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Question Paper Code : 73774

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

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. Write the condition for the application of χ^2 test?

2. What is the essential difference between confidence limits and tolerance limits?

3. What is the aim of the design of experiments?

4. What are the advantages of completely randomized experimental design?

5. Using Newton's method write down the Iterative formula to find a root of $x^3 = 6x - 4$.

6. Compare Gauss – Jacobi and Gauss – Seidal method.

7. Write down the divided difference table.

X	5	6	9	11
Y	12	13	14	16

8. Write the Geometrical interpretation of Trapezoidal and Simpson's 1/3 rule for numerical integration.

9. Give $y' = -y$ and $y(0) = 1$, determine the values of y at $x = 0.01$, by Euler method.

10. Compare Runge – Kutta and Taylor series methods.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Twenty people were attacked by a disease and only 18 survived. Will you reject the hypothesis that the survival rate, if attacked by this disease, is 85% in favour of the hypothesis that it is more, at 5% level. (6)

(ii) To determine whether there is a relationship between an employee's performance in the company's training program and his or her ultimate success in the job, the company takes a sample of 400 cases and obtains the result in the following table.

Performance in training program

		Below average	Average	Above average
Success in job	Poor	23	60	29
	Average	28	79	6
	Very good	9	49	63

Use 0.01 level of significance to test the null hypothesis that the performance in training program and the success in the job are independent. (10)

Or

(b) (i) A random sample of 200 tins of coconut oil gave an average weight of 4.95 kgs. With a standard deviation of 0.21 kg. Do we accept that the net weight is 5 kgs per tin at 5% level? Do we accept that the Net weight is 5 kgs per tin at 1% level? (8)

(ii) The following is the distribution of the hourly numbers of trucks arriving at a company's warehouse.

Trucks arriving per hour:	0	1	2	3	4	5	6	7	8
Frequency:	52	151	130	102	45	12	5	1	2

find the mean of the distribution and using its mean rounded to one decimal as the parameter λ, fit a Poisson distribution. Test for goodness of fit at the level of significance $\alpha = 0.05$. (8)

12. (a) A company appoints 4 salesman A, B, C and D and observes their sales in 3 seasons: summer, winter and monsoon the figure (in laksh of Rs.) are given in the following table.

		Salesmen			
		A	B	C	D
Season	Summer	45	40	38	37
	Winter	43	41	45	38
	Monsoon	39	39	41	41

carry out the analysis of variance. (16)

Or

(b) The following is a latin square of a design when 4 varieties of seed are being tested. Set up the analysis of variance table and state your conclusion. You may carry out suitable change of origin and scale. (16)

A	105	B	95	C	125	D	115
C	115	D	125	A	105	B	105
D	115	C	95	B	105	A	115
B	95	A	135	D	95	C	115

13. (a) (i) Solve the following system of equations by using Gauss-Seidal method correct to 3 decimal places $8x - 3y + 2z = 20$; $4x + 11y - z = 33$; $6x + 3y + 12z = 35$. (8)

(ii) Solve the system of equations by Gauss-Elimination method $x + y + z + w = 2$; $2x - y + 2z - w = -5$; $3x + 2y + 3z + 44w = 7$; $x - 2y - 3z + 2w = 5$. (8)

Or

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

$$\begin{pmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 1 \\ 6 \\ 4 \end{pmatrix}.$$

by using Gauss-Jordan method. Also solve the system using Gauss-Jordan method. (10)

(ii) Using power method, find the largest Eigen value of $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$. (6)

14. (a) (i) From the following table of half yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age 46 and 63. (8)

Age x:	45	50	55	60	65
Premium	114.84	96.16	83.32	74.48	68.48

(ii) Using Newton's divided difference formula find the value of $f(2)$, $f(8)$ and $f(15)$ given the following table. (8)

X	4	5	7	10	11	13
F(x)	48	100	294	90	1210	2028

Or

(b) (i) Evaluate $\int_0^6 \frac{1}{1+x}\,dx$ using trapezoidal rule, simpson's rule both. Also check up by direct integration. (8)

(ii) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various value of time t(seconds). Calculate the angular velocity and angular acceleration of rod at t = 0.6 seconds. (8)

t:	0	0.2	0.4	0.6	0.8	1.0
θ:	0	0.12	0.49	1.12	2.02	3.20

15. (a) (i) Using R-K method of fourth order solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given, $y(0) = 1$. (6)

(ii) Give $y' = 1 - y$ and $y(0) = 0$, $y(0.1)$ by Taylor series method, $y(0.2)$ and $y(0.3)$ by modified Euler method. Evaluate $y(0.4)$ by Milne's predictor – corrector method. (10)

Or

(b) (i) Given $y'' + xy' + y = 0$; $y(0) = 1$, $y'(0) = 0$, find the value of $y(0.1)$ by Runge Kutta method of fourth order. (8)

(ii) Solve the boundary value problem $u'' = u + x$; $u(0) = 0$, $u(1) = 0$ with h=1/4 by the finite difference method. (8)
