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Reg. No. : | | | | | | | | | | | | |

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 — ($10 \times 2 = 20$ marks)

1. Write any two applications of ψ^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: Given	Not given	Total
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 busheds/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	5	7	10	11	13
$f(x)$:	48	100	294	900	1210	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	1.1	1.2	1.3	1.4	1.5	1.6
y :	7.989	8.403	8.781	9.129	9.451	9.750	10.031

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

x :	5	6	9	11
y :	12	13	14	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)