22323/C 230

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

III Semester B.C.A.2 Degree Examination, November 2015

(Repeaters)

DISCRETE MATHEMATICAL STRUCTURES

Time : 3 Hours] [Max. Marks : 80

Instruction : *Scientific Calculators are allowed.*

PART A

I. Answer **any ten** questions : **(10 × 2 = 20)**

1. If $A = \{a, b, c, d\}$, $B = \{d, e, f, g\}$, then compute (a) $A - B$ (b) $B - A$.
2. Define combination with example.
3. Write the recursive formula for the sequence 5, 10, 20, 40, 80, 160.
4. Construct the truth table for $q \to p \vee q)$.
5. Define existential quantifier.
6. State well ordering principle.
7. Find the GCD of 108 and 288.
8. Define equivalence relation.
9. List all partitions of $A = \{a, b\}$.
10. If $A = \{a, b, c\}$, $B + \{c, d, e, f\}$, then find $A \times B$.
11. Let $A = \{2, 3, 4, 5\}$ and R be a relation on A defined by aRb if and only if $a = b$.
12. Consider the functions f and g defined by $f(x) = x^3$ and $g(x) = x^2 + 1 \ \forall \ x \in R$. Find $f \circ g$.

P.T.O.

PART B

II. Answer any **six** questions : **(6 × 5 = 30)**

13. A certain question paper contains two parts A and B each containing 4 questions. How many different ways a student can answer 5 questions by selecting atleast 2 questions from each part?

14. With usual notations prove that $\overline{A \cup B} = \overline{A} \cap \overline{B}$.

15. State any five laws of logic.

16. Give direct proof of the statement "Sum of two odd integers is even".

17. Prove by the method of mathematical induction that $1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$ $\forall\ n \in N$.

18. Find the GCD of 275 and 726 and express it as $275x + 726y$.

19. Let $A = [a, b, c, d, e\}]$ and $R = \{(a, a), (a, b), (b, c), (c, d), (c, e), (d, e)\}$ compute (a) R^2 (b) R^{∞}.

20. If R is a relation on $A = \{a_1, a_2 \ldots a_n\}$ then prove that $M_{R^2} = M_R \odot M_R$.

PART C

III. Answer any **three** full questions : **(3 × 10 = 30)**

21. (a) A fair die is thrown twice. Find the probability that

    (i) an even number occurs in atleast one throw.

    (ii) even numbers occur on both throws.

    (b) For any three sets prove that $A \cup (B \cup C) = (A \cup B) \cup C$.

(5 + 5 = 10)

22. (a) State any five rules of inference along with their names.

    (b) Test the validity of the argument :

$$\begin{array}{l} p \to r \\ \neg p \to q \\ q \to s \\ \hline \therefore\ \neg r \to s \end{array}$$

(5 + 5 = 10)

23. State and prove the fundamental theorem of arithmetic.

(10)

24. (a) Prove that congruence mod 2 is an equivalence relation.

(b) Let $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c\}$. Let

$R = \{(1, a), (1, b), (2, b), (2, c), (3, b), (4, a)\}$

compute (i) $\overline{R}$ (ii) R^{-1}.

(5 + 5 = 10)

25. (a) If $f : A \to B$ is a bijection prove that $f^{-1} : B \to A$ is also bijection.

(b) Let $f : A \to B$ and $g : B \to C$ are invertible functions then prove that $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$.

(5 + 5 = 10)