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**SAINTGITS COLLEGE OF ENGINEERING  
KOTTAYAM, KERALA**

(AN AUTONOMOUS COLLEGE AFFILIATED TO  
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIRST SEMESTER M.TECH. DEGREE EXAMINATION(R), MARCH 2021  
COMPUTER SCIENCE AND SYSTEMS ENGINEERING**

**Course Code:** 20CSSET101

**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  $f: \mathbb{R} \rightarrow \mathbb{R}$ ,  $g: \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = e^x$ ,  $g(x) = \log x$ . Then find  $f \circ (g \circ f)$  and  $g \circ (f \circ g)$
2. Let  $A = D_{45}$ , divisors of 45 and  $R$  be the relation defined by  $aRb$  if and only if  $a$  is divisible by  $b$ . Check whether  $R$  is an Equivalence Relation
3. Define Tautology. Show that  $p \rightarrow (p \vee \sim q)$  is a Tautology
4. Determine the coefficient of  $x^9 y^3$  in the expansion of  $(x + y)^{12}$
5. Prove that  $E(aX + b) = aE(X) + b$
6. Tossing a fair coin 3 times. If  $X = X_1 - X_2$  where  $X_1$  counts the number of heads and  $X_2$  counts the number of tails. Find Expectation of  $X$
7. Prove that If  $G$  is a finite group and if  $a \in G$  then order of  $a$  divides order of  $G$
8. Prove that a ring is commutative if and only if  $(a + b)^2 = a^2 + 2ab + b^2$ , for every  $a, b$  in a ring  $R$

**PART B**

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

**MODULE I**

9. Define an equivalence relation and check whether the set of all integers  $Z$  together with the relation  $x^2 = y^2$  is an equivalence relation (6)

**OR**

10. Prove that the function  $f: \mathbb{R} \rightarrow \mathbb{R}$  by  $f(x) = x^3$  is bijective and hence find its inverse. (6)

**MODULE II**

11. Explain the principle of Mathematical induction with an example. (6)

**OR**

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12. Find the complement of every element of the Lattice  $D_{42}$ , where  $D_{42}$  denotes the divisors of 42 with relation “divides”. (6)

## MODULE III

13. Show that the argument is valid. “If today is Tuesday, I have test in Maths or Economics. If my Economics Professor is sick, I did not have a test in Economics. Today is Tuesday and my Economics professor is sick. Therefore I have a test in Maths” (6)

OR

14. Explain completeness of propositional logic. (6)

## MODULE IV

15. A bag contains 9 balls of which 4 are red, 3 are blue and 2 are yellow. A ball is drawn at random from the bag. Find the probability that the ball will be 1) red 2) not blue 3) either red or blue. (6)

OR

16. Let A,B be the events taken from a sample space S.  $P(A)=0.6$   $P(B)=0.4$  and  $P(A \cup B)=0.7$ . Find  $P(A/B)$ ,  $P(A/\bar{B})$ . (6)

## MODULE V

17. Check whether the set  $A= \{1,-1,i,-i\}$  together with operation usual multiplication is an abelian group. (6)

OR

18. Define a subgroup and write any 5 subgroups of  $(Z_{12}, +_{12})$ . (6)

## MODULE VI

19. Determine whether  $\langle Z, \oplus, \otimes \rangle$  is a ring with binary operation  $x \oplus y = x+y-7$  and  $x \otimes y = x+y-3xy$ . (6)

OR

20. Is 777 a unit element in  $Z_{1009}$ ? If so find the multiplicative inverse of 777 in  $Z_{1009}$ . (6)

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