Roll No: | | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2021-22
DISCRETE STRUCTURES & THEORY OF LOGIC

Time: 3 Hours ***Total Marks: 100***

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

SECTION A

1. Attempt *all* questions in brief. 2x10 = 20

Qno.	Question	Marks	CO
a.	Let A = {1,2,3,4,5,6} be the set and R = {(1,1) (1,5) (2,2) (2,3) (2,6) (3,2) (3,3,) (3,6) (4,4) (5,1) (5,5) (6,2) (6,3) (6,6)} be the relation defined on set A. Find Equivalence classes induced by R.	2	1
b.	Solve Ackerman Function A (2,1).	2	1
c.	State and justify "Every cyclic group is an abelian group".	2	2
d.	State Ring and Field with example.	2	2
e.	Differentiate complemented lattice and distributed lattice.	2	3
f.	State De Morgan's law and Absorption Law.	2	3
g.	Translate the conditional statement "If it rains, then I will stay at home" into contrapositive, converse and inverse statement.	2	4
h.	State Universal Modus Ponens and Universal Modus Tollens laws.	2	4
i.	Explain Euler's formula. Determine number of regions if a planar graph has 30 vertices of degree 3 each.	2	5
j.	Explain pigeonhole principle with example.	2	5

SECTION B

2. Attempt any *three* of the following: 3x10 =30

Qno.	Question	Marks	CO
a.	Justify that for any sets A, B, and C: i) $(A - (A \cap B)) = A - B$ ii) $(A - (B \cap C)) = (A - B) \cup (A - C)$	10	1
b.	Explain Cyclic group. Let H be a subgroup of a finite group G. Justify the statement "the order of H is a divisor of the order of G".	10	2
c.	Solve $E(x,y,z) = \sum (0,2,6,8,10,12,14,15)$ using K-map.	10	3
d.	Construct the truth table for the following statements: i) $(P \rightarrow Q') \rightarrow P'$ ii) $P \leftrightarrow (P' \vee Q')$.	10	4
e.	Solve the recurrence relation using generating function. $\mathbf{a_{n+2} - 5a_{n+1} + 6a_n = 2}$, **with** $\mathbf{a_0 = 3}$ **and** $\mathbf{a_1 = 7}$.	10	5

SECTION C

3. Attempt any *one* part of the following: 1x10 =10

Qno.	Question	Marks	CO
a.	State Principle of Duality. Let A denote the set of real numbers and a relation R is defined on A such that (a,b)R(c,d) if and only if $a^2 + b^2 = c^2 + d^2$. Justify that R is an equivalence relation.	10	1
b.	i) Let R = {(1,2) (2,3) (3,1)} defined on A = {1,2,3}. Find the transitive closure of R using Warshall's algorithm. ii) Justify that "If f: A→B and g: B→C be one-to-one onto functions, then gof is also one to one onto and $(gof)^{-1} = f^{-1} o\, g^{-1}$".	10	1

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4. Attempt any *one* part of the following: 1x10 =10

Qno.	Question	Marks	CO
a.	Define the binary operation * on Z by x*y=x + y + 1 for all x,y belongs to set of integers. Verify that (Z,*) is abelian group? Discuss the properties of abelian group.	10	2
b.	i) Justify that "The intersection of any two subgroup of a group (G,*) is again a subgroup of (G,*)". ii) Justify that "If a,b are the arbitrary elements of a group G then $(ab)^2 = a^2b^2$ if and only if G is abelian.	10	2

5. Attempt any *one* part of the following: 1x10 =10

Qno.	Question	Marks	CO
a.	Define Modular Lattice. Justify that if 'a' and 'b' are the elements in a bounded distributive lattice and if 'a' has complement a′. then I) $a \vee (a' \wedge b)=a \vee b$ II) $a \wedge (a' \vee b)=a \wedge b$	10	3
b.	i) Justify that $(D_{36}, \backslash)$ is lattice. ii) Let L_1 be the lattice defined as D_6 and L_2 be the lattice $(P(S), \leq)$, where P(S) be the power set defined on set S= {a, b}. Justify that the two lattices are isomorphic.	10	3

6. Attempt any *one* part of the following: 1x10 =10

Qno.	Question	Marks	CO
a.	Use rules of inference to Justify that the three hypotheses (i) "If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on." (ii) "If the sailing race is held, then the trophy will be awarded." (iii) "The trophy was not awarded." imply the conclusion (iv) "It rained."	10	4
b.	Justify that the following premises are inconsistent. (i) If Nirmala misses many classes through illness then he fails high school. (ii) If Nirmala fails high school, then he is uneducated. (iii) If Nirmala reads a lot of books then he is not uneducated. (iv) Nirmala misses many classes through illness and reads a lot of books.	10	4

7. Attempt any *one* part of the following: 1x10 =10

Qno.	Question	Marks	CO
a.	Explain the following terms with example: i. Graph coloring and chromatic number. ii. How many edges in K_7 and $K_{3,3}$ iii. Isomorphic Graph and Hamiltonian graph. iv. Bipartite graph. v. Handshaking theorem.	10	5
b.	i. Justify that "In a undirected graph the total number of odd degree vertices is even". ii. Justify that "The maximum number of edges in a simple graph is n(n-1)/2".	10	5