

**Aliah University**  
 Department of Electrical Engineering  
 Odd (Autumn) Semester Examination, 2023 (Regular/Supplementary)  
 B. Tech. (CSE), 3<sup>rd</sup> Semester

**Sub: Circuit Theory & Networks**

Full Marks: 80

**Code- EENUGOE01**

Duration: 3 hrs

- Instructions:**
1. Mention the question number clearly and write all the parts of a question at one place.
  2. Draw circuit/figure wherever applicable.
  3. Make suitable assumptions wherever necessary, symbols and notations have their usual meanings.

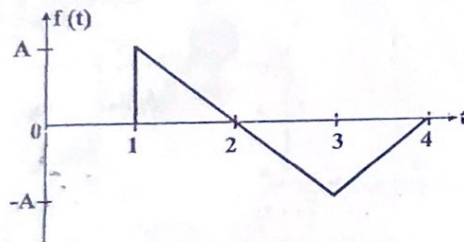
**Section – I (Answer any five: 5 x 2 = 10 Marks)**

- 1 (A) Determine the total charge transferred over the time interval of  $0 \leq t \leq 10$  s when  $i(t) = 0.5t$  A.
- (B) A lightning bolt with 8 kA strikes an object for 15  $\mu$ s. How much charge is deposited on the object?
- (C) Find the power delivered to an element at  $t = 3$  ms if the current entering its positive terminal is  $i = 6 \cos 60\pi t$  and the voltage is  $v = 5i$ .
- (D) A 60 W incandescent bulb operates at 120 V. How many coulombs flow through the bulb in one day?
- (E) A flashlight battery has a rating of 2 Ah (ampere-hour) and a lifetime of 10 hours. How much power can it deliver if its terminal voltage is 3 V?
- (F) An electrical element is said to be linear if it follows the principles of \_\_\_\_\_ and \_\_\_\_\_.

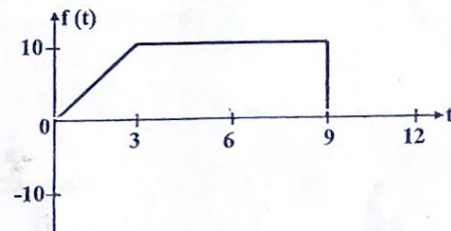
**Section – II (Answer any five: 5 x 6 = 30 Marks)**

- 2 Write the expressions for the following signals using basic signals. Show the construction steps graphically for each signal.

(i)

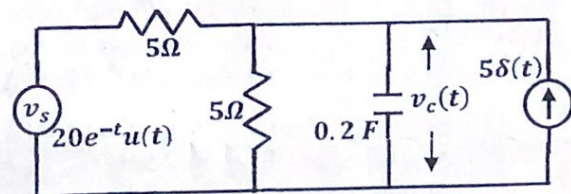


(ii)



- 3 Using Laplace transform method, derive the expression for the capacitor current in an R-C series circuit when it is connected across a DC source. Plot the current variation with respect to time.

- 4 Using Laplace transform method, find voltage across capacitor  $v_c(t)$ , in the figure shown. Assume  $v_c(0^-) = 10$  V.

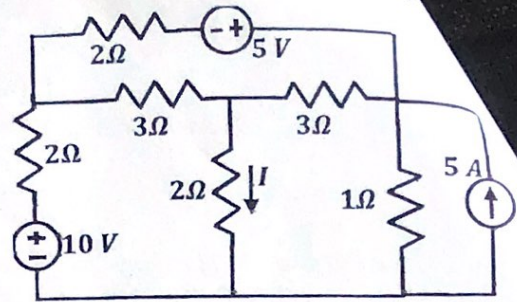


5 Given  $F(s) = \frac{5s}{(s^2 + 3s + 2)}$

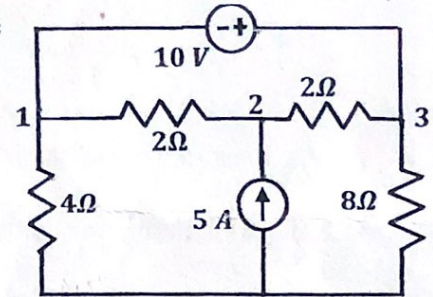
- (a) Use initial and final value theorems to find  $f(0)$  and  $f(\infty)$ , where  $f(t) = \mathcal{L}^{-1}[F(s)]$ .
- (b) Verify your answer in part (a) by finding  $f(t)$  using partial fraction expansion.



