Aliah University

Odd (Autumn)-Semester Examination - 2024

(For 3th Semester BTech(CSE) Programme)

Paper Name: Digital Logic
Paper Code: CSEUGPC02

Full Marks: 80
Time: 3 Hrs

- *Answer all parts of a question in same place.*
- *Figures on the right hand side margin indicate full marks.*
- *Acronyms have their usual meaning* *Symbols &*

Group – A

(Answer any five questions) (5X2=10)

1. (a) Convert binary $(101010)_2$ to decimal number.
   (b) Convert [1010] gray to binary.
   (c) What is D'morgan theorem?
   (d) Write dual function of (a.b + c.d)
   (e) Draw venn diagram of (A'.B')
   (f) Implement function F=(a.b +c) using switch only.
   (g) How many address bits are required for 1K Byte memory

Group – B

(Answer any 6 questions) (6X5=30)

2. (a) Convert $(53.625)_{10}$ in binary.
   (b) Convert $(A45)_{16}$ to Octal number
   (c) Reduce, a.b + (a.c)' + a.b'.c.(a.b + c)
   (d) Prove, (a + b).(b + c) = b + a.c
   (e) Describe a 2:4 Decoder.
   (f) Implement a Half-adder circuit using the 2:4 Decoder
   (g) Describe D-latch.
   (h) Design a JK flip-flop using a D flip-flop.

Group – C
(Answer any 4 questions) (10X4=40)

3. (a) Perform addition between +37 and -26 in 2's complement form. 6

   (b) Perform addition of two BCD numbers, 0111 and 1001 4

4. (a) Obtain sum of minterms of f1=(a.b+a.c.d) 5

   (b) Obtain product of maxterms f2 = x.y + x'.z 5

5. Solve the following boolean function using K-map method. $F(A,B,C,D) = \sum_m (3, 4, 5, 7, 9, 13, 14, 15)$, find out (a) prime implicants (b) essential prime implicants (c) minimal SOP form 4 4 2

6. Find out (a) SOP form (b) POS forms of the following logic function using K-map method. 5 5

   $F(A,B,C,D) = \sum_m (0, 2, 3, 6, 7) + d(8, 10, 11, 14, 15)$

7. (a) Describe a 2:1 Multiplexer. 6

   (b) Implement an AND gate using the 2:1 multiplexer. 4

8. (a) Describe 4-bit SISO and 4-bit PIPO register with block diagrams. 4

   (b) Compare Ring counter and Johnson counter with suitable figure. 6

9. (a) Implement the following functions using PLA, F1= A.B' + A.C + A'.B.C' and F2 = A.C + B.C 6

   (b) Compare between PROM and PLA. 4

10. Design an up-counter using D flip-flops. The up-counter holds state when input x=0, otherwise it changes state as shown in figure 1. 10

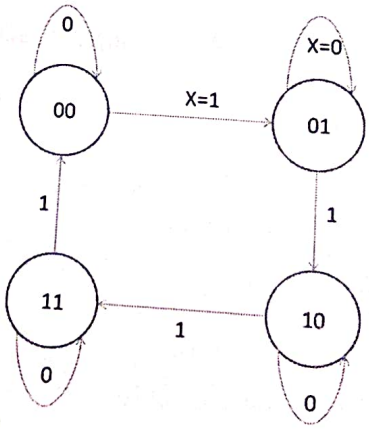


Figure 1: 2-bit up counter

Aliah University

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

Full Marks: 80 Time: 3hrs

A. Write any ten questions: (within 30 words each). 2x10=20

1. What is the significance of the Preamble of the Constitution of India?
2. Define 'Fundamental Rights'.
3. When was Abolition of the Untouchability Act enacted?
4. Discuss Article 21A of the Constitution of India.
5. Mention any two Socialist Principles of the Directive principles of State Policy.
6. Write two differences between Fundamental rights and Directive principle of state policy.
7. Discuss any two functions of the Speaker of the Lok Sabha.
8. What is impeachment? Has any President of India ever been impeached?
9. Mention the qualifications required to become a member of the Rajya Sabha.
10. Discuss the composition of the Upper House of the Indian Parliament.
11. Why the judgement in Kesavananda Bharti case considered one of the most celebrated judgements?
12. What is the significance of the 73rd Amendment to the Indian Constitution?
13. What are the primary functions of municipalities in India?

