

Total No. of Pages : 2]

S-5022

B. C. A. (First Semester)
EXAMINATION, 2016-17

Paper Third

MATHEMATICAL FOUNDATION OF
COMPUTER SCIENCE

(BCA-103)

Time : Three Hours

Maximum Marks : 70

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Prove that the relation defined by 'is perpendicular' to in the set of straight lines in a plane is symmetric but neither reflexive nor transitive.

(b) If the mappings f and g are given by :

$$f = \{(1, 2), (3, 5), (4, 1)\}$$

$$g = \{(2, 3), (5, 1), (1, 3)\}$$

then write down pairs in the mapping $(f \circ g)$ and $(g \circ f)$.

2. (a) Show that the set of all even integers (including zero) with additive property in an abelian group.

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- (b) Prove that the set $\{1, -1, i, -i\}$ is an abelian multiplicative finite group of order 4.
3. Find the generating functions of the following :
- (a) $0, 1, -2, 4, -8, \dots$
- (b) $2, 4, 8, 16, 32, \dots$
4. Solve the difference equation, with the initial condition $a_0 = 1, a_1 = 1$:

$$a_n - 5a_{n-1} + 6a_{n-2} = 2^n + n, n \geq 2$$

5. (a) Prove that the statement :

$$[(p \Rightarrow q) \wedge (q \Rightarrow r) \Rightarrow (p \Rightarrow r)]$$

is a tautology.

- (b) Draw the Hasse diagram of a poset (A, \leq) , where $A = \{a, b, c, d, e, f\}$
6. Show that every finite group is isomorphic to a permutation group (Cayley's theorem).
7. (a) Discuss Peano's axiom. Prove using Mathematical induction that $10^{2n-1} + 1$ is divisible by 11 for all $n \in \mathbb{N}$.
- (b) If x and y are any elements of a group G , then prove that :

$$(xy)^{-1} = y^{-1}x^{-1}$$