6. Find current  $I$  in the given circuit, using mesh current analysis method.

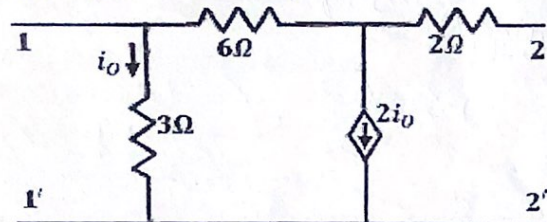


7. Determine three node voltages in the given circuit, using node voltage analysis method.



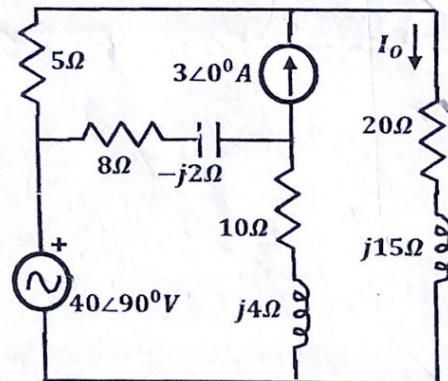
**Section – III (Answer any four:  $4 \times 10 = 40$  Marks)**

8. (A) Determine the Y parameters of the network shown in figure. [7]



- (B) Derive T-parameters in terms of z-parameters for a two-port network. [3]

9. For the circuit shown in figure, find the current  $I_o$ , using Norton's theorem.



10. Draw an oriented graph of your choice with minimum 4 nodes and 5 elements and thereby (a) write the complete incidence matrix for the graph (b) find the number of possible trees for this graph (c) deduce the tie-set matrix (d) deduce the cut-set matrix (e) verify the relation  $[B][V_b] = 0$ .
11. A 3-phase, 4-wire system having a 240 V phase voltage has the following loads connected between the respective lines and neutral:  $Z_R = 15\angle30^\circ$ ,  $Z_Y = 12\angle45^\circ$  and  $Z_B = 10\angle60^\circ$ . Calculate the current in the neutral wire and power dissipated in each load.
12. A balanced 3-phase, 400 V system supplies a star-connected load of  $Z_R = 12\angle40^\circ$ ,  $Z_Y = 10\angle60^\circ$  and  $Z_B = 8\angle15^\circ$ . Assuming the neutral of the supply is earthed, calculate the voltage of the star point (of load) to earth.



**End Semester Regular and Supplementary Examination 2023-24**  
**Digital Logic ( CSEUGPC02 )**  
**B Tech , 2<sup>nd</sup> Year, 3<sup>rd</sup> Sem**

FM: 80

Time : 3.00 Hrs

(Answer 10 marks from Section A, 20 marks from Section B, 50 marks from Section C)  
 Symbols have their usual meaning.

**Section A****1. Answer any five Questions (2x5=10)**

- |                                                     |                                              |
|-----------------------------------------------------|----------------------------------------------|
| i. Draw Venn Diagram of $A+A'B$                     | vi. Represent (-7) in 2's complement form    |
| ii. Implement $f = (A'C' + AB)$ using switches only | vii. Convert $(3140)_{10}$ to BCD number.    |
| iii. Complement the function $f = x'yz' + x'y'z$    | viii. Converts Gray [1010] to Binary number  |
| iv. Implement using NAND Gate, $f = w'x' + x'z'$    | ix. Convert $(01010101)_2$ to Decimal number |
| v. Simplify, $F(A, B, C) = \sum(1, 3, 4, 6)$ .      |                                              |

