

BTECH
(SEM III) THEORY EXAMINATION 2023-24
DISCRETE STRUCTURES & THEORY OF LOGIC

TIME: 3HRS

M.MARKS: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 7 = 14

Q no.	Question	Marks	CO
a.	Determine the greatest lower bound and least upper bound of the set $\{2, 3, 6\}$, if they exist, in the Poset $(D_{24}, /)$.	2	1
b.	Express power set of each of these sets. 1) $\{\emptyset, \{\emptyset\}\}$ 2) $\{a, \{a\}\}$	2	1
c.	Investigate whether the function $f(x) = x^2 - 1$ is injective or not for $f: \mathbb{R} \rightarrow \mathbb{R}$.	2	2
d.	Express $E(x, y, z) = xy + y'z$ into its complete sum-of-products form.	2	2
e.	Construct inverse of the following statement "If I wake up early in the morning, then I will be healthy."	2	3
f.	Show that identity element is unique in a group.	2	4
g.	Compare Euler circuit and Hamiltonian circuit.	2	5

SECTION B

2. Attempt any three of the following:

7 x 3 = 21

Q no.	Question	Marks	CO
a.	Construct the Hasse Diagram for $(P(S), \subseteq)$ where $P(S)$ is a power set defined on set $S = \{a, b, c\}$. Determine whether it is a Lattice or not.	7	1
b.	Solve the following Boolean functions using K-map: (i) $F(A, B, C, D) = \sum (m_0, m_1, m_2, m_4, m_5, m_6, m_8, m_9, m_{12}, m_{13}, m_{14})$ (ii) $F(A, B, C, D) = \sum (0, 2, 5, 7, 8, 10, 13, 15)$	7	2
c.	Show the validity of the following argument: hypotheses: "It is not sunny this afternoon and it is colder than yesterday. We will go swimming only if it is sunny. If we do not go swimming, then we will take a canoe trip. If we take a canoe trip, then we will be home by sunset." conclusion: "We will be home by sunset."	7	3
d.	Let $G = \{1, -1, i, -i\}$ with the binary operation multiplication be an algebraic structure, where $i = \sqrt{-1}$ then determine whether G is an Abelian group. Also if G is cyclic Group, then determine the generator of G .	7	4
e.	Explain Pigeon hole principle. Describe generalized form of Pigeon hole principle. If 6 colors are to paint 37 homes. Show that at least 7 of them will be of same color.	7	5



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SECTION C

3. Attempt any one part of the following:

7 x 1 = 7

Q no.	Question	Marks	CO
a.	Let R be a binary relation on the set of all strings of 0 and 1 such that $R = \{(a,b): a \text{ and } b \text{ have same number of 0's}\}$. Show that whether R is reflexive, symmetric, transitive or a partial order relation.	7	1
b.	Show that $(D_{42}, /)$ is lattice. Compare the distributive and complemented lattice with example.	7	1

4. Attempt any one part of the following:

7 x 1 = 7

Q no.	Question	Marks	CO
a.	Solve the following Boolean function using K-map: $F(A,B,C) = (1,2,5,7)$ and $D(0,4,6)$ using SOP.	7	2
b.	If $f: R \rightarrow R$, $g: R \rightarrow R$ and $h: R \rightarrow R$ defined by $f(x) = 3x^2 + 2$, $g(x) = 7x - 5$ and $h(x) = 1/x$. Compute the following composition functions. (i) $(f \circ g \circ h)(x)$ (ii) $(g \circ g)(x)$ (iii) $(g \circ h)(x)$	7	2

5. Attempt any one part of the following:

7 x 1 = 7

Q no.	Question	Marks	CO
a.	Test the validity of the following argument. "If there was a ball game, then traveling was difficult. If they arrived on time, then traveling was not difficult. They arrived on time. Therefore, There was no ball game."	7	3
b.	Describe \exists and \forall Quantifiers with example. "There is someone who got an A in the course" convert this sentence into predicate logic using quantifiers. Prove the following argument. All man are mortal. Socrates is a man. Therefore, Socrates is mortal.	7	3

6. Attempt any one part of the following:

7 x 1 = 7

Q no.	Question	Marks	CO
a.	Describe Algebraic structure, semigroup, monoid and group. Also explain the relationship among them.	7	4
b.	Consider group $G = \{1, 2, 3, 4, 5, 6\}$ under multiplication modulo 7. (a) Construct the multiplication table of G. (b) Compute 2^{-1} , 3^{-1} , 6^{-1} (c) Compute the orders and subgroups generated by 2 and 3. (d) Is G cyclic?	7	4

7. Attempt any one part of the following:

7 x 1 = 7

Q no.	Question	Marks	CO
a.	Compare bipartite and complete graph with example. Draw $K_{3,4}$ and K_5 . Explain why these two graphs are not planar.	7	5
b.	Show that $K_{3,3}$ satisfies in equality $ E \leq 3 V - 6$, but it is non-planar. (V =No. of Vertices, E =No. of Edges, R =No. of Regions)	7	5