CBCS SCHEME

USN

18CS36

Third Semester B.E. Degree Examination, Aug./Sept.2020 **Discrete Mathematical Structures**

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define proposition, tautology, contradiction. Determine whether the following compound statement is a tautology or not.

 $\{(p \lor q) \to r\} \leftrightarrow \{\neg r \to \neg (p \lor q)\}$

(06 Marks)

b. Using the laws of logic, show that

 $(p \rightarrow q) \land [\neg q \land (r \lor \neg q)] \Leftrightarrow \neg (q \lor p)$

(07 Marks)

c. Establish the validity of the following argument:

 $\forall x, p(x) \lor q(x)$ $\exists x, \neg p(x)$ $\forall x, \neg q(x) \lor r(x)$ $\forall x, s(x) \rightarrow \neg r(x)$ $\exists x, \neg s(x)$

(07 Marks)

2 a. Define Converse, Inverse and Contrapositive of a conditional. Find converse, inverse and contrapositive of $\forall x, (x > 3) \rightarrow (x^2 > 9)$, where universal set is R. (06 Marks)

b. Test the validity of the following arguments:

- If there is a strike by students, the exam will be postponed but the exam was not postponed
 - :. there was no strike by students
- (ii) If Ram studies, then he will pass in DMS. If Ram doesn't play cricket, then he will study. Ram failed in DMS.

:. Ram played cricket

(06 Marks)

c. Let $p(x): x \ge 0$

 $q(x) | x^2 \ge 0$ and $r(x) : x^2 - 3x - 4 = 0$, then

for the universe completing of all real numbers, find the truth value of

 $\{(x) \land (x) \land (x)\}\$

(06 Marks)

(i) $\exists x \{p(x) \land q(x)\}$ (ii) $\forall x \{p(x) \rightarrow q(x)\}$ (iii) $\exists x \{\phi(x)\}$ d. Define dual of logical statement. Write the dual of the statement

 $(p \vee T_o) \wedge (q \vee F_o) \vee (r \wedge s \wedge T_o)$

(02 Marks)

Module-2

a Define well ordering principle and prove the following by mathematical induction.

(i)
$$1^2 + 3^2 + 5^2 + \dots (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$$

(ii) $1*3 + 2*4 + 3*5 + \dots + n(n+2) = \frac{n(n+1)(2n+7)}{n(n+2)}$

(12 Marks)

Find the coefficients of

(i) x^9y^3 in the expansion of $(2x-3y)^{12}$

(ii) $a^2b^3c^2d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$

(08 Marks)

1 of 3

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Module-5

9 a. Merge sort the list -1, 7, 4, 11, 5, -8, 15, -3, -2, 6, 10, 3.

(06 Marks)

b. Determine whether the following graphs are isomorphic or not. [Refer Fig.Q9(b)]

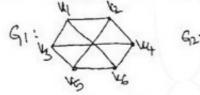


Fig.Q9(b)

(06 Marks)

- c. Define the following with an example to each:
 - (i) Simple graph
- (ii) Complete graph
- (iii) Tree (iv) Regular
- (v) Spanning subgraph (vi) Induced sub graph (vii) Complete Bipartite graph
- (viii) Complement of graph.

(08 Marks)

OR

- 10 a. Let G: (V, E) be a connected undirected graph, what is the largest possible value for |V| if |E| = 19 and deg(V) ≥ 4 for all v ∈ V?
 (06 Marks)
 - Construct an optional prefix code for the letters of the word ENGINEERING. Hence deduce the code for this word.
 (08 Marks)
 - c. T: (V, E) is a complete m-ary tree with | V | = n, if T has ℓ leaves and i internal vertices, prove the following results:
 - (i) n = mi + 1
 - (ii) $\ell = (m-1)i+1$

(iii)
$$i = \frac{\ell - 1}{m - 1} = \frac{n - 1}{m}$$

(06 Marks)