

**2018****M.Sc.****2nd Semester Examination****APPLIED MATHEMATICS WITH OCEANOLOGY AND  
COMPUTER PROGRAMMING****PAPER—MTM-204****Subject Code—21****Full Marks : 50****Time : 2 Hours**

*The figures in the right-hand margin indicate full marks.*

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

*Illustrate the answers wherever necessary.*

**( Discrete Mathematics )**

1. Answer any five questions : 5×2
- (a) State Inclusion-Exclusion principle.
  - (b) How many leaf vertices exist of a complete binary tree of height  $h$  ?
  - (c) Define Boolean algebra.

*(Turn Over)*

- (d) Explain Hamiltonian graph with example.
- (e) Show that a Boolean algebra cannot have three elements.
- (f) Find the maximum number of edges of a simple  $n$  vertices graph.
- (g) State the modus tollens inference rule for propositional logic.
- (h) What are the differences between context-free and context-sensitive language ?

2. Answer any *five* questions :

5×4

- (a) Find the sequences corresponding to the generating functions

$$(i) f(x) = \frac{2}{1-4x^2}, \quad (b) f(x) = \frac{2}{1-3x}$$

- (b) Show that any cycle free graph of  $n$  vertices and  $(n - 1)$  edges is a tree.

- (c) Define and explain with example of the following terms "eccentricity", "radius", "diameter" and "center".
- (d) Find the number of primes less than 100 using inclusion and exclusion principle.
- (e) Show that  $s$  is a valid conclusion from the given premises

$$p \rightarrow \sim q, q \vee r, \sim s \rightarrow p, \sim r.$$

- (f) Let  $A = \{2, 3, 4, 6, 8, 24, 48\}$  be a partially order set with the relation  $R$  which is defined by 'x divides y'. Determine the greatest element, least element, all the maximal and minimal elements of  $A$ .
- (g) Using mathematical induction show that for all positive integer  $n$ ,  $7^{2n} + 16n - 1$  is divisible by 64.
- (h) Show that every simple connected planar graph satisfies the following inequality  $e \leq 3n - 6$ , where  $n$  be the number of vertices and  $e$  be the number of edges of the graph.

3. Answer any two questions :

2×5

- (a) Prove that a connected graph is Eulerian if and only if each vertex has even degree.

- (b) Let  $D_{35}$  be the set of positive factors of 35. Two binary operators '+' and '.' are defined as follows :  $a + b = \text{l.c.m.}(a, b)$  and  $a \cdot b = \text{g.c.d.}(a, b)$  for all  $a, b \in D_{35}$ . A unary operation '' on  $D_{35}$  is defined as  $a' = \frac{35}{a}$  for all  $a \in D_{35}$ .

Show that  $(D_{35}, +, \cdot, ', 1, 35)$  is a Boolean algebra.

- (c) Design a finite state automation that accepts those strings over  $\{0, 1\}$  such that the number of zeros is divisible by 3.

**[Internal Assessment — 10 Marks]**

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