Graphic Era HILL UNIVERSITY

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University under section 2(f) of UGC Act, 1956

GEHU/04M/9.1.3

End Term (Odd) Semester Examination, December 2025

Roll No.........................

Name of the Course and Semester : **BCA - I Semester**
Name of the Paper : **Mathematical Foundations of Computer Science**
Paper Code : **TBC-103**
Time : 3 Hours

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.

1. (a) Explain finite set, infinite set, equal set, venn diagram and union of two set with suitable examples. (CO1)

   (b) Prove the Demorgan's Law on basis of the set theory. (CO1)

   (c) Write the following set in the set builder form:
   (i) A = {2, 3, 5, 7, 11, 13, 17, 19, 23},
   (ii) B = {1, 4, 9, 16, 25, 36, 49, 64, 81, 100},
   (iii) C = {1, 3, 5, 7, 9, 11, 13, 15, . . .},
   (iv) D = {1/2, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8}. (CO1)

   (20 Marks)

2. (a) Define the following terms with an example:
   (i) Range and domain of a function,
   (ii) One-to-one function,
   (iii) Onto function. (CO2)

   (b) Define composition of the functions. Let f, g and h be functions from N to N, where N is the set of natural numbers, such that $f(x) = x + 2$, $g(x) = 3x$ and $h(x) = 2$. Then determine:
   (i) fof (ii) fog (iii) goh (CO2)

   (c) Let A ={ 1, 2, 3, 4, 5, 6, 7 } and R = {(x,y): x-y is divisible by 3}. Show that R is an equivalence relation. (CO2)

   (20 Marks)

3. (a) Find the greatest common divisor (gcd) of the following pairs:
   (i) 66 and 88 (ii) 110 and 270 (iii) 29 and 291. (CO3)

   (b) Find the greatest common divisor (gcd) of 26 and 118 and express it in the form of $26x + 118y$ (that is, $gcd(26, 118) = 26x + 118y$ and find the values of x and y). (CO3)

   (c) Find the least common multilple (lcm) of the following pairs:
   (i) 16 and 38 (ii) 110 and 550 (iii) 39 and 198. (CO3)

   (20 Marks)

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4. (a) Define the following terms with an example:
   (i) Principle of mathematical induction,
   (ii) Random experiment,
   (iii) Independent event. (CO4)

   (b) Using the principle of mathematical induction, prove that
   $P(n) : 1 + 3 + 5 + 7 + \cdots + (2n-1) = n^2$. (CO4)

   (c) Using the principle of mathematical induction, prove that
   $P(n) : 1.2 + 2.2^2 + 3.2^3 + \cdots + n.2^n = (n-1)2^{n+1} + 2$. (CO4)

(20 Marks)

5. (a) Define the following terms with an example:
   (i) Diagonal matrix,
   (ii) Scalar matrix,
   (iii) Row matrix,
   (iv) Column matrix,
   (v) Zero matrix. (CO5)

   (b) Find the determinants of the following matrices:

$$A = \begin{pmatrix} -3 & -1 \\ -3 & -4 \end{pmatrix}, \quad B = \begin{pmatrix} -3 & -1 & 6 \\ -3 & -4 & 3 \\ 1 & 2 & 3 \end{pmatrix}, \quad C = \begin{pmatrix} -2 & -2 \\ -2 & -2 \end{pmatrix}.$$

(CO5)

   (c) Let

$$A = \begin{pmatrix} 1 & -1 & 3 \\ -2 & 0 & 1 \\ 6 & 3 & 1 \end{pmatrix}, \quad and \quad B = \begin{pmatrix} 1 & 0 & 8 \\ -3 & 4 & 3 \\ -1 & -2 & 3 \end{pmatrix}.$$

   Then find (i) AB (ii) BA (iii) A+B. (CO5)

(20 Marks)