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Question Paper Code : 21778

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

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)

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

Time : Three hours

Maximum : 100 marks

Statistical tables may be permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write any two applications of χ^2 -test.
2. What are Type-I and Type-II errors?
3. Present the ANOVA table for a completely randomized design.
4. Explain 2^2 factorial design.
5. Compare Gauss-Jordan method with Gauss-Seidel method.
6. Write the formula and order of convergence for Newton-Raphson method.
7. Construct the Newton's forward difference table for $y = x^2 - 3x + 1$, $x = 0$ to 4.
8. Write the difference between Trapezoidal and Simpson's $\frac{1}{3}$ rd rule.
9. Using Euler's method find $y(0.1)$ for $y' = x + y$, $y(0) = 1$.
10. Classify the equation : $f_{xx} - 2f_{xy} + f_{yy} = 0$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Do the following sample variances vary significantly at 5% level? (8)
 Sample I: 39 41 43 41 45 39
 Sample II: 40 42 40 44 39 38 40

- (ii) Test whether the following attributes are independent at 5% level. (8)

Small pox	Vaccination		Total
	Given	Not given	
Attacked	35	333	368
Not attacked	308	806	1114
Total	343	1139	1482

Or

- (b) (i) Test if the difference in means is significant for the following at 5% level. (8)
 $\bar{x}_1 = 1190$, $\bar{x}_2 = 1230$, $S_1 = 90$, $S_2 = 120$, $n_1 = 100$, $n_2 = 75$.
- (ii) Is there any significant difference in means, in the following at 5% level? (8)
 $\bar{x}_1 = 107$, $\bar{x}_2 = 112$, $S_1 = 10$, $S_2 = 8$, $n_1 = 16$, $n_2 = 14$.

12. (a) A farmer wishes to test the effects of 4 different fertilizers (A, B, C, D) on the yield of wheat. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers in a latin square arrangement as shown in the following table, where the number indicated yields in bushels/unit area. Perform an analysis of variance to determine whether there is a difference between the fertilizers at significant levels of

(i) .05

(ii) .01.

(16)

A18	C21	D25	B11
D22	B12	A15	C19
B15	A20	C23	D24
C22	D21	B10	A17

Or

- (b) Five doctors each test five treatments for a certain disease and observe the number of days each patient takes to recover. Discuss the difference between

(i) The doctors and

(ii) The treatments for the following data at 5% level.

(16)

Doctors	Treatments				
	1	2	3	4	5
1	10	14	23	18	20
2	11	15	24	17	21
3	9	12	20	16	19
4	8	13	17	17	20
5	12	15	19	15	22

13. (a) (i) Find the inverse of the matrix, by Gauss elimination. (8)

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

- (ii) Using Gauss-Seidel method, solve : (8)

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

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

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

Or -

- (b) Find the eigen value of $A = \begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$ using power method. (16)

14. (a) (i) Using Newton's divided difference formula find the value of $f(8)$ for the following : (8)

$$x : 4 \quad 5 \quad 7 \quad 10 \quad 11 \quad 13$$

$$f(x) : 48 \quad 100 \quad 294 \quad 900 \quad 1210 \quad 2028$$

- (ii) Evaluate $\int_0^1 e^x dx$ using Simpson's $\frac{1}{3}$ rule correct to five decimal places, taking $h = .1$. Verify your answer. (8)

Or

- (b) (i) Find $\left(\frac{dy}{dx}\right)_{1.1}$ and $\left(\frac{d^2y}{dx^2}\right)_{1.1}$ for the following : (8)

$$x : 1.0 \quad 1.1 \quad 1.2 \quad 1.3 \quad 1.4 \quad 1.5 \quad 1.6$$

$$y : 7.989 \quad 8.403 \quad 8.781 \quad 9.129 \quad 9.451 \quad 9.750 \quad 10.031$$

- (ii) Using Lagrange's method find $y(10)$ from the following : (8)

$$x : 5 \quad 6 \quad 9 \quad 11$$

$$y : 12 \quad 13 \quad 14 \quad 16$$

15. (a) Use Runge-Kutta method of order 4 to find y at $x = .1, .2, .3$ given that $y' = x + y^2$, $y(0) = 1$. (16)

Or

- (b) Given : $y' = x^2 + y^2 - 2$, $y(0) = 1$, use Taylor's method to find y at $x = -0.1, 0.1, 0.2$ and Milne's method to find y at $x = 0.3$. (16)