

M.Sc. Third Semester End Examination, 2022

**Applied Mathematics with Oceanology
and Computer Programming
PAPER-MTM-304**

Full Marks: 50

Time: 02 Hrs

The figures in the right hand margin indicate marks

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

Illustrate the answers wherever necessary

[Discrete Mathematics]

Answer question no. 1 and any four from the rest

1. Answer any eight questions:

8x2=16

- a) Define centre and diameter of a graph.
- b) Define planar graph. Is K_5 planar? Explain.
- c) Define generating function of a sequence of numbers. Find the generating function of the sequence $\{1, 1, 1, \dots\}$
- d) Define degree of a vertex in a graph. If a graph with 10 vertices each of degree six then how many edges are there?
- e) Define Bipartite graph.
- f) What is language on a non-empty set?
- g) What is phrase-structure grammar and give an example.
- h) Determine whether the word cbab belongs to the language generated by the grammar $G = (V, T, S, P)$ where, $V = \{a, b,$

(2)

c, A, B, C, S , $T = \{a, b, c\}$, S is the starting symbol and $P = \{S \rightarrow AB, A \rightarrow Ca, B \rightarrow Ba, B \rightarrow cb, B \rightarrow b, C \rightarrow cb, C \rightarrow b\}$

- i) Define walk, path of a graph.
- j) Write down the principle of induction and principle of inclusion.
- k) What is logic gate and define binary logic?
- l) Write the duality principle in Boolean algebra. Find the dual of the Boolean expression $ab(b+b'c)+a'c$

2. Answer any six questions

4x6=24

- a) Draw the diagram for finite state-machine

State	f		g	
	Input		Input	
	0	1	0	1
S_0	S_1	S_0	1	0
S_1	S_3	S_0	1	1
S_2	S_1	S_2	0	1
S_3	S_2	S_1	0	0

- b) Show that the distributive law $x(y+z) = xy + xz$ is valid
- c) Convert the Boolean expression $(a'+b+c')(a'+b+c)(a+b'+a)$ in disjunctive normal form.
- d) Use mathematical induction to prove that $z^n < n!2^n < n!$, for every positive integer n with $n \geq 4$

(3)

- e) Let G be a grammar with vocabulary $= \{S, 0, 1\}$, set of terminals $T = \{0, 1\}$ starting symbols S , and $P = \{S \rightarrow 11S, S \rightarrow 0\}$ What is $L(G)$ the Language of this grammar?
- f) Define spanning tree of a graph. Find two spanning tree of K_5
- g) Using mathematical induction, prove that

$$\frac{1}{1.2} + \frac{1}{2.3} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

Internal Assessment - 10
