 : 1A
      ii) 47 : 20 : 1B : 2E : 08 : EE
      iii) FF : FF : FF : FF : FF : FF. **(04 Marks)**

OR

8 a. Compare three Fast Ethernet implementation. **(06 Marks)**
   b. Discuss the hidden and exposed terminal / station problem in IEEE 802.11. **(04 Marks)**
   c. Write a short note on Bluetooth layers. **(06 Marks)**

Module-5

9 a. Compare two services of WiMAX. **(04 Marks)**
   b. Discuss the following operations of cellular telephones :
      i) Frequency reuse principle   ii) Handoff. **(04 Marks)**
   c. Explain IPV4 datagram format. **(08 Marks)**

OR

10 a. Write a short note on Messages of ICMPV4 protocol. **(06 Marks)**
   b. Explain the following ICMPV4 debugging tools :
      i) Ping   ii) Trace route. **(06 Marks)**
   c. Discuss IPV6 extension headers. **(04 Marks)**

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