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**Question Paper Code : 31528**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fourth Semester

Mechanical Engineering

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

(Common to Automobile Engineering and Production Engineering)

(Regulation 2008/2010)

(Common to PTMA 2266 – Statistics and Numerical Methods for B.E. (Part-Time)  
Second Semester – Production Engineering – Regulation 2009)

Time : Three hours

Maximum : 100 marks

Statistical tables may be permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State level of significance.
2. Define Type I and Type II error.
3. What is the aim of the design of experiments?
4. Define  $2^2$  factorial design.
5. State the principle used in Gauss-Jordan method.
6. Solve :  $x + y + z = 6$ ,  $3x + 3y + 4z = 20$ ,  $2x + y + 3z = 13$  using Gauss elimination method.
7. State the use of Lagrange's interpolation form.
8. Evaluate  $\int_1^2 \frac{dx}{1+x^2}$ , using Trapezoidal rule, taking  $h = 0.5$ .

9. Using Taylor's method, find  $y$  at  $x = 1.1$  given  $\frac{dy}{dx} = x^3 + y$ ,  $y(1) = 1$ .
10. Obtain the finite difference scheme for differential equation  $2\frac{d^2y}{dx^2} + y = 5$ .

PART B — (5 × 16 = 80 marks)

11. (a) (i) Time taken by workers in performing a job are given below : (8)
- |          |    |    |    |    |    |    |    |
|----------|----|----|----|----|----|----|----|
| Type I:  | 21 | 17 | 27 | 28 | 24 | 23 | -  |
| Type II: | 28 | 34 | 43 | 36 | 33 | 35 | 39 |

Test whether there is any significant difference between the variances of time distribution.

- (ii) 20 people were attacked by a disease and only 18 survived. Will you reject the hypothesis that the survival rate, if attacked by this disease is 85% in favour of the hypothesis that is more at 5% level? (8)

Or

- (b) (i) Before an increase in excise duty on tea, 900 persons out of a sample of 1100 persons were found to be tea drinkers. After an increase in excise duty, 900 persons were tea drinkers in a sample of 1300. Using standard error of proportion, state whether there is a significant decrease in the consumption of tea after the increase in excise duty? (8)
- (ii) The sales manager of a large company conducted a sample survey in two places A and B taking 200 samples in each case. The results were the following table. Test whether the average sales is the same in the 2 areas at 5% level. (8)

|               | Place A   | Place B   |
|---------------|-----------|-----------|
| Average sales | Rs. 2,000 | Rs. 1,700 |
| S.D.          | Rs. 200   | Rs. 450   |

12. (a) Analyse the following RBD and find your conclusion. (16)

|        |                | Treatments     |                |                |                |
|--------|----------------|----------------|----------------|----------------|----------------|
|        |                | T <sub>1</sub> | T <sub>2</sub> | T <sub>3</sub> | T <sub>4</sub> |
| Blocks | B <sub>1</sub> | 12             | 14             | 20             | 22             |
|        | B <sub>2</sub> | 17             | 27             | 19             | 15             |
|        | B <sub>3</sub> | 15             | 14             | 17             | 12             |
|        | B <sub>4</sub> | 18             | 16             | 22             | 12             |
|        | B <sub>5</sub> | 19             | 15             | 20             | 14             |

Or

- (b) The following is a Latin square of a design when 4 varieties of seed are being tested. Set up the analysis of variance table and state your conclusion. You can carry out the suitable change of origin and scale. (16)

|       |       |       |       |
|-------|-------|-------|-------|
| A 110 | B 100 | C 130 | D 120 |
| C 120 | D 130 | A 110 | B 110 |
| D 120 | C 100 | B 110 | A 120 |
| B 100 | A 140 | D 100 | C 120 |

13. (a) (i) Solve the system of equations by Gauss-Elimination method. (8)

$$\begin{aligned}x_1 + x_2 + x_3 + x_4 &= 2 \\2x_1 - x_2 + 2x_3 - x_4 &= -5 \\3x_1 + 2x_2 + 3x_3 + 4x_4 &= 7 \\x_1 - 2x_2 - 3x_3 + 2x_4 &= 5.\end{aligned}$$

- (ii) Find the inverse of the matrix  $\begin{pmatrix} 2 & 1 & 2 \\ 2 & 2 & 1 \\ 1 & 2 & 2 \end{pmatrix}$  by Gauss-Jordan method. (8)

Or

- (b) (i) Find the largest eigen value of the matrix  $\begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & 0 \\ 0 & -1 & 0 \end{pmatrix}$  by power method. Also find its corresponding eigen vector. (8)

- (ii) Find a positive root for the equation  $3x - \cos x = 1$  by Newton-Raphson method. (8)

14. (a) (i) Using Lagrange's method, find the value of  $f(3)$  from the following table. (8)

|      |   |   |    |     |
|------|---|---|----|-----|
| $x:$ | 0 | 1 | 2  | 3   |
| $y:$ | 2 | 3 | 12 | 147 |

- (ii) Using Newton's divided difference formula, find the value of  $f(2)$  and  $f(14)$  from the following table. (8)

|      |    |     |     |    |      |      |
|------|----|-----|-----|----|------|------|
| $x:$ | 4  | 5   | 7   | 10 | 11   | 13   |
| $y:$ | 48 | 100 | 294 | 90 | 1210 | 2028 |

Or

(b) (i) Evaluate  $\int_0^1 \int_0^1 \frac{dx dy}{1+x+y}$  using Trapezoidal rule. (8)

(ii) Taking  $h = k = \frac{\pi}{4}$ , evaluate  $\int_0^{\pi/2} \int_0^{\pi/2} \sqrt{\sin(x+y)}$  by Simpson's  $\frac{1}{3}$  rule. (8)

15. (a) (i) Using Milne's predictor-corrector method, find  $y(0.4)$ , given that  $y' = (1+x^2)y^2/2$ ,  $y(0) = 1$ ,  $y(0.1) = 1.06$ ,  $y(0.2) = 1.12$ ,  $y(0.3) = 1.21$ . (8)

(ii) Solve by Euler's method, the equation  $\frac{dy}{dx} = x + y$ ,  $y(0) = 0$ , choose  $h = 0.2$  and compute  $y(0.4)$  and  $y(0.6)$ . (8)

Or

(b) (i) Given  $y' = x^2 - y$ ,  $y(0) = 1$ ,  $y(0.1) = 0.9052$ ,  $y(0.2) = 0.8213$ , find  $y(0.3)$  using Taylor's series method. (6)

(ii) Using Runge-Kutta method of fourth order, given  $y'' + xy' + y = 0$ ,  $y(0) = 1$ ,  $y'(0) = 0$ , find the value of  $y$  at  $x = 0.1$ . (10)