SASTRA DEEMED UNIVERSITY

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

End Semester Examinations

March 2021

Course Code: **MAT133**

Course: **DISCRETE MATHEMATICS**

Question Paper No. : **U028**

Duration: **3** hours

Max. Marks:**100**

PART-A

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

1. Draw the logic diagram for the Boolean expression x'y+y'z+xz, without simplifying it.

2. Construct the truth table for the Boolean function
   F(a,b,c) =ab+ac+a'c

3. Change the order of integration in $\int_{y=0}^{2}\int_{x=0}^{y}(xy+4)dxdy$

4. Evaluate $\int_{0}^{\frac{\pi}{2}}\int_{0}^{2} r\, sin^4\theta\; dr\; d\theta$

5. Obtain $\frac{d^2y}{dx^2}$, if y = cos2x+e^xsinhx.

6. Give an example for a relation, which is neither reflexive nor irreflexive.

7. Define integral domain.

8. Solve S(n)-5S(n-1)+6S(n-2) =0.

9. How many different strings can be made from the letters in MISSISSIPPI, using all the letters?

10. State generalized pigeonhole principle.

PART-B

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

11. (a) Obtain the sum of product canonical form for the Boolean expression x'y+x'z+y'z using truth table and hence find the product of sum canonical form.
    (b) Simplify the Boolean expression abc+a'b+ac'd using Karnaugh map.

(OR)

12. Prove the following laws for Boolean algebra.
    (i) Absorption law
    (ii) De Morgan's law
    (iii) Idempotent law
    (iv) Involution law

13. (a) Obtain the n^{th} derivative of $y = \frac{1}{x^2+a^2}$ with respect to x.
    (b) If $y=\frac{ax^2+bx+c}{1-x}$, where a,b and c are constants then prove that $(1-x)\frac{d^3y}{dx^3} = 3\frac{d^2y}{dx^2}$

(OR)

14. (a) Find the volume of the rectangular box which is bounded by x=0, x=2, y=0, y=3, z=0 and z=4 using triple integrals.
    (b) Change the order of integration in $\int_0^{\frac{1}{2}}\int_y^{1-y} xy\, dx\, dy$ and hence evaluate it.

15. (a)State and prove Lagrange's theorem. Is the converse true? Justify.

(b) If in a group G, $(a.b)^2=a^2.b^2$ then show that G is abelian.

(OR)

16. (a) If A, B and C are sets then prove that
$A X(B \cup C) = (A XB) \cup (AXC)$
(b) Find the relation graph and matrix of the relation R, if $R=\{(a,b) / a < b\}$ is a relation on the set $A =\{1,2,3,4,5,6\}$.Is R transitive? Explain.
(c) Define field and give an example for a ring which is not a field.

17. (a) Show that if five integers are selected from the first eight positive integers, there must be a pair of these integers with a sum equal to 9.
(b) Prove that $n !> 2^n$, where $n >3$.
(c) How many four digit numbers can be formed using the digits 0,1,2,3,4,5 and 6?

(OR)

18. (a) Consider a game in which two players take turns removing any positive number of matches they want from one of two piles of matches. The player who removes the last match wins the game. Show that if the two piles contain the same number of matches initially, the second player can always guarantee a win.
(b) Suppose that a valid code word is an n-digit number in decimal notation containing an even number of zeros. If a(n) denotes the number of n-digit codewords. Find a recurrence relation for a(n) and hence solve it using generating function.