SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

NOV 2019

Course Code: **MAT133**

Course: **DISCRETE MATHEMATICS**

Question Paper No. : **N0747**

Duration: **3** hours

Max. Marks: **100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Does the statement R justify the statement A given below. Justify.
   Assertion (A) : The set of Real numbers, R forms an Integral Domain under usual Addition and Multiplication.
   Reason (R): The algebraic structure (R, +) is an Abelian group.

2. Define the term Coset of a subgroup with an appropriate example.

3. How many one-one function can be constructed from a set A containing 4 elements to a set B containing 9 elements?

4. Determine how many 4-digit even numbers less than 5000 can be formed using the digits 3,2,6,7 and 4?

5. Write the dual of the Boolean function $f(x,z) = x\bar{z} + x \bullet z + \bar{x} \bullet 1$.

6. Construct a truth table verifying the expression
   $$\sim(p \vee q) \equiv \sim p \wedge \sim q.$$

7. Compare the XOR Gate and the OR gate by drawing the corresponding Truth tables. Are the two gates opposites of each other?

8. Evaluate $\lim_{x \to \infty} \frac{4x^5-1}{3x^3+7}$

9. Represent the sequence 6,10,12,18,28,40,58 ,... as a recurrence relation.

10. Solve the recurrence relation $S(K) - 2S(K-1) = 6$ if $S(0) = 2$

PART –B

Answer all the questions **4 x 15 = 60 Marks**

11. Consider the problem of affixing stamps to post letters and suppose your local stamp vendor has only 5-rupee stamps and 9-rupee stamps. Comment on the minimum postage of N rupees such that any postage of K rupees can be managed by using only 5-rupee and 9- rupee stamps.
Justify your answer to question 11 by sketching a valid appropriate proof of the statement .

(OR)

12. Use the principle of Mathematical Induction and establish the correctness of the following statement.
$6 \times 7^n - 2 \times 3^n$ is divisible by 4 for all integer values of n.

13. Evaluate the volume of the solid bounded by $x^2 + y^2 = 9$ above $z = 0$ and below $x + z = 4$.

(OR)

14. Change the order of integration and evaluate the integral $\int_0^1 \int_{x^2}^{2-x} xy\, dy\, dx$

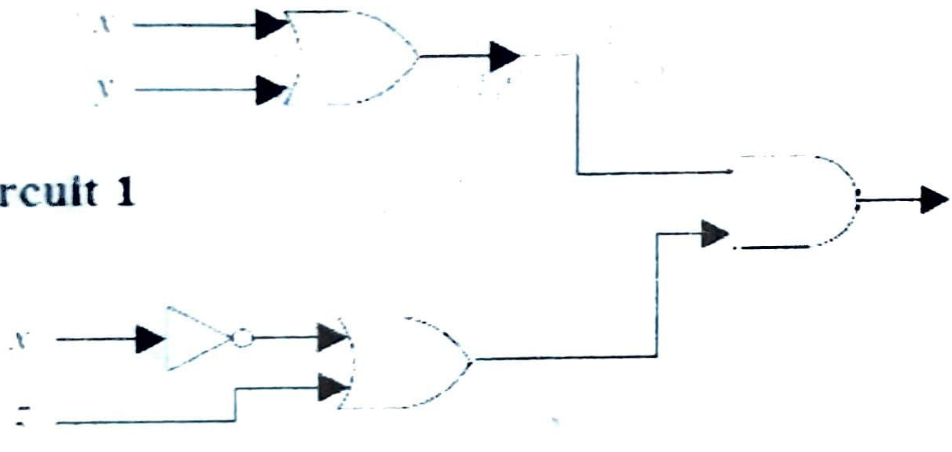
15. Define the order of a subgroup H of a group (G,*). Recall Lagrange's theorem between the order of a subgroup H and the order of a subgroup G and establish a proof by using the properties of cosets.

(OR)

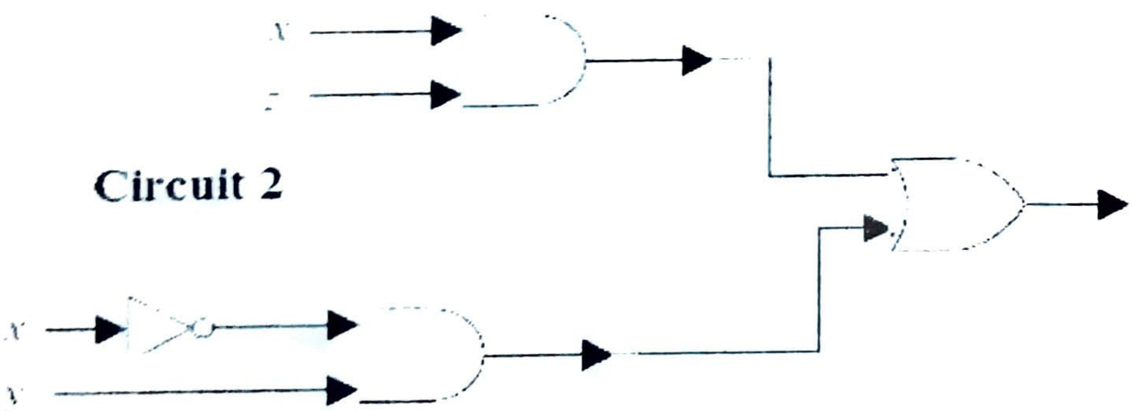
16. Prove that the set of all ordered pairs (a,b) of real numbers is a commutative ring with zero divisors under the binary operations $\oplus$ and $\circ$ defined as follows $(a,b) \oplus (c,d) = (a+c, b+d)$ and $(a,b) \circ (c,d) = (ac, bd)$.

17. Find the output of the circuits given below.

Draw truth tables for both circuits to determine if they give the same output.



Circuit 1



Circuit 2

(OR)

18. Simplify the following Boolean expressions using Boolean Algebra

i) $((x + y + xy)(x + z)$
ii) $x(y + z\overline{(xy + xz)}$
iii) $x\bar{y} + z + (\bar{x} + y)\bar{z}$

PART - C

Answer the following **1x 20 = 20 Marks**

19. a) Solve the Non-Homogenous recurrence relation $S(k) + 8(k - 1) + 12S(k - 2) = 42k + 20, S(0) = 0, S(1) = 6$ and verify the answer by determining S(2) in two different methods.

b) Use Karnaugh Maps to minimize the sum of product expansion $f(a, b, c, d) = \Sigma(2,3,7,9,11,13)$

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