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Total No. of Pages: 02
Total No. of Questions: 09

B. Tech. (CSE) (IT)(Sem.-3rd)
DISCRETE STRUCTURES
Subject Code: BTCS-302
Paper ID: A1124

Time: 3 Hrs.

Max. Marks: 60

Note: Attempt all questions in these Sections.

Section –A

(10x2=20)

Q.1.

- (a) What is the power set of the set $\{0, 1, 2\}$.
- (b) Let $A = (a, b, c, d)$, $B = (x, y, z)$.
Find (a) $A \times B$ (B) $B \times A$
- (c) Define an ideal in a ring R . Give an example of an ideal in the ring of integers.
- (d) Find the values, if any, of the Boolean variable x that satisfy the equation $x + x = 0$.
- (e) How many positive integers between 100 and 999 inclusive are divisible by 7?
- (f) What is the generating function for the sequence 1, 1, 1,
- (g) Prove that the set of integers under the binary operation of addition is a group.
- (h) Give an example of a semi group without an identity element.
- (i) How many connected components are there in a discrete graph on n vertices?
- (j) Define a Hamiltonian circuit a graph. Give an example of a graph with a Hamiltonian circuit.

Section –B

Note: Attempt any Four questions from this section.

Q2. Prove that the relation 'congruence modulo' is an equivalence relation on

- the set of integers. Find the equivalence classes of this relation. 5
- Q3. Construct a circuit that produces the output $(x + y) \bar{x}$ 5
- Q4. How many elements are there in $A_1 \cup A_2 \cup A_3$ if each A_i has 100 elements ($i = 1, 2, 3$), each pair A_i, A_j has 50 common elements and 25 elements are common in all the three sets. 5
- Q5. Prove that in a finite group G , the order of any element divides the order of G . 5
- Q6. Let G be a connected planar simple graph with e edges and v vertices where $v \geq 3$, then prove that $e \leq 3v - 6$ 5

Section –C

Note: Attempt any two questions from this section

- Q7. A) Define a total ordering on the set $\{1, 2, 3, 5, 10, 12\}$ compatible with the partial order of divisibility.
 b) Give an example of a relation from a set A to a set B which is not a function. 5, 5
- Q8. Find an explicit formula for the Fibonacci numbers defined by (10)

$$f_n = f_{n-1} + f_{n-2}, f_0 = 0, f_1 = 1.$$
- Q9. A) Prove that A_n - the set of all even permutations on n symbols is a normal sub group of S_n - the set of all permutations on n symbols.
 b) Give an example of a non-commutative ring. 5, 5

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