

**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : BM-301

MATHEMATICS FOR COMPUTING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own
words as far as practicable.*

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following : $10 \times 1 = 10$

i) In how many ways can 5 questions be selected from 8 questions ?

- | | |
|-------|---------|
| a) 20 | b) 40 |
| c) 56 | d) 336. |

ii) Determine the type of grammar which consists of the productions,

$S \rightarrow aAB, AB \rightarrow bB, B \rightarrow b, A \rightarrow aB$

- | | |
|-------------------|--------------------|
| a) Type-1 grammar | b) Regular |
| c) Type-3 grammar | d) Type-2 grammar. |

iii) Express the following sentence in symbolic form :

It is raining but not cloudy.

- a) $\sim p \wedge \sim q$ b) $\sim (\sim p \vee q)$
c) $p \wedge \sim q$ d) none of these.

iv) Does there exist a simple graph with 5 vertices of the given degrees ?

1, 2, 3, 4, 5.

- a) No b) Yes
c) Sometime it exists d) Never exists.

v) If R_1 and R_2 are two regular expressions (R.E.) then $R_1 + R_2$ is

- a) R.E. b) CFG
c) CSG d) Regular grammar.

vi) Prim's Algorithm is used to find the minimal spanning tree of a

- a) Dense graph b) Sparse graph
c) Null graph d) Normal graph.

vii) How many bit strings of length 10 contain exactly four 1's ?

- a) 120 b) 720
- c) 386 d) 210.

viii) The mathematical model of a Mealy Machine is a

- a) 5-tuple b) 4-tuple
- c) 6-tuple d) none of these.

ix) A regular language is accepted by

- a) every DFA b) every NFA
- c) no DFA d) at least one DFA.

x) Number of elements contained in an incidence matrix of a digraph is

- a) 1 b) 2
- c) 3 d) None of these.

xi) If $n! = x(n-2)!$ then $x =$

- a) n b) $n - 1$
- c) $n(n - 2)$ d) $n(n - 1)$.

xii) The proposition $p \wedge (q \wedge \sim q)$ is a

- a) contradiction b) tautology
- c) both (a) and (b) d) none of these.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Prove that $((P \wedge \sim Q) \rightarrow R) \rightarrow (P \rightarrow (Q \vee R))$ is a tautology.
3. There are 50 students in each of the senior or junior classes. Each class has 25 male and 25 female students. In how many ways can an eight student committee be formed so that there are four females and three juniors in the committee ?
4. Find out the characteristic roots for $a_n + 4a_{n-1} + 3a_{n-2} = 0$ and hence solve it.
5. Find the generating function corresponding to the sequence $\{1, -1, 1, -1, 1, -1, \dots\}$.
6. Prove that for a graph $G = (V, E)$, there can be even number of odd vertices.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Write CNF & DNF of the following statement :

$$p \rightarrow (p \wedge (q \rightarrow p))$$

- b) Verify whether the argument given below is valid or not :

If I like Mathematics then I will study.

Either I do not study or I pass the examination.

If I do not graduate then I did not pass Mathematics.

.....

... If I like Mathematics, then I will graduate.

- c) Prove the following equivalence :

$$p \equiv (p \wedge q) \vee (p \wedge \sim q). \quad 5 + 5 + 5$$

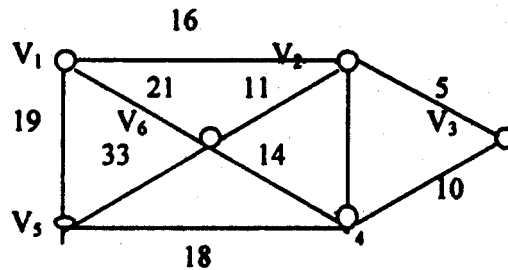
8. a) Prove that the number of vertices of odd degree in a graph is always even.
- b) Show that $(2n)! = 2^n \cdot n! \cdot \{1, 3, 5, \dots, (2n-1)\}$.
- c) In how many ways can three prizes be distributed among 4 boys when,
- i) no one gets more than one prize ?
- ii) a boy can get any number of prizes ? $5 + 5 + 5$
9. a) Find the Grammar on the set of terminals $\{a, b\}$ that generates the language $L = \{a, ab, ab^2, ab^3, \dots\}$.
- b) Draw the transition diagram for the FSA with $I = \{a, b\}$, $Q = \{q_0, q_1, q_2\}$, $F = \{q_0, q_1\}$ and δ is given by

Δ	A	B
Q_0	Q_0	Q_1
Q_1	Q_0	Q_2
Q_2	Q_2	Q_2

7 + 8

10. a) Write Kruskal's Algorithm for minimal spanning tree.

b) Find the minimal spanning tree of the following labeled connected graph by Kruskal's algorithm.



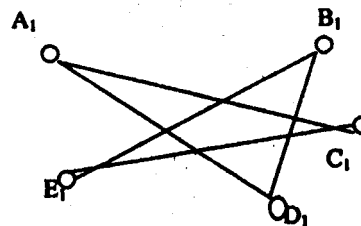
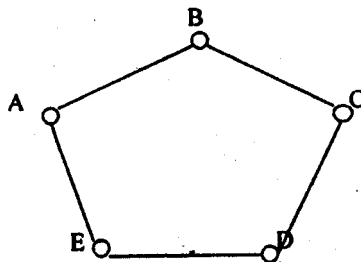
c) How many permutations can be made out of the letters of the word 'Basic' that

i) Begin with B ?

ii) End with C ?

$$5 + 5 + 5$$

11. a) Examine if the following two graphs are isomorphic



b) Using generating function solve the recurrence relation $a_n - 7a_{n-1} + 10a_{n-2} = 0$ for all $n > 1$, and $a_0 = 3, a_1 = 3$.

c) Write short notes on any *two* of the following :

i) Spanning Graph.

ii) Hamiltonian Graph.

iii) Digraph.

5 + 5 + 5

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