B. Write any four questions: (within 100 words each). 5x4=20

1. What are the differences between the Constitutional law and the Constitutionalism.
2. Write a short note on the writs of Habeas Corpus and Mandamus.
3. Describe the procedure for electing the President of India.
4. Mention Five Fundamental Duties enshrined in the Indian Constitution
5. Critically analyse the Right to Freedom of Religion as guaranteed under Articles 25to 28.
6. Write a short note on the 74th Amendment Act

C. Write any four questions: (Within 350 words each). 10x4=40

1. Discuss the basic features of the Indian Constitution and explain how they reflect the vision of its framers.
2. Explain Article 19 of the Indian Constitution and highlight its reasonable restrictions.
3. "The Constitution of India is neither purely federal nor unitary but a combination of both." Do you agree with this view? Justify your answer.

   Or,

   Discuss the nature of Indian federalism'
4. Discuss the emergency powers of the President of India as provided in the Constitution. How do these powers ensure national security?
5. Explain the composition and functions of the Gram Panchayat in the Panchayati Raj system.
6. Explain the procedure for amending the Indian Constitution. How does it balance rigidity and flexibility?

End – Semester Examination (Autumn Semester) 2024 – 25
(For 2nd Year 3rd Semester B.Tech)

Paper Name: Data Structures & Algorithms **Full Marks: 80**
Paper Code: CSEUGPC01 **Time: 3 Hrs**

Section – A

Answer any five of the following ***5 x 2 = 10***

1. Define an array. Give two examples of its applications.
2. What is the difference between infix, postfix, and prefix notations?
3. Describe the characteristics of an algorithm.
4. Write the formula to calculate the mid-point of an array during binary search.
5. What is recursion, and how does it work?
6. List two sorting algorithms that are not comparison-based.
7. Write the formula to calculate the position of an element in a 2D array in column-major order.
8. Explain the concept of "Big O" notation.

Section – B

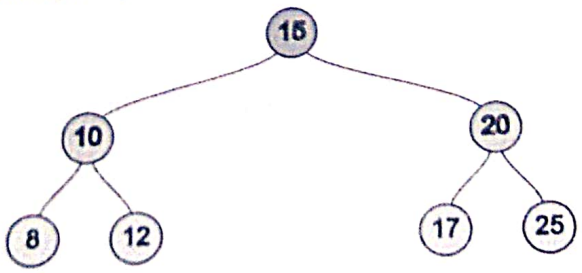
Answer any five of the following ***5 x 6 = 30***

1. Write the algorithm for insertion sort and use it to sort the array [5, 3, 8, 6, 2, 4].
2. Write an algorithm to perform in-order and post-order traversal of a binary tree.
3. Explain the steps to evaluate a postfix expression with an example.
4. Sort the following array using the Bubble Sort algorithm and show all steps. Array: [64, 34, 25, 12, 22, 11, 90].
5. Convert the following infix expression to postfix using a stack. Infix Expression: (A + B / P) * (C - D^E).
6. Given a singly linked list, write a function to delete a node at a specified position.
7. Construct a binary search tree given the preorder traversal sequence: 50, 30, 70, 20, 40, 60, 80.

Section – C

Answer any four of the following ***4 x 10 = 40***

1. a) Perform an in-order, pre-order, and post-order traversal on the following binary tree:



b) Explain radix sort with an example. Use it to sort the array [170, 45, 75, 90, 802, 24, 2, 66].

[5 + 5]

2. Explain the steps with algorithms in implementing a stack using a linked list. What is the difference between merge sort and quicksort in terms of their divide-and-conquer strategy? Define a binary tree. How does it differ from a binary search tree? [5 + 3 + 1 + 1]

3. Explain the purpose of an AVL tree. What condition does it maintain? Construct an AVL tree by inserting the following elements sequentially: 10, 20, 30, 40, 50, 25. Show the rotations performed. [2 + 2 + 6]

4. Explain bucket sort to arrange the elements in the array [0.42, 0.32, 0.23, 0.52, 0.25, 0.47, 0.51]. Solve the following problem using binary search: find 45 in the sorted array [10, 20, 30, 40, 45, 50, 60], depicting all steps. [5 + 5]

5. Implement the quicksort algorithm with divide and conquer strategy and use it to sort the array [10, 80, 30, 90, 40, 50, 70]. [5 + 5]

6. Write an algorithm to implement the different operations in a queue using an array. Construct a binary tree for the given pre-order and in-order traversal:
Preorder: [A, B, D, E, C, F, G] In-order: [D, B, E, A, F, C, G]. [6 + 4]

End-Semester Examination - 2024 (Autumn)
MATUGBS04
(Discrete Mathematics)
Semester – III (B. Tech in CSE)

Full Marks – 80 **Time – 3 Hours**

Notations and symbols have their usual meaning.

