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Question Paper Code : 60778

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 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 — ($10 \times 2 = 20$ marks)

1. A firm is suspicious of the claim that the average life time of certain tires is atleast 28,000 miles. To check the claim, the firm puts 40 of these tires on its trucks and gets a mean life time of 27,463 miles with a standard deviation of 1,348 miles. Test the null hypothesis $\mu \geq 28{,}000$ at 0.01 level of significance.

2. Define Type I and Type II errors.

3. Compare RBD and LSD.

4. Explain 2^2 – factorial design.

5. Using the Newton–Raphson method write down the iterative formula to find a root of the equation $x^3 - 2x - 5 = 0$.

6. Define row pivoting in Gauss–Elimination method.

7. Write down the Trapezoidal rule of numerical integration.

8. Given $f(2) = 4$, $f(2.5) = 5.5$, find the linear interpolating polynomial using Newton's divided difference interpolation.

9. Compare Runge – Kutta and Taylor's series methods.

10. Write down the Miline predictor formula method.

PART B — (5 × 16 = 80 marks)

11. (a) (i) The following random samples are measurements of the heat – producing capacity of specimens of coal from two mines::

Mine 1: 8260 8130 8350 8070 8340

Mine 2: 7950 7890 7900 8140 7920 7840

Use the 0.01 level of significance to test whether the difference between the means of these two samples is significant. (8)

(ii) The following table gives the number of aircraft accidents that occurred during the seven days of the week. Find whether the accidents are uniformly distributed over the week. (8)

Days:	Mon	Tue	Wed	Thur	Fri	Sat
No. of accidents:	14	18	12	11	15	14

Or

(b) (i) Before an increase in excise duty on tea, 800 persons out of a sample of 1000 persons were found to be tea drinkers. After an increase in duty, 800 people were tea drinkers in a sample of 1,200 people. 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) An insurance agent has claimed that the average age of policy-holders who insure through him is less than the average for all agents, which is 30.5 years. A random sample of 100 policy – holders who had insured through him gave the following age distribution.

Age last birthday:	16-20	21-25	26-30	31-35	36-40
No. of persons:	12	22	20	30	16

Calculate the arithmetic mean and use it to test his claim at the 5% level of significance. (8)

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

Treatments

Blocks	T_1	T_2	T_3	T_4
B_1	10	12	18	20
B_2	15	25	17	13
B_3	13	12	15	10
B_4	16	14	20	10
B_5	17	13	18	12

Or

(b) A company wants to purchase cars for its own use. He has to select the make of the car out of the four makes A, B, C and D available in the market. For this he tries four cars of each make by assigning the cars to four drivers to run on four different routes. For this, he chooses a latin squares design. The efficiency of cars is measured in terms of time in hours. The layout and time consumed is as given below.

	Drivers			
Routes	1	2	3	4
1	18 (C)	12 (D)	16 (A)	20 (B)
2	26 (D)	34 (A)	25 (B)	31 (C)
3	15 (B)	22 (C)	10 (D)	28 (A)
4	30 (A)	20 (B)	15 (C)	9 (D)

Analyse the experimental data and draw conclusion. (16)

13. (a) (i) Solve the following system of equations using Gauss elimination method with partial pivoting. (8)

$2x_1 + x_2 + x_3 - 2x_4 = -10$, $4x_1 + 2x_3 + x_4 = 8$, $3x_1 + 2x_2 + 2x_3 = 7$, $x_1 + 3x_2 + 2x_3 - x_4 = -5$

(ii) Find the inverse of the following matrix using Gauss–Jordan method. (8)

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$

Or

(b) (i) Solve the following system of equations by Gauss–Jacobi method.

$27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$

starting with $(0, 0, 0)^T$. (8)

(ii) Solve the following system of equations by Gauss – Seidel method.

$10x - 5y - 2z = 3$, $4x - 10y + 3z = -3$, $x + 6y + 10z = -3$ starting with $(0, 0, 0)^T$. (8)

14. (a) (i) The values of x (in degrees) and $\sin x$ are given in the following table :

x	$\sin x$
15	0.2588
20	0.3420
25	0.4226
30	0.5
35	0.5736
40	0.6428

Determine the value of $\sin 38°$. (8)

(ii) Using Lagrange's method, find the value of $f(1.5)$ from the following table. (8)

x:	1.0	1.3	1.6	1.9	2.2
$f(x)$:	0.7652	0.6201	0.4554	0.2818	0.1104

Or

(b) (i) Evaluate $\int_1^2 \left(1+\frac{\sin x}{x}\right) dx$, correct to three decimal places, using Trapezoidal rule. (8)

(ii) Evaluate $\int_0^1 \frac{1}{1+x} dx$, correct to three decimal places, using Simpson's 1/3 rule, $h = 0.5$. (8)

15. (a) (i) Use Runge – Kutta method of fourth order to find the numerical solution at $x = 0.8$ for $\frac{dy}{dx} = \sqrt{x+y}$, $y(0.4) = 0.41$. Assume the step length $h = 0.2$. (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) Using Milne's method, find $y(0.8)$ given that $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. (8)

(ii) Solve, by finite difference method, $y'' = x + y$ with boundary condition $y(0) = y(1) = 0$ by dividing the interval (0, 1) into four sub – intervals. (8)
