

II Semester B.C.A. Examination, August/September 2023
(NEP – Freshers and Repeaters)
COMPUTER APPLICATION (Paper – II)
Discrete Mathematical Structures

Time : 2½ Hours

Max. Marks : 60

Instruction : Answer *all* the Sections.

SECTION – A

I. Answer **any six** questions.**(6×2=12)**

- 1) If $A = \{1, 2, 3\}$, $B = \{3, 4, 5\}$ and $C = \{0, 2, 3\}$ find $(A \cap B) \times C$.
- 2) Define Tautology.
- 3) State principle of mathematical induction.
- 4) Define scalar matrix with an example.
- 5) If $A = \begin{bmatrix} 4 & 1 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix}$ find $(A+B)^T$.
- 6) Show that ${}^n P_r = n \times (n-1) P_{r-1}$.
- 7) Find the value of ${}^{10} C_5$.
- 8) Write the recurrence relation for Fibonacci numbers.
- 9) Define a complete graph with an example.

SECTION – B

II. Answer **any four** questions.**(4×6=24)**

- 10) i) Write the converse, inverse and contra positive of the conditional statement
 “If two angles are right angles then they are congruent”.
- ii) Prove that $p \vee (q \wedge r) \leftrightarrow (p \vee q) \wedge (p \vee r)$ is a Tautology.

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- 11) i) Show that the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 3 - 4x$ is one-one and onto.
- ii) In how many ways the letters of the word "MISSISSIPPI" be arranged, so that all the S's are together ?
- 12) A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways this can be done when the committee consists of
- i) Exactly 3 girls
- ii) At least 3 girls
- iii) At most 3 girls
- 13) i) Find the coefficient of x^2y^4 in the expansion of $(x + y)^6$.
- ii) Explain a regular graph with an example.
- 14) Solve the system of equations using Cramer's rule
- $$3x + y + z = 3$$
- $$2x + 2y + 5z = -1$$
- $$x - 3y - 4z = 2.$$
- 15) In a survey of 260 college students the following data obtained. 64 had taken mathematics, 94 had taken computer science, 58 had taken electronics, 28 had taken both mathematics and computer science, 26 had taken both mathematics and electronics, 22 had taken both computer science and electronics, 14 had taken all the three. Determine
- i) How many students had taken none of the three ?
- ii) How many had taken only computer science ?

SECTION – C

III. Answer **any three** questions.

(3×8=24)

- 16) i) Determine the relation R in the set

$$A = \{1, 2, 3, \dots, 14\} \text{ defined as}$$

$$R = \{(x, y) | 3x - y = 0\} \text{ is an equivalence relation or not.}$$

- ii) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = x + 2$ and $g(x) = x - 2$. Find $f \circ g$ and $g \circ f$.



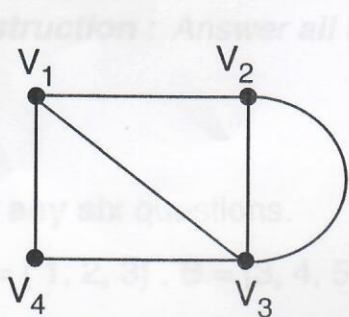
17) Prove by mathematical induction, for all positive integers $n \geq 1$

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

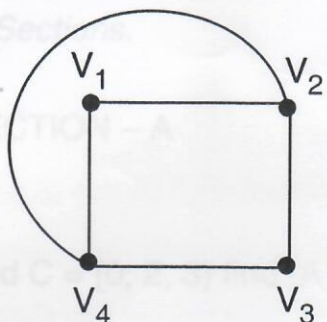
18) Solve the recurrence relation

$$a_n - 4a_{n-1} + 4a_{n-2} = 0, n \geq 2, a_0 = 1, a_1 = 3.$$

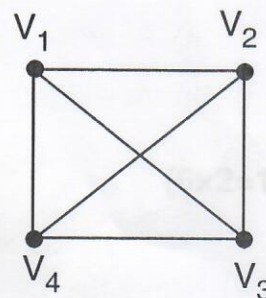
19) i) Explain which of the following is a complete graph and why ?



i)



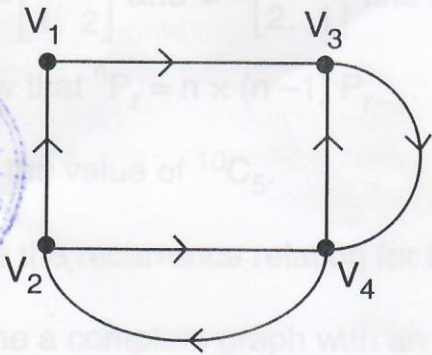
ii)



iii)

ii) Explain an Euler graph with an example.

20) i) Write the matrix of the following digraph.



ii) Draw the graph which is both Hamiltonian path and Hamiltonian circuit.

