Register No.: ………………………………. Name: ………………………………………………………….

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), FEBRUARY 2022

(COMPUTER SCIENCE & SYSTEM ENGINEERING)

(2021 Scheme)

Course Code: **21SE101**

Course Name: **Discrete Structures for Computer Science**

Max. Marks: **60** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Let R = {(x,y)/x,y∈ Z & $x^2=y^2$ }. Show that R is an equivalence relation on Z.
2. Define Complete lattice and Bounded lattice.
3. Show that p→(p v ~q) is a tautology.
4. In how many ways can the letters of the word ‘ARRANGE’ be arranged such that *no two* R’s occur together.
5. Define group homomorphism with an example.
6. Prove that every cyclic group is Abelian.
7. For a Ring < R,+,.>,Prove that
   a. the additive identity of the ring is unique.
   b. the additive inverse of each element in a ring is unique.
8. Determine the multiplicative inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 7 \end{bmatrix}$ in the ring < $M_2(z)$,+,×>.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Let f: R\{3} →R\{1} defined by f(x) = $\frac{x-2}{x-3}$. Show that f is bijective and find the inverse of f. (6)

OR

10. Let A= {1,2,3…..,12} and let R be the equivalence relation on A× A defined by (a,b)R(c,d) if and only if a+d = b+c. Prove that R is an equivalence relation and find the equivalence class of (3,2). (6)

MODULE II

11. Let (A,R_1) and (B,R_2) be two Posets on A×B defined by a relation R by (a,b) R (x,y) if aR_1x and bR_2y. Prove that R is a partial order. (6)

OR

12. Define Distributive lattice. Show that lattice (Z^+,≤) is distributive. (6)

MODULE III

13. Show that the following argument is valid: (6)
It is not sunny in the afternoon and it is colder than yesterday. We will go for swimming if it sunny. If we do not go for swimming, we will take a trip. If we take a trip, then we will be home by sunset. Therefore, we will be at home.

OR

14. State and prove the *soundness* of propositional logic. (6)

MODULE IV

15. Determine the *number* of integer solution of $X_1+X_2+X_3+X_4=32$ where (6)
    a. $X_i \geq 0$ $1 \leq i \leq 4$
    b. $X_1, X_2 \geq 5$ & $X_3, X_4 \geq 7$
    c. $X_i \geq 8$ $1 \leq i \leq 4$

OR

16. Let X be the binomial random variable that consists the number of success, each with probability p, among n, Bernoulli trials. Prove that $E(X) = np$ (6)

MODULE V

17. Consider $G = \{1, -1, i, -i\}$ where $i = \sqrt{-1}$. Prove that G is a cyclic group under usual multiplication. (6)

OR

18. Let G be a finite group and H be a subgroup of G. Prove that order of H divides order of G. Is the converse always true? (6)

MODULE VI

19. Let $U = \{1, 2\}$ and $R = P(U)$ denotes the power set of U. Define + and * on the elements of R by (6)
A+B= {x/ x∈ A or x ∈ B, but not both}
A*B= A∩ B
Check whether < R, +,* > is a commutative ring with unity

OR

20. Find $[a]^{-1}$ in Z_{1009} for (6)
    1. a= 17
    2. a= 777

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