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MCS-212

**MASTER OF COMPUTER
APPLICATIONS**

(MCA-NEW)

Term-End Examination

June, 2026

MCS-212 : DISCRETE MATHEMATICS

Time : 3 Hours

Maximum Marks : 100

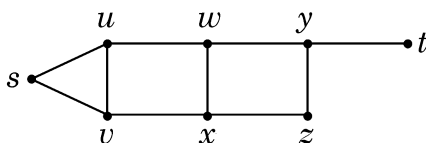
Weightage : 70%

Note : *Question No. 1 is compulsory and carries 40 marks. Attempt any three questions from the rest four questions (Question No. 2 to 5)*

1. (a) Verify that $(p \rightarrow q) \leftrightarrow (\sim p \vee q)$ is a tautology or not. 5

- (b) Show that $\sqrt{7}$ is irrational. 5
- (c) Construct the logic circuit and obtain the logic table for the expression $(x_1 \vee (x_2' \wedge x_3))$. 5
- (d) Given set $A = \{1, 2, 3, 4, 5\}$ and set $B = \{3, 5, 6, 7\}$. Determine $A \Delta B$ i.e., symmetric difference of Set A and B. Also verify that symmetric difference is commutative. 5
- (e) Define regular expression. Determine the language defined by regular expression ab^*a . 5
- (f) If there are 7 males and 5 females, then determine the number of circular arrangements that are possible, where females do not sit adjacent to each other. 5

- (g) Write the Pigeon hole principle. 5
- (h) Using the recurrence relation $b_n = nb_{n-1}$, $n \geq 2$ with $b_1 = 1$; show that $b_n = n!$. 5
2. (a) Write and explain the conditions for the two graphs G and H to be isomorphic. Use suitable example to support your explanation. 7
- (b) What are Bipartite graphs ? How Bipartite graphs can be used to solve some of the real life problems ? Explain. 7
- (c) Define vertex connectivity and vertex-cutset of a graph. Also, find both for the graph given below : 6



3. (a) Describe the following terms with suitable example/diagram : 8

(i) Trail

(ii) Circuit

(iii) Open trail

(iv) Eulerian Circuit

- (b) Is an Eulerian graph Hamiltonian ?

Give reason for your answer. 5

- (c) Explain Travelling Salesman Problem

with a suitable example. 7

4. (a) Use mathematical induction to prove that 8

$$1^2 + 2^2 + 3^2 + \dots + n^2$$

$$= \frac{n(n+1)(2n+1)}{6} \forall n \in \mathbb{N}$$

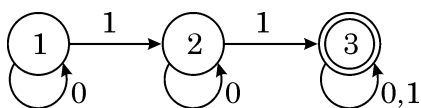
- (b) Find inverse of the function $f(x) = x^3 - 3$.

6

- (c) Define “Turing Acceptable Language” and “Turing Decidable Language”.

6

5. (a) Prepare the state transition table and deduce the regular expression for the language accepted by the finite automata given below :



Will this automata accept the input string “0001001”, check.

5

- (b) Write short notes on following : $5 \times 3 = 15$

- (i) Edge colouring

- (ii) Halting Problem
- (iii) Non-Deterministic Turing machine
- (iv) Moore Machines
- (v) Equivalence relations

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