Section A. Answer ALL questions. Each question carries one mark only.

1. Let A, B be two sets such that $|A| = 20$ and $|B| = 30$ and $|A \cup B| = 40$. Then $|A \cap B|$ is –
   (a) 20
   (b) 30
   (c) 40
   (d) 10
2. The cardinality of the power set of the set $\{1,5,6\}$ is –
   (a) 5
   (b) 6
   (c) 8
   (d) 10
3. Which one of the following is a proposition?
   (a) How are you?
   (b) What time is it?
   (c) India is in Europe.
   (d) $4+x=5$.
4. What is the negation of the statement "Sam is rich and happy"?
   (a) Sam is poor and unhappy.
   (b) Sam is either poor or happy.
   (c) Sam is either poor or unhappy
   (d) Sam is poor and happy.
5. What is the number of edges in the complete graph K_n?
   (a) n
   (b) $\frac{n(n-1)}{2}$
   (c) $\frac{n(n+1)}{2}$
   (d) $n-1$

6. A vertex which is not adjacent to any other vertex is called —— vertex.

(a) isolated

(b) pendant

(c) incident

(d) simple

7. Consider the following statements.

I. Every bipartite graph contains an odd cycle.

II. Every tree is a bipartite graph.

(a) Both I and II are true.

(b) Both I and II are false.

(c) I is true and II is false.

(d) I is false and II is true

8. Any graph that contains some parallel edges is called a –

(a) simple graph.

(b) mixed graph.

(c) multi graph.

(d) null graph.

9. If a set A has m elements and the set B has n elements then the number of elements in $A \times B$ is –

(a) m^n

(b) n^m

(c) $m+n$

(d) $m.n$

10. A partial ordered relation on a non-empty set is –

(a) reflexive, but not transitive.

(b) anti-symmetric, but not reflexive.

(c) reflexive, transitive and anti-symmetric.

(d) reflexive, symmetric and transitive.

Section B. Answer ALL questions. Each question carries one mark only.

11. What is the total number of edges of a k-regular graph with n vertices?

12. Construct the truth table of the proposition $p \vee \sim p$.

13. In a lattice L, if $a \geq b$, then $a \wedge b =$?

14. What is meant by greatest element in a poset?

15. Write the rule of Modus tollens of predicates.

16. What is the chromatic number of an odd cycle?

17. Write down the Euler's formula for a planar graph.

18. Define a cut vertex of a graph.

19. What is the necessary and sufficient condition for a graph to be bipartite?

20. Find the inverse of the function $f(x) = e^x$ defined from $\mathbb{R}$ to $\mathbb{R}^+$.

Section C. Answer any SIX questions. Each question carries 10 marks.

21. (a) If $A = \{1,2,3,4,5,6,7,8,9,10,11,12\}$ and $R = \{(x,y)/x-y \text{ is multiple of } 5\}$ is a relation on A, find the partition of A given by R. 5

(b) Use mathematical induction to show that $1+2+2^2+2^3+\ldots+2^n = 2^{n+1}-1$. 5

22. (a) Prove 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 by (i) using truth table, (ii) using laws of logic. 2+4

(b) Prove that $\mathscr{P}(A) \subseteq \mathscr{P}(B)$ if and only if $A \subseteq B$. 4

23. (a) Draw the Hasse diagram representing the partial ordering $\{(A,B) : A \subseteq B\}$ on the power set $\mathscr{P}(S)$ where $S = \{a,b,c\}$. Find the maximal, minimal, greatest and least elements of the poset. 2+4

(b) Without using truth table, prove that $\sim p \to (q \to r) \longleftrightarrow q \to (p \vee r)$. 4

24. (a) Out of 5 men and 2 women, a committee of 3 is to be formed. In how many ways can it be formed if at least one woman is to be included? 5

