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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **End - Term Examinations – January 2025** |
| **Date:** 04- 01- 2025 **Time:** 1:00 pm – 04:00 pm |

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| **School:** SOCSE | **Program:** B.Tech-CSE |
| **Course Code :** MAT2004 | **Course Name :** Discrete Mathematical Structures |
| **Semester**: III | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **14** | **29** | **41** | **16** | **--** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** |
| **1** | If $p \rightarrow q$ is a conditional statement then what is the converse of its inverse? | **2 Marks** | **L2** | **CO1** |
| **2** | State which rule of inference is the basis of the following statement : “ It is below freezing and raining now. Therefore, it is below freezing now.” | **2 Marks** | **L1** | **CO1** |
| **3** | Write the cardinality of the set $ A = \left\{0 < x < 10, x \in N\right\}$ where $N$ is the set of all natural numbers. | **2 Marks** | **L1** | **CO2** |
| **4** | Let A = {a, b, c, d, e} and B = {a, b, c, d, e, f, g, h}, then Find (i) A – B (ii) B – A | **2 Marks** | **L2** | **CO2** |
| **5** | When a relation $R$ on a set $S$ is said to be a partial order relation? | **2 Marks** | **L2** | **CO3** |
| **6** | Let $\left(A, |\right)$ be a poset where $A = \left\{1,2,3\right\}$ and $|$ denotes the relation divisibility. Then what is the supremumu of $B = \left\{1,2\right\}?$ | **2 Marks** | **L2** | **CO3** |
| **7** | In the poset $\left(R^{+},|\right),$ whwre $R^{+}$ denotes the set of all positive real numbers and $|$ denotes the relation divisibility, are the numbers $\sqrt{2}$ and 2 comparable? | **2 Marks** | **L2** | **CO3** |
| **8** | How many solutions does the equation $x\_{1}+x\_{2}+x\_{3}=9$ have, where $x\_{1}, $ $x\_{2},$ and $x\_{3}$ are non negative integers?  | **2 Marks** | **L3** | **CO4** |
| **9** | How many strings of length 3 can be formed from the lowercase letters of English alphabet? | **2 Marks** | **L3** | **CO4** |
| **10** | How many ways to distribute hands of 6 cards to each of five players from the standard deck of 52 cards? | **2 Marks** | **L3** | **CO4** |

 **Part B**

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| **Answer the Questions Total 80 Marks** |
| **11.** | **a.** | Obtain the Principle disjunctive normal of $\left(p˄q\right)˅\left(\~p˄r\right)˅\left(q˄r\right).$ | **10 Marks** | **L4** | **CO1** |
| **Or** |
| **12.** | **a.** | Show that the following premises are inconsistent : $e\rightarrow s, s \rightarrow h, a \rightarrow \~h$ and $e ˄ a$. | **10 Marks** | **L3** | **CO1** |
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| **13.** | **a.** | Show that the mapping $f : R \rightarrow R$ defined by $f(x)=\sqrt{2} x + \sqrt{3}$ for $x \in R$ is a bijective map from $R$ to $R$. | **10 Marks** | **L3** | **CO2** |
| **Or** |
| **14.** | **a.** | Let $f(x) = x+2, g(x) = x -2$ and $h(x) = 3x$ for $x \in R,$ where $R$ is the set of real numbers. Verify the commutativity of $f ∘g$ and $f ∘h$. | **10 Marks** | **L2** | **CO2** |

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| **15.** | **a.** | Show that the divisibility relation divides” $|"$ is a partial ordering on the set of positive integers. | **10 Marks** | **L3** | **CO3** |
| **Or** |
| **16.** | **a.** | Draw the Hasse diagram of the partial ordering $⊆$ on the power set $P(S)$ where $S = \left\{1,2,3\right\}.$ Further, find the supremum and infimum of $ A = \left\{\left\{1\right\},\left\{1,2\right\}\right\}$ and $B = \left\{\left\{2,3\right\},\left\{1,2,3\right\}\right\}.$ | **10 Marks** | **L3** | **CO3** |

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| **17.** | **a.** | Show that the diamond lattice and the pentagon lattice are not distributive. | **10 Marks** | **L3** | **CO3** |
| **Or** |
| **18.** | **a.** | Prove that cancelation laws holds in a Boolean algebra. | **10 Marks** | **L3** | **CO3** |

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| **19.** | **a.****b.** | How many ways to select four pieces of fruit from a bowl containing apples, oranges, and pears if the order in which the pieces are selected does not matter, only the type of fruit and not the individual piece matters, and there are at least four pieces of each type of fruit in the bowl?How many different strings can be made by reordering the letters of the word PRESIDENCY? | **10 Marks** | **L3** | **CO4** |
| **Or** |
| **20.** | **a.** | How many ways to pack six copies of the same book into four identical boxes, where a box can contain as many as six books? | **10 Marks** | **L3** | **CO4** |

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| **21.** | **a.** | Define an equivalence relation. Let $R$ be the relation on the set of real numbers such that $aRb$ if and only if $a-b$ is an integer. Is $R$ an equivalence relation? | **15 Marks** | **L1** | **CO2** |
| **Or** |
| **22.** | **a.** | Define an equivalence relation. Let $X = \left\{1,2,3,4,5,6,7\right\}$ and $R = \left\{\left(x,y\right)/x-y is divisible by 3\right\}.$ Show that $R$ is an equivalence relation. | **15 Marks** | **L1** | **CO2** |

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| **23.** | **a.** | Prove that $\left(D\_{20},|\right)$ is a distributive lattice where $D\_{20}$ is the set of all positive divisors of 20. | **15 Marks** | **L3** | **CO3** |
| **Or** |
| **24.** | **a.** | Prove that $\left(P(S),⊆\right)$ is a Boolean algebra where $S = \left\{p,q,r\right\}.$ | **15 Marks** | **L3** | **CO3** |