

**M.SC. (MATHEMATICS) PART-I**  
**Discrete Mathematics &**  
**Differential Equations (R-2016)**  
**(JUNE - 2019)**

(3 hours)

[Total marks: 80]

Instructions:

- 1) Attempt any two questions from each section.
- 2) All questions carry equal marks.
- 3) Answer to Section I and section II should be written in the same answer book.

**SECTION-I ( Attempt any two questions)**

Q.1] A] Prove that ' if  $(a, m) = d$ , then a Diophantine equation  $ax + my = b$  is solvable

if and only if  $d|b$ '. [10]

B] Use Cardanos method to find the roots of the cubic equation  $64x^3 - 48x^2 + 12x - 1$ . [10]

Q.2] A] Define Derangement on ' $n$ '. Prove that  $D_n = n! \left[ 1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \dots + (-1)^n \frac{1}{n!} \right]$

by using the principle of inclusion and Exclusion. [10]

B] If  $S(n, k)$  denotes the Stirling number of second kind, then prove that

$$S(n, k) = \sum_{i=0}^k (-1)^i \times \binom{k}{i} (k-i)^n, \quad k \leq n. \quad [10]$$

Q.3] A] Given 5 points in the plane with integer coordinates, show that there exists a pair

of points whose midpoint also has integer coordinates. [10]

B] Let  $m$  and  $n$  be relative prime positive integer then prove that the system

$$x \equiv a \pmod{m} \text{ and } x \equiv b \pmod{n} \text{ has a solution.} \quad [10]$$

Q.4] A] Let a simple graph  $G(v, e)$  is connected then prove that  $v \leq e + 1$ . [10]

B] Find the disjunctive normal to the function  $F(x, y, z) = (x \vee y) \wedge z$ . [10]

**SECTION-II ( Attempt any two questions)**

Q.5] A] Show that solution matrix  $\Phi$  of  $y' = A(x)y$  is fundamental matrix if and only if

$$\det(\Phi) \neq 0. \quad [10]$$

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**J Elliott**



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