**Section B****2. Answer any four Questions (5x4=20)**

- |                                                           |                                     |
|-----------------------------------------------------------|-------------------------------------|
| a. Minimize, $A(B+C'(AB+AC'))'$                           | d. Add, (-32) and (-41) in 2's form |
| b. Find the sum of minterms of $F(A, B, C, D) = AB + ACD$ | e. Design a 4:1 Multiplexer circuit |
| c. Add BCD Numbers, $(293 + 786)_{BCD}$                   | f. Design 2:4 Decoder               |
|                                                           | g. Describe a JK flip-Flop          |

**Section C****Answer any five Questions (10x5=50)**

3. Convert  $(118.511)_{10}$  to Octal Number. Perform addition  $(84 + 76)$  in BCD form. (5+5)
4. Prove  $ABC + C'D + ABD = ABC + C'D$ . Reduce the function,  $(A+BC)(A+B') + A'B'$  (5+5)
5. State and prove the D'Morgan Theorem. Design XOR gate using 4 NAND Gates only. (5+5)
6. Obtain sum-of-product (SOP) of  $F(A, B, C, D) = \sum(3, 4, 5, 7, 9, 13, 14, 15)$ . Obtain product of sum (POS) of  $F(A, B, C, D) = \sum(3, 4, 5, 7, 11, 12, 13, 14, 15)$  (5+5)
7. Simplify and find essential prime implicants of  $F(A, B, C, D) = \sum(3, 4, 5, 7, 11, 12, 13, 14, 15)$ . Write down all possible simplified functions. (6+4)
8. Describe Full Adder and Implement it using 4:1 Multiplexer (4+6)
9. Describe Full Subtractor circuit. Design a Full Subtractor using a 3:8 Decoder Circuit (6+4)
10. Draw a state diagram and state table of a 2 bit up-counter that holds state when input  $x=0$ , otherwise counts up in sequence. Design the said counter using DFF. (3+3+4)
11. Compare between Moore and Mealy machine. Describe 4 bit ripple counter (4+6)



# Aliah University

Odd Semester Examination (Autumn Semester) 2023  
(For 2<sup>nd</sup> Year 3<sup>rd</sup> Semester B.Tech in CSE)

Paper Name: Data Structures & Algorithms  
Paper Code: CSEUGPC01

Full Marks: 80  
Time: 3 hours

## Group A

Answer all the questions

(5X2=10)

1. Define recursion.
2. Differentiate full and complete binary tree.
3. What is a sparse matrix?
4. What is a height balanced tree?
5. Differentiate linear and nonlinear data structure with examples.

## Group B

Answer any 5 questions

(5X6=30)

1. Distinguish between a) Stack and Queue b) Array and Linked list (3+3)
2. Explain the application of a stack for representing arithmetic expressions. Convert the following infix expression into postfix expressions using stack.  $(A+B)^C-(D^*E)/F$  (3+3)
3. Differentiate between row major and column major array index notation. How is the index calculated in both? (3+3)
4. Write an algorithm to perform the intersection operation on two singly linked lists.
5. Obtain a binary search tree for the following data set. 45, 56, 78, 23, 11, 54, 88, 43, 55, 21, 67, 55. Do the in-order traversal of the tree. What is the difference between a heap and a binary tree? (3+2+1)
6. Give an algorithm to perform binary search. Using the algorithm, search for 23 in the given set of elements [12 23 27 35 39 42 50]. (4+2)

## Group C

Answer any 4 questions

(4X10=40)