(b) Solve the recurrence relation $a_n = 7a_{n-1} - 10a_{n-2}$ with $a_0 = 2$ and $a_1 = 3$. 5

25. (a) What is a Eulerian graph? State a necessary and sufficient condition for a graph to be Eulerian. Illustrate with an example. 2+1+2

(b) Obtain the tree whose Prüfer code is $\{1,3,3,4,2,3\}$. Find its radius and diameter. 3+2

26. (a) What do you mean by chromatic number of a graph? Show that every tree is bi-chromatic, but not every bi-chromatic graph is a tree. 2+3

(b) What is a binary tree? Find the number of pendant vertices in a binary tree with n vertices. 2+3

27. (a) What is a planar graph? Prove that a bipartite planar graph has at least one vertex of degree 3 or less. 2+3

(b) When are two graphs called isomorphic? Provide examples of two non-isomorphic graphs with equal number of vertices, equal number of edges and with same degree sequence. 2+3

28. (a) When is a graph called Hamiltonian? For which values of m and n, does the graph $K_{m,n}$ contain a Hamiltonian cycle? Explain. 2+3

(b) Draw the Petersen graph. Show that it is not a planar graph. 2+3

29. (a) Prove that every connected graph which is not itself a tree must have at last three different (although possibly isomorphic) spanning trees. 5

(b) Prove that the chromatic polynomial of a tree with n vertices is given by $x(x-1)^{n-1}$. 5

End

Aliah University

Autumn Semester Examination - 2024

B.Tech 2nd year, 3rd semester Examination

Paper Name: Numerical Methods **Full Marks: 80**

Paper Code: MATUGOE01 **Time: 3 hrs**

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

1. Differentiate the methods of Regula-Falsi and Newton-Raphson for finding the root of $3x^3 - 5x - 18 = 0$ correct to two decimal places. Discuss the convergence for the Secant Method? Design a comparative analysis of the methods discussed in terms of their computational efficiency and accuracy for solving f(x)=tan(x)−x=0.

(4+2+4=10), (CO5), (Und, Und, Cre)

2. What is Boole's Rule and Weddle's Rule for numerical integration? Solve the following integrals for n=6 intervals using both Simpson's 1/3 and 3/8 rule, applied on each integral and compare the results for (i) and (ii). Create a C program file to store the numerical integration values for (ii).

(i) $\int_0^6 \frac{1}{(x+\cos(x))} dx$ (ii) $\int_0^6 \frac{e^{-x}}{(1+e^x)} dx$.

(3+5+2=10), (CO3), (Rem, Eva, Cre)

3. Find the error terms for the Lagrange Interpolation formula. Use Newton's forward and backward interpolation formula to estimate f(1.3) from the given table x: 1, 3, 5, 7, 9; y: 1.1, 4.5, 6.7, 8.9, and compare the results. Give the output for "char c[ ] = "GATE2023"; char *p = c; printf ("%s", p + p[3] – p[1]);". Give the Newton's divided difference expression for five inputs (xi,yi)(i=1,2,3,4,5) **(3+4+1+2=10), (CO2), (Eva, Ana, Und)**

4. Perform the division 1/3 using 4-digit rounding arithmetic. Compare the result with the exact division up to 6 decimal places. What is the machine epsilon? How is it related to the precision of floating-point arithmetic? Drive Euler's ODE formula from Taylor's series expansion. **(1+1+1+2+5=10), (CO1, CO6), (Eva, Ana, Syn)**

5. Use Euler's Method to solve the given ODE and calculate the approximation of y(1.5) where y(x) is the solution of the initial-value problem that is as follows. y'=2sin(3x)-xy, y(0)=1. Use the Runge-Kutta method of fourth order, compute k4 if dy/dx=4x-5y^2, y(0.1)=1.1, h=0.1. The global error is not simply the sum of the local errors. Why not?

(4+4+2=10), (CO6, CO1), (Ana, Ana, Rem)

6. Define a system of Linear Equations, for n variables. Solve: 14x –2y + 3z = 1; 3x - 5y + z = 5; 5x – 2y – 8z = 3, upto 2 iterations. Differentiate between Gauss Jacobi and Gauss-Seidel methods. Apply Gauss Jordan method to solve the following equations: 3x-2y+3z+5u=3; -6x+8y-z-4u=5; 3x+y+4y+11u=2; 5x-9y-2z+4u=7.

