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

Question Paper Code : 77194

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Mechanical Engineering

MA 6452 — STATISTICS AND NUMERICAL METHODS

(Common to Automobile Engineering, Mechatronics Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Use of statistical tables is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the expected frequencies of 2×2 contingency table $\begin{array}{|c|c|}\hline a & b \\ \hline c & d \\ \hline\end{array}$?

2. Write down the formula of test statistic t to test the significance of difference between the means of large samples.

3. What do you understand by design of an experiment?

4. What are the basic principles of the design of experiments?

5. Perform four iterations of the Newton-Raphson method to find the smallest positive root of the equation $f(x) = x^3 - 5x + 1 = 0$.

6. Solve the equations $10x - y + 2z = 4$; $x + 10y - z = 3$; $2x + 3y + 20z = 7$ using the Gauss elimination method.

7. Given $f(2) = 5$, $f(2.5) = 5.5$ find the linear interpolating polynomial using Lagrange interpolation.

8. Construct the divided difference table for the data.

X:	0.5	1.5	3.0	5.0	6.5	8.0
$F(X)$:	1.625	5.875	31	131	282.125	521

9. Given $y' = \frac{y-x}{x+y}$ with initial condition $y=1$ at $x=0$ find y for $x=0.1$ by Euler's method.

10. Given the initial value problem $u' = -2tu^2$, $u(0)=1$ estimate $u(0.4)$ using modified Euler-Cauchy method.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Fit a binomial distribution for the following data and also test the goodness of fit. (8)

X:	0	1	2	3	4	5	6	Total
$F(X)$:	5	18	28	12	7	6	4	80

(ii) The mean value of a random sample of 60 items was found to be 145, with a standard deviation of 40. Find the 95% confidence limits for the population mean. What size of the sample is required to estimate the population mean within 5 of its actual value with 95% or more confidence, using the sample mean? (8)

Or

(b) (i) Test made on the breaking strength of 10 pieces of a metal gave the following results 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 kg. Test if the mean breaking strength of the wire can be assumed as 577 kg. (8)

(ii) A group of 10 rats fed on diet A and another group of 8 rats fed on diet B recorded the following increase in weight :

Diet A :	5	6	8	1	12	4	3	9	6	10
Diet B :	2	3	6	8	10	1	2	8		

Show that the estimates of the population variance from the samples are not significantly different. (8)

12. (a) The following table shows the lives in hours of four brands of electric lamps brand.

A	1610	1610	1650	1680	1700	1720	1800
B	1580	1640	1640	1700	1750		
C	1460	1550	1600	1620	1640	1660	1740	1820
D	1510	1520	1530	1570	1600	1680		

Perform an analysis of variance and test the homogeneity of the mean lives of the four brands of lamps. (16)

Or

(b) Analyze the variance in the following Latin square of yields of paddy where A, B, C, D denote the different methods of cultivation.

D122	A121	C123	B122
B124	C123	A122	D125
A120	B119	D120	C121
C122	D123	B121	A122

Examine whether the different methods of cultivation have given significantly different yields. (16)

13. (a) (i) Find the inverse of the coefficient matrix of the system

$$\begin{pmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{pmatrix}\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 6 \\ 4 \end{pmatrix}$$ by the Gauss Joardan method, also solve the system. (10)

(ii) Find the smallest eigenvalue in magnitude of the matrix $A = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$ using four iterations of the inverse power method. (6)

Or

(b) Solve the equations $5x+2y+z=12$; $x+4y+2z=15$; $x+2y+5z=20$ by

(i) Jacobi's method and

(ii) Gauss Seidel method. (16)

14. (a) (i) Evaluate $\int_1^2\int_1^2 \frac{dxdy}{x+y}$ by Simpson's rule and Trapezoidal rule with $h=0.5$ and $k=0.25$. (8)

(ii) The table gives the distances in nautical miles of the visible horizon for the given heights in feet above the earth's surface. (8)

X:	100	150	200	250	300	350	400
Y:	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the values of y when $x = 218$ ft and 410 ft.

Or

(b) (i) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using trapezoidal rule and Simpson's 1/3 rule and compare with its exact solution. (8)

(ii) Given that : (8)

X:	1	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

find $\frac{dy}{dx}$ and y^* at $x=1.1$ and $x=1.6$.

15. (a) (i) The deflection of a beam is governed by the equations $y''+81y=\phi(x)$ where $\phi(x)$ is given by the table :

X:	1/3	2/3	1
$\phi(x)$:	81	162	243

And the boundary conditions $y(0)=y'(0)=y^*(1)=y''(1)=0$. Evaluate the deflection at the pivotal points of the beam using three subintervals. (10)

(ii) Apply Taylor's method to obtain approximate value of y at $x = 0.2$ for the differential equation $y'=2y+3e^x$, $y(0)=0$. Compare the numerical solution with its exact solution. (6)

Or

(b) Using R.K fourth order method to find y at $x = 0.1, 0.2, 0.3$ given that $y'=xy+y^2$, $y(0)=1$. Continue the solution at $x=4$ using Milne's P-C method. (16)
