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Question Paper Code : 51778

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

Fourth Semester

Mechanical Engineering

MA 2266/MA 42/MA 1254/080120014/10177 SN 401 – STATISTICS AND NUMERICAL METHODS

(Common to Automobile Engineering and Production Engineering)

(Regulations 2008/2010)

Time : Three Hours

Maximum : 100 Marks

Statistical tables may be permitted.

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What are Type I and Type II risk ?
2. Present the test statistics for small samples concerning difference between two means.
3. What is a 2^2 factorial design ?
4. Compare one-way classification with two-way classification.
5. Write the iterative formula and the order of convergence of Newton-Raphson method.
6. Compare Gauss-Elimination with Gauss-Seidel method.
7. Create the table for the following data using Newton's divided difference formula :

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

8. Compare trapezoidal rule with Simpson's $\frac{1}{3}$ rule.
9. Given the two methods : Taylor's series and R.K. method – which is better ? Why ?
10. Express $(\Delta^2 - 3\Delta + 2)$ in terms of the operator E.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Test if the means are significantly different for the following data : **(8)**

X_1 : 5 6 8 1 12 4 3 9 6 10

X_2 : 2 3 6 8 10 1 2 8

- (ii) Random samples of 200 bolts manufactured by machine A and 100 bolts manufactured by machine B showed 19 and 5 defective bolts respectively. Test the hypothesis at 5% level of significance that the two machines are showing different qualities of performance. **(8)**

OR

- (b) (i) Do the sample variances vary significantly for the following data : **(8)**

Sample I : 39 41 43 41 45 39

Sample II : 40 42 40 44 39 38 40

- (ii) The following data represents the no. of books borrowed from a library during the various days of the week.

| Days of the week : | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---------------------------|-----|-----|-----|-----|-----|-----|-----|
| No. of books : | 14 | 16 | 8 | 12 | 11 | 9 | 14 |

- Find if the books borrowed are uniformly distributed over the week. **(8)**

12. (a) Carryout an ANOVA for the following :

(16)

| | Consignment | | | | | |
|----------|-------------|----|----|----|----|----|
| Observer | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 9 | 10 | 9 | 10 | 11 | 11 |
| 2 | 12 | 11 | 9 | 11 | 10 | 10 |
| 3 | 11 | 10 | 10 | 12 | 11 | 10 |
| 4 | 12 | 13 | 11 | 14 | 12 | 10 |

OR

(b) Perform Analysis of variance for the 2^2 experiment and draw your conclusions for the following data :

(16)

| Block | Yields (Potato) | | | |
|-------|-----------------|-----|----|-----|
| I | (1) | a | b | ab |
| | 23 | 25 | 22 | 38 |
| II | b | (1) | a | ab |
| | 40 | 26 | 36 | 38 |
| III | (1) | a | ba | b |
| | 29 | 20 | 30 | 20 |
| IV | ab | a | b | (1) |
| | 34 | 31 | 24 | 28 |

13. (a) (i) Solve by Gauss-Seidel, the equations

(8)

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Starting with $(0, 0, 0)^T$

(ii) Using power method, find the longest Eigen value and its corresponding Eigen vector from

(8)

$$A = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$$

OR

(b) (i) Using Newton-Raphson's method, find the root of $x^4 - x - 10 = 0$, nearing to 2, correct to 3 decimal places. (8)

(ii) Find the inverse of $A = \begin{pmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{pmatrix}$ using Gauss-Jordan method. (8)

14. (a) (i) Using Lagrange's method, find the polynomial $f(x)$ given that $f(0) = 2$, $f(1) = 3$, $f(2) = 12$ & $f(3) = 35$. Hence find $f(5)$. (8)

(ii) Find $\frac{dy}{dx}$ for $x = 1.05$ from the following data :

| | | | | | | | |
|------|------|--------|---------|---------|---------|---------|---------|
| $x:$ | 1.00 | 1.05 | 1.1 | 1.15 | 1.2 | 1.25 | 1.3 |
| $y:$ | 1 | 1.0247 | 1.04881 | 1.07238 | 1.09544 | 1.11803 | 1.14017 |

OR

(b) (i) Using Simpson's $\frac{1}{3}$ rule, evaluate $\int_0^{20} V dt$ for the following data : (8)

| | | | | | | | | | | |
|------|----|----|----|----|----|----|----|----|----|----|
| $t:$ | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| $V:$ | 10 | 18 | 25 | 29 | 32 | 20 | 11 | 5 | 2 | 0 |

(ii) Find y when $x = 410$ for the following : (8)

| | | | | | | | |
|------|-------|-------|-------|-------|-------|------|-------|
| $x:$ | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
| $y:$ | 10.63 | 13.03 | 15.04 | 16.81 | 18.42 | 19.9 | 21.27 |

15. (a) (i) Using R.K. method 4th order, find $y(0.2)$ with $h = 0.1$ for $\frac{dy}{dx} = \sqrt{x+y}$, $y(0) = 1$. (8)

(ii) Apply Euler's modified method to solve $\frac{dy}{dx} = x + 3y$, $y(0) = 1$, to find y when $x = 1$. (8)

OR

(b) Given $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$ and $y(0) = 1$. Find the values of y for $x = 0.1, 0.2$ and 0.3 using Taylor's series and hence find $y(0.4)$ by Milne's Predictor-Corrector method. (16)