1. What are queues? What is the disadvantage of a linear queue? How can it be removed? Write down algorithms for inserting and deleting elements from a queue implemented using arrays. (1+1+2+6)
2. How can we represent a binary tree in memory? Prove that
  - i) For a non-empty binary tree if  $n_0$  is the number of nodes of degree 0 and  $n_2$  is the number of nodes with degree 2 then  $n_0 = n_2 + 1$
  - ii) The maximum number of nodes in a binary tree of height  $h$  is  $2^h - 1$ . Given the following inorder and preorder traversal reconstruct a binary tree; Inorder – D, G, B, E, A, F, I, C; Preorder – A, B, D, E, H, C, F, I (1+3+(3+3)+2)
3. Define list. What are the types of linked lists? What are the advantages and disadvantages of linked lists? Write algorithms to perform the following operations. a) Insert a new node at the end b) Delete the first node. (1+2+2+2.5+2.5)
4. Write an algorithm for Selection Sort. Discuss the complexity analysis of Selection sort. Illustrate Selection sort algorithm on input [30, 20, 10, 60, 70, 40, 80, 50] (4+3+3)
5. Define Hashing. How does collision happen during hashing? Explain the various collision resolving technique used in hashing functions. The following values are to be stored in a hash table: 25, 42, 96, 101, 102, 162, 197. Describe how the values are hashed by using the division method of hashing with a table size of 7. Use chaining as the method of collision resolution. (1+1+4+4)



**Aliah University**  
**Odd-Semester (Autumn) Examination - 2023**  
**(For 3rd Semester, BTech, CSE)**

Paper Name: Discrete Mathematics

Full Marks: 80

Paper Code: MATUGBS04

Time: 3 Hrs

**Group – A**

(5X2=10)

**1. Answer in short -**

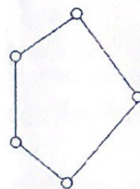
- a) Differentiate between paths and trails with the help of an example.
- b) When a recurrence relation is called linear? Define order of a recurrence relation.
- c) Define To-sets. What do you mean by 'comparable elements' in a hasse-diagram?
- d) Set  $A = \{a, b, c, d\}$ , then  $|P(P(A))| = ?$ , where  $P(A)$  is power set of  $A$ .
- e) Write a short note on normal forms - CNF and DNF in mathematical logic.

**Group – B**

(Answer any 6 questions)

(6X5=30)

- 2. Let  $f: A \rightarrow B$  and  $g: B \rightarrow C$ , such that  $f(a) = a-1$  and  $g(b) = b^2$ , then calculate compositions -  $f \circ g$  and  $g \circ f$ . Is the composition operation commutative?
- 3. Suppose a tree has 'p' vertices of degree 1, 2 vertices of degree 2, 4 vertices of degree 3, and 3 vertices of degree 4. Find the value of 'p'.
- 4. Insert values given below (in the order) and form the Binary Search Tree (BST) - Values are (in order): 28, 42, 18, 17, 23, 13, 85, 36, 19, 81, 55. Perform deletion of 42 and then show final BST.
- 5. Write short notes on – Cut-set and Bridge. Mention important properties.
- 6. Define Boolean Lattice. Is the below given lattice Boolean? Justify your answer.



7. Without using truth table show that –

$$(p \vee q) \wedge (\sim p \vee \sim q) \equiv (p \wedge \sim q) \vee (\sim p \wedge q)$$

8. If there exists functions from set  $A$  to set  $B$ , where  $|A|=m$  and  $|B|=n$  then how many one-to-one and onto functions are possible?

**Group – C**

(Answer any 4 questions)

(10X4=40)

9.

- a) Prove by mathematical induction that –  $f(n) = n^3 - n$  is divisible by 3 for every positive integer.
- b) Solve the recurrence relation:  $a_n = 4a_{n-1} + 4^n$  for  $n \geq 1$  and  $a_0 = 3$  [5+5]

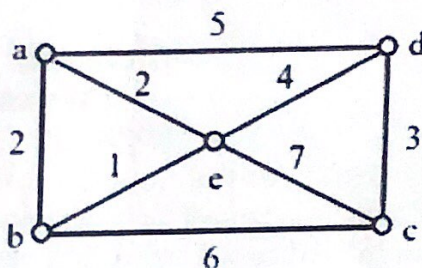


10.

- a) Explain rules of inferences used in mathematical logic. (Modus tollens, modus ponens, hypothetical syllogism and disjunctive syllogism).
- b) Differentiate between universal and existential quantifiers in mathematical logic. Suppose there are predicates - Regular(x): x is a regular graph, Connected(x): x is connected graph. Write a first order logic statement for - "Disconnected graphs are not always regular graph". [5+5]

11.

