

CBCS SCHEME

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16/17MCA15

First Semester MCA Degree Examination, Aug./Sept. 2020

Discrete Mathematical Structures

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Express the contra positive, converse, inverse and negation forms of the following conditional statement. "If x is rational, then x is real". (06 Marks)
- b. Using the laws of logic, simplify the Boolean expression $(p \wedge \neg q) \vee q \vee (\neg p \wedge q)$. (05 Marks)
- c. Contrast truth table for i) $p \vee \neg q \Rightarrow p$ ii) $(\neg(p \wedge q) \wedge r) \Rightarrow \neg p$. (05 Marks)

OR

- 2 a. Prove the following implications without using the truth tables
 $(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r) \rightarrow r$ (06 Marks)
- b. Show that
 $((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$ is a tautology. (05 Marks)
- c. For each integer x, if x is even, then $x^2 + x$ is even. Write the negation of the above statement. (05 Marks)

Module-2

- 3 a. If $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 3, 4\}$ and $U = \{0, 1, 2, 3, \dots, 9\}$. Then show that $A - B = A \cap B'$ and if $B < A$ then $B - A = \phi$. (06 Marks)
- b. Given that $f : \mathbb{R} \rightarrow \mathbb{R}$ such that $f(x) = x^2$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ given as $g(x) = x + 3$. Find $\text{gof}(2)$ and $\text{fog}(2)$. (05 Marks)
- c. Show that the mapping $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = ax + b$, where $a, b \in \mathbb{R}$, and $a \neq 0$ is invertible. Define its inverse. (05 Marks)

OR

- 4 a. Let A, B, C be three sets, then show that $A \times (B \cup C) = (A \times B) \cup (A \times C)$ (06 Marks)
- b. $\langle P(A), \subseteq \rangle$. Where $A = \{a, b, c\}$. Design Hasse diagram for poset and find first and last element. (05 Marks)
- c. Determine the domain and range of the given function $-\sqrt{-2x+3}$. (05 Marks)

Module-3

- 5 a. Find the number of different arrangements of the letters of the word REFERENCE. (06 Marks)
- b. A group of students 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 girl (ii) at least one girl and a boy. (05 Marks)
- c. In a class of 25 students of economics and political science, 12 students have taken economic, out of these, 8 have taken economics but not political science. Find the number of students have taken economics and political science and those who have taken political science but not economic. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, $42+8=50$, will be treated as malpractice.

OR

- 6 a. Find the particular solution of the recurrence relation $a_r - 3a_{r-1} + 2a_{r-2} = 3^r$ where $r \geq 2$. (06 Marks)
- b. If ${}^{48}C_{12} + {}^{48}C_{13} + {}^{49}C_{14} = {}^{50}C_x$. Find the value of x. (05 Marks)
- c. State and explain generalized Pigeonhole principle. (05 Marks)

Module-4

- 7 a. State and prove addition theorem in probability. (06 Marks)
- b. For any two independent events A and B, prove that $P(A \cap B) = P(A) \cdot P(B)$ (05 Marks)
- c. If 10% of bolts proceed by a machine are defectives determine the probability that out of 10 bolts chosen at random (i) one will be defective (ii) at least one will be defective and (iii) at most two will defective. (05 Marks)

OR

- 8 a. Explain axioms of probability. (06 Marks)
- b. A card is drawn from a well shuffled pack of playing cards. What is the probability that it is either a spade or a king? (05 Marks)
- c. If three coins are tossed, represent the sample space and the event of getting (i) two heads and one tail (ii) at least two tails and the number of sample points in them. (05 Marks)

Module-5

- 9 a. Explain the terms with examples.
i) pendent vertex ii) walk iii) regular graph iv) Euler graph. (06 Marks)
- b. Show that the complete bipartite graph $K_{3,3}$ is non planar (05 Marks)
- c. Define Hamiltonian cycle. How many edge disjoint Hamiltonian cycle exist in the complete graph with seven vertices? (05 Marks)

OR

- 10 a. Explain the terms with example :
(i) Complete graph (ii) Bipertite graph (iii) Wheel (iv) Hamiltonian Graph. (06 Marks)
- b. Define isomorphism and show that the following graphs are isomorphic (Ref Fig Q10(b)).

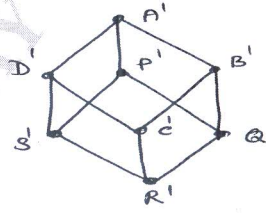
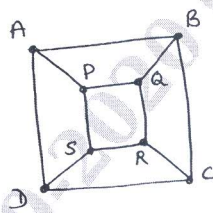
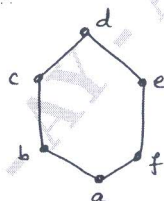


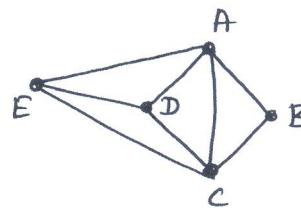
Fig Q10(b)

(05 Marks)

- c. What is proper colouring of a graph? Explain chromatic number. Determine the chromatic number of the following graphs (Ref. Fig Q10(c))



(i)



(ii)

Fig Q10(c)

(05 Marks)