05 AUG 2023

Reg. No.												

Question Paper Code	12117

B.E. / B.Tech - DEGREE EXAMINATIONS, APRIL / MAY 2023

Second Semester

Computer Science and Engineering

(Common to Computer Science and Engineering (Cyber Security), Computer Science and Engineering (IOT), Computer Science and Engineering (AIML), Artificial Intelligence and Data Science, Information Technology & M.Tech. - Computer Science and Engineering)

20BSMA204 - DISCRETE STRUCTURES

(Regulations 2020)

Duration: 3 Hours　　　　Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

Marks, K-Level, CO

1. Find the range of $f(x) = \frac{x+1}{x-1}$. *2,K2,CO1*
2. Let $f, g: R \to R$ defined by $f(x) = 2x + 5$ and $g(x) = x - 5 \; \forall \; x \in R$. Find the composites $f \circ g$ and $g \circ f$. *2,K2,CO1*
3. State generalized pigeon hole principle. *2,K1,CO2*
4. From a club consisting of 6 men and 7 women, in how many ways can we select a committee of 4 persons that has at most one man? *2,K2,CO2*
5. Using truth table, prove that $(p \to q) \wedge (q \to r) \to (p \to r)$. *2,K2,CO3*
6. Obtain principal disjunctive normal form for $p \vee \neg q$. *2,K2,CO3*
7. Define ring with an example. *2,K1,CO4*
8. Show that $a + a = 1$ and $a . a = a \forall \; a \in B$. *2,K2,CO4*
9. State the handshaking theorem. *2,K1,CO5*
10. Define tree. *2,K1,CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) Let $f: Z \to Z$ be a function defined by $f(x) = 2x^2 + 7x$. Test f is one-one and onto. *8,K3,CO1*

(ii) Examine whether R an equivalence relation is or not where R is the relation on the set of integers Z defined as follows: For $a, b \in Z, a \; R \; b$ if and only if a is a multiple of b. *8,K3,CO1*

OR

b) (i) Let $f(x) = 2x + 3$ and $g(x) = x^2 + 4$, $h(x) = x + 2$ find $(f \circ g) \circ h$ and $f \circ (g \circ h)$. *8,K3,CO1*

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create　　***12117***

(ii) Let R be a relation on the set of integers Z and $\{a, b\} \in R$ if and only if $b = a^m$ for some positive integer$m$. Show that R is a partial order on Z. 8,K3,CO1

12. a) (i) Prove that $8^n - 3^n$is a multiple of 5 by using method of induction. 8,K3,CO2

(ii) Find the number of integers between 1 and 250 that are not divisible by any of the integer 2, 3, 5 and 7. 8,K3,CO2

OR

b) (i) In a survey of 100 students, it was found that 40 studied maths, 64 studied physics, 35 studied chemistry, 1 studied all the three subjects, 25 studied maths and physics, 3 studied maths and chemistry and 20 studied physics and chemistry. Find the number of students who studied chemistry only. 8,K3,CO2

(ii) a) In how many ways can 6 boys and 4 girls sit in a row? 8,K3,CO2

b) In how many ways can they sit in a row if the boys are to sit together and girls are sit together?

c) In how many ways can they sit in a row if the girls are to sit together?

d) In how many ways can they sit in a row if just the girls are to sit together?

13. a) (i) Prove that $\big((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))\big) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$ is a tautology. 8,K3,CO3

(ii) Obtain the PDNF and PCNF of $\big(P \to (Q \wedge R)\big) \wedge [\neg P \to (\neg Q \wedge \neg R)]$. 8,K3,CO3

OR

b) (i) Use indirect method to show that $R \to 7Q, R \vee S, S \to 7Q, P \to Q \Rightarrow 7P$. 8,K3,CO3

(ii) Show that the following premises are inconsistent. 8,K3,CO3

(a) If Jack misses many classes through illness then he fails high school.

(b) If jack fails high school, then he is uneducated.

(c) If Jack reads a lot of books then he is not uneducated.

(d) Jack misses many classes through illness and reads a lot of books

14. a) (i) Show that the set of all non zero real number is an abelian group under the operation $*$ defined by $a * b = \frac{ab}{2}$. 6,K3,CO4

(ii) State and prove Lagrange's theorem on finite group. 10,K3,CO4

OR

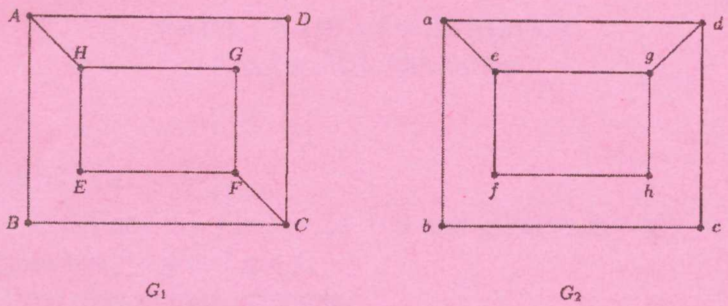
b) (i) Prove that the necessary and sufficient condition for a nonempty subset H of a group $(G,*)$ to be a subgroup is $a, b \in H \Rightarrow a * b^{-1} \in H$. 8,K3,CO4

(ii) In any Boolean algebra, prove that the following statements are equivalent. 8,K3,CO4

$$a + b = b,$$
$$a.b = a,$$
$$a' + b = 1,$$
$$a.b' = 0.$$

15\. a) (i) Prove that the maximum number of edges in a simple disconnected graph G with n vertices and k components is $\frac{(n-k)(n-k+1)}{2}$. 8,K4,CO5

(ii) Examine whether the following pairs of graphs G_1 and G_2 given in figures are isomorphic or not. 8,K4,CO5



OR

b) (i) Prove that a connected graph G is Euler graph if and only if every vertex of G is of even degree. 8,K4,CO5

(ii) A graph G is a tree if and only if every two vertices of G connected by a unique path. 8,K4,CO5