Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination December 2024

Roll no...............................

Name of the Course and semester: B.Tech. III semester
Name of the Paper: Discrete Structure and Combinatorics
Paper Code: TMA-316

Time: 3 hour   Maximum Marks: 100

Note:
   (i)   All the questions are compulsory.
   (ii) Answer any two sub questions from a, b and c in each main question.
   (iii) Total marks for each question is 20 (twenty).
   (iv) Each sub-question carries 10 marks.

Q1.   (2X10=20 Marks)
  a.   Draw the Hasse diagram of Poset $(P(A), \subseteq)$, $where\ A = \{a,b,c\}$. Find greatest element, least element, minimal element and maximal element.   CO1

b. Prove that if R is an equivalence relation on set A then R^{-1} is also an equivalence relation on set A.

CO1

c . Define the following with examples: (i) Bijective function (ii) Many one function (iii) Invertible function (iv) Identity function.   CO1

Q2.   (2X10=20 Marks)
  a.   A die is thrown 8 times and it is required to find the probability that 3 will show (i) Exactly 2 times (ii) At least six times (iii) At most three times.   CO2

b. Define the following: (i) Normal distribution (ii) Random variables (iii) Exponential distribution (iv) Bayes theorem.   CO2

c. If mean and variance of a binomial distribution are 4 and 2 respectively, find the probability of (i) exactly 2 successes (ii) less than 3 successes (iii) at least 4 successes.   CO2

Q3.   (2X10=20 Marks)
a.   Define the following with suitable examples:
       (i) Quantifiers
       (ii) Tautologies   CO3
       (iii) Logical equivalence

b. Show that (i) $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$ CO3
(ii) $\neg(p \leftrightarrow q) \equiv (p \vee q) \wedge \neg(p \wedge q)$.

b.   Using Principle of Mathematical induction proves that $(n^5 - n)$ is divisible by 5.   CO3

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Q4.   (2X10=20 Marks)

a. Prove that the fourth root of unity $\{1, -1, i, -i\}$ form an abelian group with respect to multiplication.
                                                                                            CO4

b. A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has (i) no girls? (ii) at least one boy and one girl? (iii) at least 3 girls?   CO4

c. Define the following (i) Abelian group (ii) Pigeonhole principle (iii) Isomorphism.   CO4

Q5.   (2X10=20 Marks)

a. (i) State and prove Handshaking theorem.   CO5
(ii) Explain Adjacency matrix.

b. Define the following: (i) Directed graph (ii) Connected graph (iii) Complete graph (iv)
    Hamilton path.   CO5

c. Draw the following graphs: (i) $K_{3,4}$ (ii) W_6 (iii) K_5 (iv) C_6.   CO5