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Question Paper Code: 54023

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

Fourth Semester

Mechanical Engineering

15UMA423 - STATISTICS AND NUMERICAL METHODS

(Regulation 2015)

(Statistical tables may be permitted)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. If an individual rejects a true null hypothesis, then she/he has
(a) Type I error (b) Type II error (c) one tailed (d) two tailed CO1- R
2. The form of the alternative hypothesis can be:
(a) one-tailed (b) two-tailed
(c) neither one nor two-tailed (d) Type I error CO1- R
3. Degree of freedom for SSE in RBD is
(a) $(c-1)(r-1)$ (b) $(c-1)$ (c) $(r-1)$ (d) $n-k$ CO2- R
4. The conclusion of ANOVA based on
(a) F-test (b) t-test (c) Chi-Square test (d) Normal CO2- R
5. Iteration method is a
(a) direct method (b) indirect method (c) self correcting method (d) step by step CO3- R
6. What is the order of convergence of Newton-Raphson method?
(a) 1 (b) 2 (c) 3 (d) 4 CO3- R
7. The backward difference operator is denoted by the symbol
(a) nabla (b) delta (c) omega (d) alpha CO4- R
8. The order of convergence of cubic spline is
(a) 4 (b) 6 (c) 8 (d) 2 CO4- R
9. What is the restriction on the number of intervals for Simpson's 3/8 rule?
(a) Odd (b) Even (c) Multiple of 3 (d) None CO5- R
10. Simpson's 3/8th rule is applicable only when
(a) multiple of 3 (b) multiple of 6 (c) multiple of 8 (d) multiple of 24 CO5- R

PART – B (5 x 2 = 10 Marks)

11. Define null hypothesis and alternative hypotheses CO1- R

12. What are the principles of design of experiment . CO2- R
 13. State Newton's algorithm for finding square root of N. CO3- R
 14. Find the divided difference table for the following data CO4- App

x	2	5	10
f(x)	5	29	109

15. Evaluate $\int_{-1}^1 |x| dx$ with two sub intervals by Trapezoidal rule CO5- App

PART – C (5 x 16= 80Marks)

16. (a) (i) Two independent samples of 8 and 7 items respectively had the following values. CO1- App (8)

Sample 1	9	11	13	11	15	9	12	14
Sample 2	10	12	10	14	9	8	10	

Is the difference between the means of the samples significant?

- (ii) 1,000 students at college level are graded according to their I.Q and their economic conditions. Use the Chi-Square test to find out whether there is any association between economic conditions and the level of I.Q CO1- App (8)

Economic Conditions	I.Q			
	High	Medium	Low	Total
Rich	160	300	140	600
Poor	140	100	160	400
Total	300	400	300	1000

Or

- (b) (i) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables. Do the estimates of the population variances differ significantly at 5% level? CO1- App (8)

Sample1 18 13 12 15 12 14 16 14 15

Sample2 16 19 13 16 18 13 15

- (ii) The theory predicts that the proportion of beans in the four groups A,B,C, and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Do the experimental results support the theory. CO1- App (8)

17. (a) A vertical trial was conducted at a Research station. The research CO2- Ana (16)
 adopted for the same was five Randomized blocks of 6 plots
 each the yields in lb per plot (of 1/20) of an area obtained from
 the experiment are given in the following table

Blocks	Varieties					
	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆
I	30	23	34	25	20	13
II	29	22	28	25	28	32
III	56	43	43	31	49	17
IV	38	45	36	35	32	20
V	44	51	23	58	40	30

Analyze the design and comment on your findings

Or

- (b) The following data resulted from an experiment to compare three CO2- Ana (16)
 burners B1, B2, and B3. A Latin square design was used as the
 tests were made on 3 engines and were spread over 3 days.

	Engine-1	Engine-2	Engine-3
Day-1	B1-16	B2-17	B3-20
Day-2	B2-16	B3-21	B1-15
Day-3	B3-15	B1-12	B2-13

18. (a) (i) Solve the system of equations by Gauss seidel method CO3- App (8)

$$\begin{aligned}
 27x + 6y - z &= 85 \\
 x + y + 54z &= 110 \\
 6x + 15y + 2z &= 72
 \end{aligned}$$

- (ii) Using Gauss Jordan method find the inverse of the matrix CO3- App (8)

$$\begin{pmatrix} 2 & 2 & 3 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{pmatrix}$$

Or

(b) (i) Find a root of $x \log_{10} x - 1.2 = 0$ by Newton Raphson method correct to three decimal places. CO3- App (8)

(ii) Using Gauss-Jordan method, find the inverse of CO3- App (8)

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & -3 & 3 \\ -2 & -4 & -4 \end{bmatrix}$$

19. (a) Find $f(8)$ by Newton's divided difference formula for the following data CO4- Ana (8)

x:	4	5	7	10	11	13
f(x):	48	100	294	900	1210	2028

(ii) Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for CO4- Ana (8)

x	0	1	2	5
f(x)	2	3	12	147

Or

(b) The population of a town is as follows. CO4- Ana (16)

Year	1941	1951	1961	1971	1981	1991
Population in Lakhs	20	24	29	36	46	51

Estimate the population increase during the period 1946 to 1976.

20. (a) (i) Calculate $\int_{0.5}^{0.7} e^{-x} \sqrt{x} dx$ taking 5 ordinates by Simpson's 1/3 rule. CO5- E (8)

(ii) Evaluate $\int_0^{\pi/2} \int_0^{\pi/2} \sqrt{\sin(x+y)} dx dy$ by using double integration of Simpson's rule CO5- E (8)

Or

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Romberg's method correct to 4 decimal places. Hence deduce an approximate value of π CO5- E (16)