Reg.No.

23697

Velammal College of Engineering and Technology

Viraganoor, Madurai – 625 009
(Autonomous)

B.E./B.Tech. End Semester Examinations April 2024

Second Semester | **Regulation 2021**
Time : 3 Hours | **Max. Marks 100**

21MA103 – SAMPLING TECHNIQUES AND NUMERICAL METHODS

(Common to ECE , CSE ,IT AND AI&DS branches)

(Statistical tables are permitted)

Answer ALL Questions
PART-A (10 x 2 = 20 Marks)

1. If $\bar{A}$ is the complement of A then prove that $P(\bar{A}) = 1 - P(A)$.
2. Let X and Y are two independent events such that P(X) = 0.3 and P(Y) = 0.7. Find P(X or Y).
3. What are Type-I and Type-II errors?
4. Give two applications of χ^2 test.
5. What are the basic principles in design of experiments?
6. Compare Latin Square Design and Randomized Block Design.
7. State order of in Newton-Raphson method.
8. Distinguish between direct and iterative method of solving simultaneous equations.
9. State Lagrange's interpolation formula.
10. State the basic principle deriving Simpson's $\frac{1}{3}^{rd}$ rule

Part – B (5 x 16 = 80 marks)

11. a) (i) An urn contains 10 white and 3 black balls. Another urn contains 3 white and 5 black balls. Two balls are drawn at random from the first urn and placed in the second urn and then 1 ball is taken at random from the later. Calculate the probability that it is a white ball?.

(ii) The probability that at least one of the events A and B occurs is 0.6. If A and B occur simultaneously with probability 0.2, then what is $P(\bar{A}) + P(\bar{B})$? (8 + 8 Marks)

OR

b) (i) A box contains 2000 components of which 15% are defective. A second box contains 5000 components of which 25% are defective. Two other boxes contains 1000 components each with 10% defective components. A box is chosen at random and an item selected was found to be defective. Calculate the probability that this has come from the second box

(ii) Write the axioms and properties of probability. (8 + 8 Marks)

12. a) (i) A sample of 100 bulbs of brand A gave a mean lifetime of 1200 hours with a S.D of 70 hours, while another sample of 120 bulbs of brand B gave a mean lifetime of 1150 hours with a S.D of 85 hours. Can we conclude that brand A bulbs are superior to brand B bulbs?

(ii) In one sample of 10 observations, the sum of the squares of the deviations of the sample values from the sample mean was 120 and in another sample of 12 observations it was 314. Test whether this difference is significant at 5% level of significance.

(8 + 8 Marks)

OR

b) (i) A survey of 320 families with 5 children each revealed the following distribution:

No. of boys	:	5	4	3	2	1	0
No. of girls	:	0	1	2	3	4	5
No. of families:		14	56	110	88	40	12

Identify this result consistent with the hypothesis that male and female births are equally probable?

(ii) A mathematics test was given to 50 girls and 75 boys. The girls made an average grade of 75 with a S.D. of 6 , while boys made an average grade of 82 with a S.D. of 2 . Compute whether there is any significant difference between the performance of boys and girls.

(8 + 8 Marks)

13. a) An experiment was designed to study the performance of 4 different detergents for cleaning fuel injectors. The following cleanness readings were obtained with specially designed equipment for 12 tanks of gas distributed over 3 different models of engine.

	Engine 1	Engine 2	Engine 3
Det A	45	43	51
Det B	47	46	52
Det C	48	50	55
Det D	42	37	49

Perform the ANOVA and test at 0.01 LOS whether there is any difference in the detergents or in the engines.

OR

b) The following is a Latin square of a design, when 5 varieties of wheat A, B, C, D and E were studied. The plan, the varieties shown in each plot and yields obtained in kg are given in the following table. Carry out an ANOVA. What inference can you draw from the given data?

B90	E80	C134	A112	D92
E85	D84	B70	C141	A82
C110	A90	D87	B84	E69
A81	C125	E85	D76	B72
D82	B60	A94	E85	C88

14. a) (i) Find a root of $x log_{10} x - 1.2 = 0$, by Newton-Raphson method correct to three decimal places.

(ii) Solve the system of equations by Gauss-Seidal iteration method :

$20x + 4y - z = 32, \quad x + 3y + 10z = 24, \quad 2x + 17y + 4z = 35$ (8 + 8 Marks)

OR

b) (i) Solve by Gauss-Jordan method, the equations $2x + y + 4z = 12, 8x - 3y + 2z = 20, \quad 4x + 11y - z = 33$

(ii) Find the numerically largest eigen value of $A = \begin{pmatrix} 4 & 6 & 0 \\ 0 & 5 & 3 \\ 2 & 0 & 3 \end{pmatrix}$ and the corresponding eigen vector. (8 + 8 Marks)

15. a) (i) Find the Lagrangian interpolating polynomial for the following data : (8 + 8 Marks)

x	1	2	3	5
$f(x)$	0	7	26	124

(ii) The population of a certain town is given below. Find the rate of growth of the population in 1941

Year x:	1931	1941	1951	1961	1971
Population in 1000's y:	40.62	60.80	79.95	103.56	132.65

OR

b) (i) Given the data

x	0	1	2	3	4
y	2	3	12	35	78

Find the cubic function of x, using Newton's backward interpolation formula.

(ii) Evaluate $\int_0^{1.2} e^{-x^2}$ dx using (i) Simpson's $\frac{1}{3}$ *rule* (ii) Simpson's $\frac{3}{8}$rule, taking $h = 0.2$.

(8 + 8 Marks)