Reg. No. : | | | | | | | | | | | | |

# Question Paper Code : X 20788

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth Semester
Computer Science Engineering
MA 6566 – DISCRETE MATHEMATICS
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Give the truth value of $T \leftrightarrow T \wedge F$.

2. Write the symbolic representation of "if it rains today, then I buy an umbrella".

3. How many different words are there in the word ENGINEERING ?

4. State the pigeon hole principle.

5. Define a complete graph.

6. Draw the graph with the following adjacency matrix $\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$.

7. Prove that inverse of each elements in a group is unique.

8. Define a Field.

9. Let $X = \{1, 2, 3, 4, 5, 6\}$ and R be a relation defined as $\langle x, y \rangle \in R$ if and only if $x - y$ is divisible by 3. Find the elements of the relation R.

10. Show that the absorption laws are valid in a Boolean algebra.

PART – B **(5×16=80 Marks)**

11. a) i) Obtain the PDNF and PCNF of $(P \wedge Q) \vee (\sim P \wedge R)$. **(8)**

ii) Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q, Q \rightarrow R, P \rightarrow M, \sim M$. **(8)**

(OR)

b) i) Show that $(x)[P(x) \rightarrow Q(x)] \wedge (x)[Q(x) \rightarrow R(x)] \Rightarrow (x)[P(x) \rightarrow R(x)]$. **(8)**

ii) Show that $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$, without using truth table. **(8)**

12. a) i) Using induction principle, prove that $n^3 + 2n$ is divisible by 3. **(8)**

ii) Use the method of generating function, solve the recurrence relation $s_n + 3s_{n-1} - 4s_{n-2} = 0; n \geq 2$ given $s_0 = 3$ and $s_1 = -2$. **(8)**

(OR)

b) i) Prove that in a group of six people, atleast three must be mutual friends or at least three must be mutual strangers. **(8)**

ii) From a club consisting of six men and seven women, in how many ways we select a committee of (1) 3 men and four women ? (2) 4 person which has at least one women ? (3) 4 person that has at most one man ? (4) 4 persons that has children of both sexes ? **(8)**

13. a) i) If G is a connected simple graph with n vertices with $n \geq 3$, such that the degree of every vertex in G is at least $\frac{n}{2}$, then prove that G has Hamilton cycle. **(10)**

ii) Prove that the complement of a disconnected graph is connected. **(6)**

(OR)

b) i) Define isomorphism between two graphs. Are the simple graphs with the following adjacency matrices isomorphic ? **(10)**

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$

ii) Prove that the number of odd degree vertices in any graph is even. **(6)**

14. a) i) Prove that in a graph, $(a*b)^{-1} = b^{-1} * a^{-1} \ \forall a, b \in G$. **(8)**

ii) Prove that for any commutative Monoid $(M, *)$, the set of all idempotent elements forms a submonoid. **(8)**

(OR)

b) i) Prove that Kernel of a homomorphism is a normal sub group of G. **(8)**

ii) Prove that in a finite group the order of any subgroup divides the order of the group. **(8)**

15. a) i) Show that every chain is a distributive lattice. **(8)**

ii) In a distributive complemented lattice. Show that the following are equivalent.

i) $a \leq b$

ii) $a \wedge \bar{b} = 0$

iii) $\bar{a} \vee b = 1$

iv) $\bar{b} \leq \bar{a}$. **(8)**

(OR)

b) i) Show that the De Morgan's laws are valid in a Boolean Algebra. **(8)**

ii) Show that every chain is modular. **(8)**