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

Question Paper Code : 91586

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

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)

(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. Twenty people were attacked by a disease and only 18 survived. The hypothesis is set in such a way that the survival rate is 85% if attacked by this disease. Will you reject the hypohthesis that it is more at 5% level $(z_{0\cdot 05} = 1.645)$?

2. Write the formula for the Chi-square test of goodness of fit of a random sample to a hypothetical distribution.

3. Explain the situations in which randomised block design is considered an improvement over a completely randomised design.

4. State the advantages of a factorial experiment over a simple experiment.

5. Find a real root of the equation $x = e^{-x}$, using Newton-Raphson method.

6. Write down the iterative formula of Gauss-Seidal method.

7. Write the Lagrange's formula for interpolation and state its uses.

8. Evaluate $I = \int_0^1 \frac{1}{1+x}\,dx$, correct to three decimal places using trapezoidal rule with $h = 0.25$.

9. Use the Runge-Kutta forth order method to find the value of y when $x = 1$ given that $y = 1$ when $x = 0$ and that $\frac{dy}{dx} = \frac{y - x}{y + x}$.

10. Given $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$. Determine $y(0.02)$ using Euler's modified method.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Explain clearly the procedure generally followed in testing of a hypothesis.

(ii) The demand for a particular spare part in a factory was found to vary from day-to-day. In a sample study the following information was obtained.

Days :	Mon	Tues	Wed	Thurs	Fri	Sat
No. of spare parts demanded :	1124	1125	1110	1120	1126	1115

Test the hypothesis that the number of parts demanded does not depend on the day of the week. $\left(\chi^2_{0.05}(5) = 11.07\right)$.

Or

(b) (i) Explain briefly the procedure involved in testing the significance for difference of proportions in the case of large samples.

(ii) The height of six randomly chosen sailors are (in inches) : 63, 65, 68, 69, 71 and 72. Those of 10 randomly chosen soldiers are 61, 62, 65, 66, 69, 69, 70, 71, 72 and 73. Discuss, the height that these data thrown on the suggestion that sailors are on the average taller than soldiers $(t_{0.05}(14) = 1.76)$.

12. (a) A company wants to produce cars for its own use. It 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. 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 conclusions. $(F_{0.05}(3, 5) = 5.41)$. (16)

Or

(b) Consider the results given in the following table for an experiment involving six treatments in four randomised blocks. The treatments are indicated by numbers within parenthesis.

Blocks	Yield for a randomised block experiment treatment and yield					
1	(1)	(3)	(2)	(4)	(5)	(6)
	24.7	27.7	20.6	16.2	16.2	24.9
2	(3)	(2)	(1)	(4)	(6)	(5)
	22.7	28.8	27.3	15.0	22.5	17.0
3	(6)	(4)	(1)	(3)	(2)	(5)
	26.3	19.6	38.5	36.8	39.5	15.4
4	(5)	(2)	(1)	(4)	(3)	(6)
	17.7	31.0	28.5	14.1	34.9	22.6

Test whether the treatments differ significantly. ($F_{0.05}(3, 15) = 5.42$; $F_{0.05}(5,15) = 4.5$).

13. (a) (i) Find the dominant eigenvalue and its eigenvector of the matrix by power method $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$.

(ii) Find the solution, to three decimals, of the system using Gauss-Seidal method $8x + 11y - 4z = 95$, $7x + 52y + 13z = 104$ and $3x + 8y + 29z = 71$.

Or

(b) (i) Find the inverse of the matrix

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & 4 \\ 1 & 2 & 2 \end{bmatrix} \text{ using Gauss - Jordan method.}$$

(ii) Solve the system of equations using Gauss-elimination method.

$5x - 2y + z = 4$, $7x + y - 5z = 8$ and $3x + 7y + 4z = 10$.

14. (a) (i) Given the table of values

x :	50	52	54	56
$\sqrt[3]{x}$:	3.684	3.732	3.779	3.825

Use Lagrange's formula to find $\sqrt[3]{53}$.

(ii) Given the set of tabulated points (1, -3), (3, 9), (4, 30) and (6, 132) obtain the value of y when $x = 2$ using Newton's divided difference formula.

Or

(b) (i) The velocities of a car (running on a straight road) at intervals of 2 minutes are given below.

Time in minutes :	0	2	4	6	8	10	12
Velocities in km/hr :	0	22	30	27	18	7	0

Apply Simpson's rule to find the distance covered by the car.

(ii) Find the first and second derivatives of $f(x)$ at $x = 1.5$ if

x :	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$:	3.375	7.000	13.625	24.000	38.875	59.000

15. (a) (i) Compute $y(0.4)$ and $y(0.5)$, given that $y' = y - \frac{2x}{y}$, $y(0) = 1$, $y(0.1) = 1.0954$, $y(0.2) = 1.1832$, $y(0.3) = 1.2649$ using Milne's predictor-corrector method. (8)

(ii) Solve by Taylor's method to find an approximate value of y at $x = 0.2$ for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$. Compare the numerical solution with the exact solution. Use first three non-zero terms in the series. (8)

Or

(b) (i) Consider the initial value problem $\frac{dy}{dx} = y - x^2 + 1$; $y(0) = 0.5$. Compute $y(0.2)$ by Euler's method and modified Euler's method. (8)

(ii) Solve $\frac{dy}{dx} = xy + y^2, y(0) = 1$ or $y(0.1)$, $y(0.2)$, using fourth order Runge-Kutta method. (8)