- a) Find the minimal Spanning Tree in the following graph by using Kruskal Algorithm.



- b) Define Chromatic number. Find the chromatic polynomial and chromatic number for the graph mentioned in Question 11.(a). [4+6]

12.

- a) Prove that - A connected graph has an Euler path but not an Euler circuit iff it has exactly two vertices of odd degree.
- b) Consider the set  $D_{40} = \{1, 2, 4, 5, 8, 10, 20, 40\}$  and the relation divides ( $/$ ) make a Po-set  $P=(D_{40}, /)$ . Draw the Hasse Diagram for P. Is it a lattice? If yes, then find complements of 5 and 8. [5+5]

13.

- a) Of the members of three athletic teams in a school, 21 are in the cricket team, 26 are in the hockey team and 29 are in the football team. Among them, 14 play hockey and cricket, 15 play hockey and football, and 12 play football and cricket. Eight play all the three games. Find the total number of members in the three athletic teams.
- b) Consider a binary relation  $R = \{(x, y), (x, z), (z, x), (z, y)\}$  on Set  $A = \{x, y, z\}$ . Conclude the type of R. Is it Reflexive, Symmetric, Anti-symmetric and transitive or not? [4+6]

END



**Aliah University**  
**Theoretical Examination, 2024**  
**UG section (Science & Engg/Autumn Semester)**  
**Sub: Indian Constitution (UCCUGAU03)**

Full Marks: 80

Time: 3hrs

1. **Write any ten questions:** (within 30 words each) 2x10=20
- ☒ a. Which principles were added to the Constitution of India by the 42<sup>nd</sup> Amendment Act?
  - ☒ b. Discuss Article 17 of the Constitution of India.
  - ☒ c. Discuss Article 21A of the Constitution of India.
  - ☒ d. Explain the term of 'Prohibition'.
  - ☒ e. Write down any two fundamental duties mentioned in our Constitution.
  - ☒ f. What is the composition of the Electoral College that elects the President?
  - ☒ g. What is 'Ordinance'?
  - ☒ h. What do you mean by the impeachment of the President of India?
  - i. Discuss any two functions of the Speaker of the Lok Sabha.
  - j. Mention the qualifications of the members of the Lok Sabha.
  - k. Discuss the composition of the Upper House of the Indian Parliament.
  - ☒ l. Mention two areas where the Rajya Sabha is more powerful than the Lok Sabha.

1. **Write any four questions:** (within 100 words each) 5x4=20
- a. Write a short note on the writs of Habeas Corpus and Quo Warranto.
  - ☒ b. Critically discuss the Right to Freedom of Religion.
  - c. Enumerate the differences between the Fundamental Rights and the Directive Principles of State Policy.
  - d. Describe the election procedure for the President of India.
  - ☒ e. Mention Five Fundamental Duties mentioned in our Constitution.
  - f. Write any five Directive Principles of the State Policy.

2. **Write any four questions:** (Within 350 words each) 10x4= 40
- ☒ a. Discuss the basic features of the Indian Constitution.
  - ☒ b. Discuss articles 14 to 18 of the Indian Constitution.
  - ☒ c. Discuss Article 19 as enumerated in the Constitution of India and point out its reasonable restrictions.
  - d. "The Constitution of India is neither purely federal nor unitary but a combination of both". Do you agree with this view? Give reasons in support of your answer.
  - e. Discuss the powers and functions of the Prime Minister of India.
  - f. Analyse the relationship between the two houses of Parliament.

practice and propagate.  
religious affair  
no tax for religion.



