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Question Paper Code: 31003

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Fourth Semester

Mechanical Engineering

01UMA423 - STATISTICS AND NUMERICAL METHODS

(Regulation 2013)

Duration: Three hours   Maximum: 100 Marks

(Statistical tables may be permitted)

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. What do you mean by critical region and acceptance region?

2. Write any two properties of the F distribution.

3. Write any two differences between randomized block design and Latin square design.

4. What are the basic principles of experimental design?

5. What is the order of convergence of Newton-Raphson method and convergence condition for Newton method?

6. State the condition for convergence of Gauss - Seidal method.

7. Find the second degree polynomial through the points (0, 2), (2, 1) and (1, 0) using Lagrange's interpolation formula.

8. State the properties of cubic spline.

9. State Simpson's 1/3 and 3/8 rule of numerical integration formula.

10. What are the conditions for Simpson's $\dfrac{3^{th}}{8}$ rule and state the formula.

11. (a) (i) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal are same, at 5% level. (8)

(ii) In a investigation into the health and nutrition of two groups of children of different social status, the following results are got. Discuss the relation between health and their social status. (8)

Social status health	Poor	Rich	Total
Below normal	130	20	150
Normal	102	108	210
Above normal	24	96	120
Total	256	224	480

Or

(b) (i) Two samples of sizes nine and eight gave the sums of squares of deviation from their respective means equal to 160 and 91 respectively. Can they be regarded as drawn from the same normal population? (8)

(ii) The following data are collected in two characters:

	Smokers	Non - smokers
Literates	83	57
Illiterates	45	68

Based on this, can you say that there is no relation between smoking and literacy? (8)

12. (a) Four doctors each test four treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows (recovery time in days)

Treatment				
Doctor	1	2	3	4
A	10	14	19	20
B	11	15	17	21
C	9	12	16	19
D	8	13	17	20

Discuss the difference between (a) doctors and (b) treatments. (16)

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Or

(b) The following is a Latin square of a design when four varieties of seeds are being tested. Set up the analysis of variance table and state your conclusions. You may carry out suitable change of origin and scale.

D	122	A	121	C	123	B	122
B	124	B	123	A	122	D	125
A	120	C	119	D	120	C	121
C	122	D	123	B	121	A	122

(16)

13. (a) (i) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton - Raphson method correct to 6 decimal places. (8)

(ii) Find the largest Eigen value and the corresponding Eigen vector of

$$A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}.$$

(8)

Or

(b) (i) Solve the equations $8x - 3y + 2z = 20$, $4x + 11y - z = 33$, $6x + 3y + 12z = 35$ by using Gauss - Seidal method correct to three decimal. (8)

(ii) Find the inverse of the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$ by Gauss Jordan method. (8)

14. (a) (i) Given the values

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

Evaluate $f(9)$ using Lagrange's formula. (8)

(ii) Construct Newton's forward interpolation polynomial for the following data.

x	4	6	8	10
y	1	3	8	16

Use it to find the value of y for $x = 5$. (8)

Or

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(b) (i) Obtain the cubic spline approximation for the function tabulated as follows

x	0	1	2	3
y	1	2	33	244

Assume $M(0) = 0$ and $M(3) = 0$. Hence find an estimate of $f(2.5)$. (16)

15. (a) (i) From the following table, which gives the velocity v of a body, during the time t, find its acceleration at $t = 1.1$.

t	1.0	1.1	1.2	1.3	1.4
v	43.1	47.7	52.1	56.4	60.8

(8)

(ii) Evaluate $\int_0^1 \frac{\sin x}{x} dx$, by dividing the range into six equal parts using Simpson's $\frac{1}{3}^{rd}$ rule and Simpson's $\frac{3}{8}^{th}$ rule. (8)

Or

(b) Evaluate $\int_1^{1.4} \int_2^{2.4} \frac{dxdy}{xy}$ using Trapezoidal rule and Simpson's rule. (16)

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