**United Group of Institution**

**Department of Computer Science and Information Technology**

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**IInd Sessional Examination (2021-22) B.Tech. (IIIrd Semester)**

**Discrete Structure and Theory of Logic**

**Subject Code: KCS-303**

**Time:** 3.00 hours **Max. Marks:** 100

**Note:** There are three sections in this paper. All sections are compulsory.

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| **Questi**  **on No.** | **Question** | **Marks** | **CO** | **Bloom’s**  **level** |
| **Section-A** | | | | |
| **1. Attempt all questions. Each questions has equal marks.** | | | | |
| a | Define Ring algebraic structure. | 20 | 2 | L1 |
| b | Define Boolean ring. | 2 | L1 |
| c | Define Group Isomorphism. | 2 | L1 |
| d | Define modular lattice. | 3 | L1 |
| e | Define POSET. | 3 | L1 |
| f | Write the converse of the implication: “if it is Sunday then it is a  holiday”. | 4 | L2 |
| g | The following is the incomplete operation table of a 4-element group.  The last row of the table is:-   1. c a e b 2. c b a e 3. c b e a 4. c e a b | 2 | L2 |
| h | The inclusion of sets into R = {{1, 2}, {1, 2, 3}, {1, 3, 5}, {1, 2, 4},  {1, 2, 3, 4, 5}} is necessary and sufficient to make R a complete lattice under the partial order defined by set containment.   1. {1}, {2, 4} 2. {1}, {1, 2, 3} 3. {1} 4. {1}, {1, 3}, {1, 2, 3, 4}, {1, 2, 3, 5} | 3 | L2 |
| i | Let P, Q, R, S represent the following propositions. P: x ∈{8,9,10,11,12}  Q: x is composite number. | 4 | L3 |

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|  | R: x is perfect square. S: x is prime number.  The integer x ≥ 2 which satisfies 1((P  Q) ∧ (1 R∨ 1S)) is …………….. |  |  |  |
| j | Which one of the following is not equivalent to p Xq?  (A) (1𝑝∨𝑞) ∧ (𝑝∨1𝑞) (B) (1𝑝∨𝑞) ∧ (q→p)  (B) (1𝑝 ∧ 𝑞) ∨ (𝑝 ∧ 1𝑞) (D) (1𝑝 ∧ 1𝑞) ∨ (𝑝 ∧ 𝑞) | 4 | L3 |
| **Section-B** | | | | |
| **2. Attempt any three.** | | | | |
| a. | Obtain all distinct left cosets of { 0, 3 } in the group ( Z6, +6 ) and find their union. | 10 | 2 | L2 |
| b. | Answer these questions for the poset({3, 5, 9, 15,24, 45}, |).  i. Find the maximal elements. ii. Find the minimal elements.  iii. Is there a greatest element? iv. Is there a least element?  v. Find all upper bounds of {3, 5}.vi. Find the least upper bound of {3, 5}.  vii. Find all lower bounds of {15, 45}. viii.Find the greatest lower bound of {15, 45}, if it exists. | 10 | 3 | L3 |
| c. | Let (L,∨,∧,≤) be a distributive lattice and a, b∈ L . if a ∧ b = a ∧ c and a ∨ b = a ∨ c then show that b = c | 10 | 3 | L4 |
| d. | Show that the following are equivalent in a Boolean algebra  a ≤ b⇔ a\*b' = 0⇔b' ≤ a’ ⇔ a’⊕ b = 1 | 10 | 3 | L4 |
| e. | Verify that the given propositions are tautology or not.   1. p ∨￢ (p ∧q) 2. ￢p ∧q | 10 | 4 | L2 |
| **Section-C** | | | | |
| **3. Attempt any one.** | | | | |
| a. | Define **normal subgroup**. Prove that a subgroup H of a group G is said  to be normal iff g-1hg  H, for every h  H, g  G. | 10 | 2 | L4 |
| b. | Prove that (R,+,\*) is a ring with zero divisors, where R is 2x2 matrix  and + and \* are usual addition and multiplication operations. | 10 | 2 | L4 |
| **4. Attempt any one.** | | | | |
| a. | Simplify the following Boolean function using three variables maps:   1. f(w,x,y,z)=Σ(0,1,5,7, 9,10,14,15) 2. f(x,y,z)=Σ(1,2,3,6,7) | 10 | 3 | L3 |
| b. | Draw the Haase diagram of [p(a,b,c),≤], Find greatest element , least  element ,minimal element & maximal element. | 10 | 3 | L3 |

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| **5. Attempt any one.** | |  |  |  |
| a. | In a Lattice if a≤b≤c , then show that   1. a∨b=b∧c 2. (a∨b)∨(b∧c) = (a∨b) ∧ (a∨c) = b | 10 | 3 | L3 |
| b. | Give an example of a lattice which is a modular but not a distributive. | 10 | 3 | L3 |
| **6. Attempt any one.** | |  |  |  |
| a. | Define a Boolean function of degree n. Simplify the following Boolean expression using K-map:  xyz + xy’z + x’y’z + x’yz + x’y’z’ | 10 | 3 | L3 |
| b. | Show that ((P ∨Q) ∧¬( ¬ Q∨ ¬ R)) ∨ ( ¬ P∨ ¬ Q) ∨ ( ¬ P∨ ¬ R) is a tautology by using equivalences. | 10 | 4 | L4 |
| **7. Attempt any one.** | |  |  |  |
| a. | Construct the truth table for the following statements:   1. (P→Q’)→P’ 2. PX(P’∨ Q’). | 10 | 4 | L3 |
| b. | What do you mean by cosets of a subgroup? Consider the group Z of  integers under addition and the subgroup H = {…., -12, -6, 0, 6 12, ……} considering of multiple of 6   1. Find the cosets of H in Z 2. What is the index of H in Z. | 10 | 2 | L4 |

**Bloom’s taxonomy level** (1- Remembering, 2. Understanding, 3. Applying, 4.

Analyzing, 5. Evaluating, 6. Creating)

**CO** -- Course Outcome

**Marks distribution CO wise**

40

**Marks distribution Bloom's**

**level wise**

30

L1 L2 L3 L4

20

10

17%

33%

0

27%

CO2 CO3 CO4

23%

Series1