(4+2+4=10), (CO4), (Kno, Ana, Syn)

7. Explain the term 'test of convergence for Newton Raphson method'. If A is a 2 X 2 invertible matrix then what is the inverse of 2A? The goal of row-reduction in Gaussian elimination converts the matrix into? Find the computational complexity for computing LU factorization of an n X n matrix. Discuss the formulation for the LU factorization-based system of solutions of linear equations. Express the nth-degree Lagrange Polynomial with (n+1) data points.

(2+2+1+1+2+2=10), (CO5, CO4), (Und, Ana, Syn)

8. Use the distance s(t) that a car travels along a straight road in time (t) (seconds): 0, 5, 10, 15; Distance (m): 0, 100, 300, 700. Using the forward, backward or centred difference approximation, what is the best estimate you can find for the velocity v = ds/dt of the car at t = 10 seconds? Write an expression for the Runge-Kutta method of order 2. You are working with a hypothetical binary computer that stores integers as unsigned 4-bit words. What is the largest non-negative integer that can be represented on this computer?

(3+4+3=10), (CO2, CO6), (Eva, Ana, Syn)

9. Prove that $(1 + \Delta)(1 - \nabla)=1$. Write an algorithm for finding the roots of an equation using the Bisection method. What do you mean by diagonally dominant? Find f(3) and f'(3) from the following table: X: 0, 1, 2, 5; F(x): 2, 3, 12, 147. Determine the largest eigenvalue and the corresponding eigenvector of the matrix A=[[4,1,0], [1,20,1], [0,1,4]].

(2+2+2+2+2=10), (CO1, CO5, CO6), (Eva, Ana, Und)

Aliah University

Department of Electrical Engineering

Odd (Autumn) Semester Examination, 2024 (Regular/Supplementary)

B. Tech. (CSE), 3rd Semester

Sub: Circuit Theory & Networks **Code- EENUGOE01**

Full Marks: 80 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) If it takes 35 J of energy to move a charge of 5 C from one point to another, what is the voltage between the two points?

(B) An electric heater consumes 1.8 MJ when connected to a 250 V supply for 30 minutes. Find the power rating of the heater and the current taken from the supply.

(C) What is the resistance of a coil which draws a current of (a) 50 mA and (b) 200 μA from a 120 V supply?

(D) An electric equipment takes a current of 13 A from a 240 V supply. Estimate the cost per week of electricity if the equipment is used for 30 hours each week and 1 unit of energy costs ₹ 8/-.

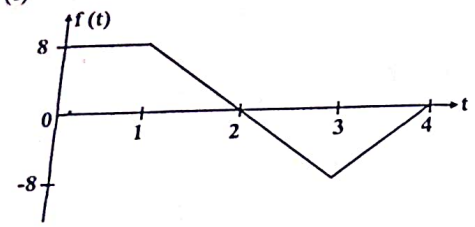
(E) A piece of wire of cross-sectional area 2 mm^2 has a resistance of 300 Ω. Find the cross-sectional area of a wire of the same length and material of resistance 750 Ω.

(F) At t=0, the voltage across a 50 mF capacitor is 10 V. Calculate the voltage across the capacitor for t>0 when current 4.t mA flows through it.

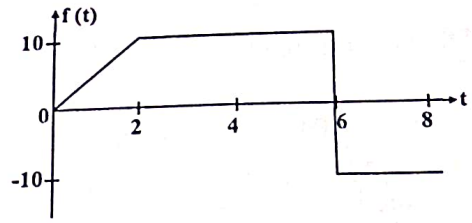
Section – II (Answer any five: 5 x 6 = 30 Marks)

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

(i)

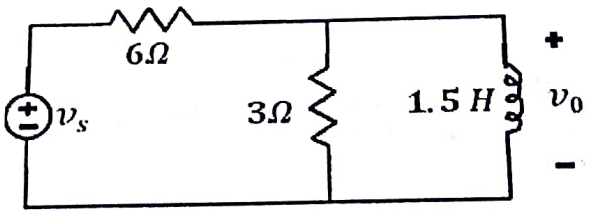


(ii)



3. *With reference to the graph theory, explain the significance of an incidence matrix, with the help of an example. Find the number of possible trees for your considered example.*

4. *Using Laplace transform method, determine the unit step response $v_0(t)$ to v_s, in the given circuit.*



