

M.Sc. - I (Computer Science) (NEP Pattern) Semester-I  
**NEP-24-2 / 01MSCCS04.2 - Paper-IV - Elective-II - Discrete Mathematics**

P. Pages : 2

Time : Three Hours



**GUG/W/24/15082**

Max. Marks : 80

- Notes :
1. All the questions are compulsory and carry equal marks.
  2. Draw neat and labeled diagram wherever necessary.
  3. Avoid vague answer and write answers relevant and specific to question only.

**Either:**

1. a) Prove by mathematical induction  $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$  8
- b) Obtain the principle disjunctive normal form of  $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$ . 8

**OR**

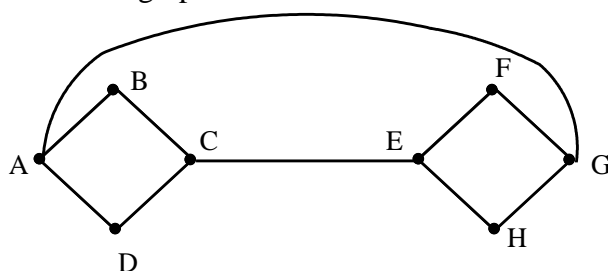
- c) Show that :  $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$  8
- d) Show that  $R \rightarrow S$  can be derived from the premises  $P \rightarrow (Q \rightarrow S), \neg R \vee S$  and  $Q$ . 8
2. a) Prove the following: 8
- i)  ${}^n P_n = 2 * {}^n P_{n-2}$  ii)  ${}^n P_n = {}^n P_{n-1}$
- b) Let  $X = \{1, 2, 3, 4\}$  and  $R = \{(x, y) / x < y\}$  Draw diagram of R and find its matrix. 8

**OR**

- c) How many distinguishable permutation can be formed from. 8
- i) BOOLEAN ii) BANANA
- d) Let  $A = \{a, b, c, d\}$ , Let  $R = \{(a, b), (a, c), (b, a), (b, c), (c, d), (d, a)\}$  find the transitive closure of R. 8

**Either:**

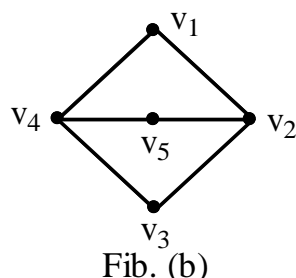
3. a) Determine Euler circuit for this graph. 8



- b) Define following terms: 8
- |               |                                     |
|---------------|-------------------------------------|
| i) Graph      | ii) Mixed graph                     |
| iii) Diagraph | iv) Initial node and terminal node. |

**OR**

- c) Let  $(L, \leq)$  be a lattice and  $*$  &  $\oplus$  be binary operation called meet Join, then for any  $a, b \in L$   $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$ . 8
- d) Show that the graph of fig. (b) does not contain a Hamiltonian cycle. 8



**Either:**

- 4 a) Let  $(A, *)$  be semigroup, show that for  $a, b, c$  in  $A$ , if  $a * c = c * a$  and  $b * c = c * b$ , then  $(a * b) * c = c * (a * b)$ . 8
- b) Let  $G$  be the grammar. 8
- $S \rightarrow aB \mid bA$
- $A \rightarrow a \mid aS \mid bAA$
- $B \rightarrow b \mid bS \mid aBB$
- For the string 'aaabbabba'
- Find : i) Leftmost derivation ii) Rightmost derivation

**OR**

- c) Define Binary operation. Explain its various properties. 8
- d) Show that inverse of an element 'a' in the group is unique. 8

5. Attempt all the questions:
- a) Write a short note on SETS and SUBSETS with example. 4
- b) Determine the value of following. 4
- |                    |                     |
|--------------------|---------------------|
| i) ${}^{50}C_{45}$ | ii) ${}^{20}C_{10}$ |
|--------------------|---------------------|
- c) Write down a function of Boolean algebra's. 4
- d) Explain: 4
- |             |                    |
|-------------|--------------------|
| i) Subgroup | ii) Abelian group. |
|-------------|--------------------|

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