K M M INSTITUTE OF POST GRADUATE STUDIES :: TIRUPATI

MCA 1 ST Semester / Mathematics For Computer Applications– Pre-Final

A

Time: 70 min **Marks: 70**

Answer Any Five Of The Following Questions **(5x4=20)**

1) Write the **truth table** for p→q.
2) Differentiate between **weak induction and strong induction**.
3) State the **basic principles of counting**.
4) What is the **divide and conquer technique**?
5) What are **vertices and edges**?
6) What is the difference between **adjacency matrix** and **adjacency list**?
7) Find the number of integers divisible by 2 or 3 between 1 and 20.
8) What are **binomial coefficients**?
9) Write a recurrence relation for Fibonacci sequence.
10) What is a **tautology**? Give one example.

Answer Any Five Of The Following Questions **(5x10=50)**

Unit-1

1) Prove using **logical equivalences** that $\neg(p \wedge q) \equiv (\neg p \vee \neg q)$

OR

2) Using **rules of inference**, prove that the following argument is valid:
   - If it rains, the ground is wet.
   - If the ground is wet, the match is canceled.
   - It rains.
   - The match is canceled.

Unit-2

3) Write a **recursive algorithm** to compute Fibonacci numbers and trace the execution for n=6n = 6n=6.

OR

4) Prove using **well-ordering principle** that there is no smallest positive rational number.

Unit-3

5) Using the **Pigeonhole Principle**, prove that in any group of 13 people, at least two have birthdays in the same month.

OR

6) How many 6-digit numbers can be formed using digits 1–9 without repetition?

Unit-4

7) Find how many integers from 1 to 1000 are **not divisible** by 2, 3, or 5.

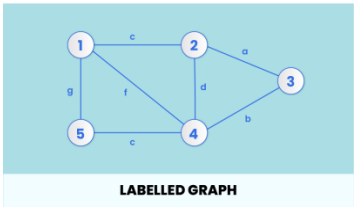
OR

8) Solve the linear recurrence relation using characteristic roots: an=2an−1+an−2

Unit-5

9) Define a **graph** and explain the following terms with the help of a **neatly labeled diagram**:

- Vertex
- Edge,
- Degree of a vertex,
- Isolated vertex,
- Pendant vertex,
- Loop and multiple edges



LABELLED GRAPH

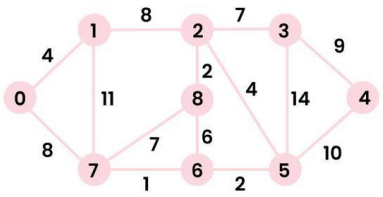
OR

10) **Shortest Path Problem**

Given a **weighted graph**:

a) Apply **Dijkstra's Algorithm,**

b) Find the shortest path between two specified vertices.



Working of Dijkstra's Algorithm

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B

Time: 70 min **Marks: 70**

Answer Any Five Of The Following Questions **(5x4=20)**

1) Distinguish between **universal** and **existential quantifiers**.
2) What is **structural induction**?
3) Define **permutation** and **combination**.
4) Write the recurrence relation for Tower of Hanoi problem.
5) What is **graph isomorphism**?
6) Define **Euler path** and **Euler circuit**.
7) What is the use of inclusion–exclusion principle?
8) What is counting with **repetition**?
9) Mention two advantages of recursion.
10) State any **four rules of inference**.

Answer Any Five Of The Following Questions **(5x10=50)**

Unit-1

11) Explain different **Proof Methods**:
- Direct proof,
- Proof by contrapositive,
- Proof by contradiction.

OR

12) Explain **Propositional Logic** and logical connectives in detail. Construct truth tables for compound propositions.

Unit-2

13) State and explain the **Principle of Mathematical Induction.**

OR

14) Explain **Recursive Algorithms** and trace the execution of a recursive function.

Unit-3

15) In how many ways can a committee of 4 members be chosen from 6 men and 5 women such that at least one woman is included?

OR

16) Find the number of ways to arrange the letters of the word **COMPUTER**.

Unit-4

17) Solve the recurrence relation:

$$a_n = 3a_{n-1} - 2, a_0 = 1.$$

OR

18) Using **Inclusion–Exclusion**, find the number of integers between 1 and 100 that are divisible by 3 or 5.

Unit-5

19) **Graph Isomorphism** - Give two graphs G1 and G2.
a) Draw both graphs
b) Check whether they are **isomorphic**
c) Justify using **degree sequence and adjacency structure**

OR

20) Discuss **Graph Coloring** and its applications.