5. *Find the relation between phase voltage and line voltage of a three-phase balanced star-connected system. Use both graphical and equation methods for the calculation.*

6. Find the voltage across 5 Ω resistance, using mesh current analysis method. Refer Fig. Q (6).

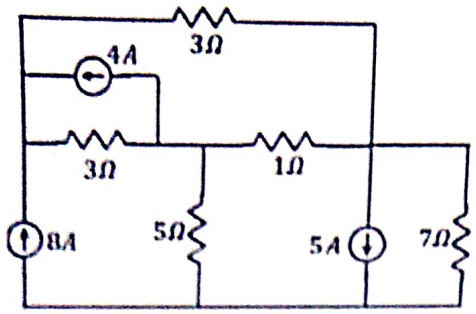


Fig. Q (6)

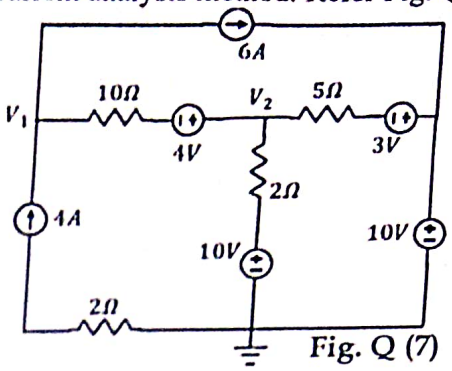


Fig. Q (7)

7. Determine the node voltages V_1 and V_2 in the given circuit, using node voltage analysis method. Refer Fig. Q (7).

Section – III (Answer any four: 4 x 10 = 40 Marks)

8. For the AC circuit shown in figure, find the currents I_1 and I_2. Refer Fig. Q (8). [10]

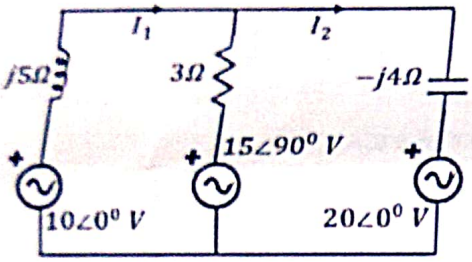


Fig. Q (8)

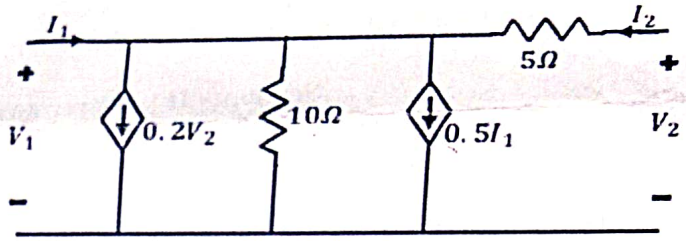
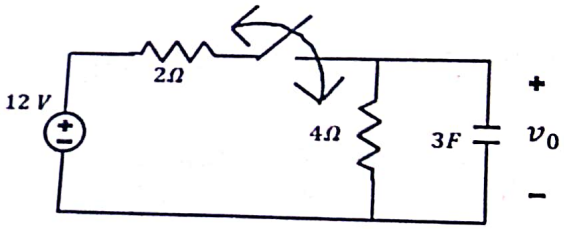


Fig. Q (9A)

9. (A) Determine the Y parameters of the network shown in figure. Refer Fig. Q (9A). [7]

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

10. Using Laplace transform technique, find $v_0(t)$, if
(a) the switch has been open for a long time and is closed at $t = 0$.
(b) the switch has been closed for a long time and is opened at $t = 0$. [10]



11. A three-phase, 440 V, ACB system has a Δ-connected load, with $Z_{AB} = 12\angle 60^0$, $Z_{BC} = 15\angle 0^0$ and $Z_{CA} = 15\angle 45^0$. Obtain the phase and line currents and draw the phasor diagram. Take V_{AB} as reference phasor. [10]

12. (A) The load connected to a three-phase supply comprises three similar coils connected in delta. The line currents are 15 A and the kVA and kW inputs are 20 and 17.5 respectively. Find the phase voltages, the kVAR input and the resistance & reactance of each coil. [5]

(B) For a graph of your choice, establish the following relations: $[B][V_b] = 0$ and $[C][I_b] = 0$. [5]