Enrol. No. | S | R | H | U | | | | | | | | **Regn. No.** | D | D | | | | | | | | | |

END SEMESTER EXAMINATION, JUNE - 2019
BCA THIRD SEMESTER

COURSE CODE: BCA202	COURSE TITLE: DISCRETE MATHEMATICAL STRUCTURES

[Time allotted: Three hours] **[Max. Marks: 100]**

Note: *Attempt all Sections &Questions.*

Section (A)

Q. 1. Attempt **all** questions. **(2 x 10 = 20)**

a. Write down the absorption law of set theory.

b. Define equivalence relation.

c. Differentiate between Euler and Hamiltonian graph.

d. Discuss Pigeonhole principle with suitable example.

e. If f (x) = cos x and g(x) = x^3 , then (f o g) (x) is...

f. Let A be a finite set of size n. The number of elements in the power set of A x A is…………..

g. Is **(P Λ Q) Λ ~ (P ∨ Q)** a tautology or a fallacy?

h. What are the various types of conditional statement?

i. Find a set of three real numbers that is closed under addition modulo 2 and multiplication modulo 2.

j. Suppose **v** is a pendant vertex in a graph, then the degree of **v** is…………………………………….

Section (B)

Q. 2. Attempt **any 5** questions. **(7 x 5 = 35)**

a. If P(n, k) = P(n-1, k-1) + k P(n-1, k) with P(n, 1) = P(n, n) = 1, where P(n,k) is the number of partitions of a set with n elements into k subsets. Find P(4, 2) and compare your result by listing the partitions of {a, b, c, d}.

b. If P(n, r) = 240 and C(n, r) = 120, then find the value of n and r.

c. Define graph. Give an example of a graph which is Euler but not Hamiltonian and vice-versa.

d. Show that the set {1, 2, 3, 4, 5} is not a group under addition and multiplication modulo 6.

e. Consider an algebraic system (G, *), where G is the set of all non-zero real numbers and * is a binary operation defined by

a * b = (ab)/4

Show that (G, *) is an abelian group.

f. A set contains (2n+1) elements. If the number of subsets of this set which contain at most n elements is 8192. Find the value of n.

g. Draw a diagraph for each of the following relation

(i) Let A = {a, b, c, d} and let R = {(a, b), (b, d), (a, d), (d, a), (d, b), (b, a), (c, c)}

(ii) Let A = {1,2,3,4,5,6,7,8} and Let xRy , wherever y is divisible by x.

(iii) Determine which of the relations are reflexive, transitive, symmetric and antisymmetric.

Section (C)

Attempt **any 3** questions. **(15 x 3 = 45)**

Q.3. **a.** Solve the following recurrence relation: (10)

$$a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3} \text{ with } a_0 = 1, a_1 = -2, a_2 = -1$$

b. Using algebraic laws of set theory, prove that $((A \cup B) \cap A^c) \cup (B \cap A)^c = (A \cap B)^c$ (5)

Q.4. **a.** Prove that the set Q of rational numbers other than -1 forms an abelian group w.r.t. the operation * defined as:

$$a * b = a + b + ab$$ (10)

b. Out of 5 males and 6 females, a committee of 5 is to be formed. Find the number of ways in which it can be formed so that among the persons chosen in the committee there are at least 2 males and one female. (5)

Q.5. **a.** Solve the following recurrence relation using generating function (10)

$$a_{n+2} - 2a_{n+1} + a_n = 2^n \quad \text{with } a_0 = 2, a_1 = 1$$

b. If f,g: R→R where $f(x) = ax + b$, $g(x) = 1-x+x^2$ and $(gof)(x) = 9x^2 - 9x + 3$, then find the values of a and b. (5)

Q.6. **a.** Verify whether the set S = {0, 1, 2, 3, 4, 5} is an integral domain with respect to addition modulo 6 and multiplication modulo 6. (10)

b. A connected plane graph has 10 vertices each of degree 3. Into how many regions, does a representation of this planar graph split the plane? (5)

Q.7. **a.** Find a set of three real numbers that is closed under addition modulo 2 and multiplication modulo 2. (5)

b. Which of the following sets are equal?

(5)

$$S_1 = \{1, 2, 2, 3\}, \qquad S_2 = \{x \mid x^2 - 2x + 1 = 0\},$$
$$S_3 = \{1, 2, 3\}, \qquad S_4 = \{x \mid x^3 - 6x^2 + 11x - 6 = 0\}$$

c. A graph G has 21 Edges, 3 vertices of degree 4 and other vertices are of degree 3. Find the number of vertices in G. (5)