**United Group of Institution**

**Department of Computer Science and Information Technology**

**IInd Sessional Examination (2020-21)**

**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.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Question No.** | **Question** | **Marks** | **CO** | **Bloom’s level** |
| **Section-A** | | | | |
| 1. **Attempt all questions. Each question 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 | |  |  |  |  |  | | --- | --- | --- | --- | --- | | \* | e | a | b | c | | e | e | a | b | c | | a | a | b | c | e | | b |  |  |  |  | | c |  |  |  |  |   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. (A) {1}, {2, 4} (B) {1}, {1, 2, 3} (C) {1} (D) {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.  R: x is perfect square.  S: x is prime number.  The integer x ≥ 2 which satisfies ˥((P 🡪 Q) ∧ (˥ R∨ ˥S)) is …………….. | 4 | L3 |
| j | Which one of the following is not equivalent to p ↔q?   1. (˥𝑝∨𝑞) ∧ (𝑝∨˥𝑞) (B) (˥𝑝∨𝑞) ∧ (q→p) 2. (˥𝑝 ∧ 𝑞) ∨ (𝑝 ∧ ˥𝑞) (D) (˥𝑝 ∧ ˥𝑞) ∨ (𝑝 ∧ 𝑞) | 4 | L3 |
| **Section-B** | | | | |
| 1. **Attempt any three.** | | | | |
|  | Obtain all distinct left cosets of { 0, 3 } in the group ( Z6, +6 ) and find their union. | 10 | 2 | L2 |
|  | 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 |
|  | 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 |
|  | Show that the following are equivalent in a Boolean algebra  a ≤ b⇔ a\*b' = 0⇔b' ≤ a’ ⇔ a’⊕ b = 1 | 10 | 3 | L4 |
|  | Verify that the given propositions are tautology or not.   1. p ∨￢ (p ∧q) 2. ￢p ∧q | 10 | 4 | L2 |
| **Section-C** | | | | |
| 1. **Attempt any one.** | | | | |
|  | 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 |
|  | 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 |
| 1. **Attempt any one.** | | | | |
|  | 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 |
|  | Draw the Haase diagram of [p(a,b,c),≤], Find greatest element , least element ,minimal element & maximal element. | 10 | 3 | L3 |
| 1. **Attempt any one.** | |  |  |  |
|  | 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 |
|  | Give an example of a lattice which is a modular but not a distributive. | 10 | 3 | L3 |
| 1. **Attempt any one.** | |  |  |  |
|  | 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 |
|  | Show that ((P ∨Q) ∧¬( ¬ Q∨ ¬ R)) ∨ ( ¬ P∨ ¬ Q) ∨ ( ¬ P∨ ¬ R) is a tautology by using equivalences. | 10 | 4 | L4 |
| 1. **Attempt any one.** | |  |  |  |
|  | Construct the truth table for the following statements:   1. (P→Q’)→P’ 2. P↔(P’∨ Q’). | 10 | 4 | L3 |
|  | 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