**Answer any EIGHT (08) questions without attempting extra questions.**

1. Define a system of Linear Equations in four variables. Solve:  $11x - 3y + 4z = 7$ ;  $2x + 6y + 3z = 3$ ;  $x - 8y - 12z = 4$  upto 2 iterations. Define Boole's rule, and Weddle's rule for Numerical integration. Find the outcome of "int main(){int x; x = 10; if(x > 10) x -= 10; else if(x >= 0) x += 00; else if(x) x += 10; else x -= 10; printf("%d\n",x); return 0;}". **2+4+2+2=10**

2. Find the positive root of the equation  $x^3 + x^2 + 3x - 7 = 0$ , using the Regula Falsi method and correct to 3 decimal places. What is the purpose of "rb" in the "fopen()" function in c-programming? Find the optimal polynomial  $y=f(x)$  using the given data and compute  $y(1.3)$  and  $y(1.6)$ . **4+2+4=10**

x	2	3	4	5	6
y	1.1	1.2	1.3	1.4	1.5

3. Differentiate the results of Regula-Falsi and Newton-Raphson methods for finding the root of  $x^3 + 4x - 11 = 0$  correct to two decimal places. How to declare a double-pointer in C? Solve the following integrals for  $n=5$  intervals using both Simpson's 1/3 and 3/8 rule, applied on each integral and compare the results: **4+1+5=10**

(i)  $\int_{-1}^1 \frac{1}{(1+\sin(x))} dx$       (ii)  $\int_0^5 \frac{1}{(1+e^{\tan x})} dx$

4. Use Euler's Method to calculate the approximation of  $y(0.3)$  where  $y(x)$  is the solution of the initial-value problem that is as follows.  $y'' + 2xy' + y = 0$ ,  $y(0)=1$ ,  $y'(0)=2$ . Write formulations for Euler's Method and Modified Euler's Method for the solution of an ODE. Use Runge-Kutta method of fourth order to compute  $k_4$  if  $dy/dx = 2x + 3y^2$ ,  $y(0.1)=1.16$ ,  $h=0.1$ . Give the output for "char c[ ] = "GATE2023"; char \*p = c; printf("%s", p + p[3] - p[1]);". **4+2+3=10**

5. How can you differentiate between Gauss Jacobi and Gauss Seidel methods? Construct the Lagrange interpolating polynomials for  $f(x)$ , such that  $x$ : 12, 0, -1, 2, and  $f(x)$ : 3, 1, 5, 6, find  $f(1.6)$ . What are constrained and unconstrained optimizations? Discuss the convergence conditions of the iteration method for finding the roots of a transcendental equation. When does the Gauss elimination method fail? **2+4+2+1+1=10**

6. A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Trapezoidal Rule rule, find the velocity of the rocket at  $t = 80$  seconds, such that  $t(s)$ : 0, 10, 20, 30, 40, 50, 60, 70, 80;  $f$  (cm/s<sup>2</sup>): 30, 31.63, 33.34, 35.47, 37.75, 40.33, 43.25, 46.69, 50.67. Explain: Rounding error; Truncation error; Absolute error; Relative error with example. **5+5=10**

7. Use LU Factorization to find the solution of the system of linear equations:  $x + 2y + z = 1$ ,  $x + y - 3z = 5$  and  $x + 2y - 3z = 10$ . What is  $==$  in C? Explain the concept of convergence in Newton Raphson method. Write a C program to copy contents from one file to another. **4+1+2+3=10**

8. Use Newton's divided difference formula to determine  $f(9)$  as a polynomial in  $x$  for the following data  $X$ : -4, -1, 0, 2, 5;  $F(x)$ : 1245, 33, 5, 9, 1335. Apply Gauss elimination method to solve the following equations:  $10x - 7y + 3z + 5u = 6$ ;  $-6x + 8y - z - 4u = 5$ ;  $3x + y + 4y + 11u = 2$ ;  $5x - 9y - 2z + 4u = 7$ . What will be the output of "struct student {int no; char name[20]; }; struct student s; no = 8; printf("%d", no);" **4+4+2=10**

9. Write an algorithm for finding the roots of an equation using the Bisection method. What will be the outcome of "int arr [ ] = {1,2,3,4,5,6,7,8,9,0,1,2,5}, \*ip = arr+4; printf ("%d\n", ip[1]);"? Determine the maximum value of the root of the equation.  $0.51(x) - \sin(x) = 0$  by Newton's method. Take the initial guess as 2 and do 4 iterations. **3+2+5=10**