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

Question Paper Code : 23774

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fourth Semester

Mechanical Engineering

MA 2266 — STATISTICS AND NUMERICAL METHODS

(Common to Automobile Engineering and Production Engineering)

(Regulations 2008)

Time : Three hours Maximum : 100 marks

Use of Statistical tables may be permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define χ^2 test of goodness of fit.

2. What is type I, type II errors?

3. Write the steps to find F ratio.

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

5. Find the Newton's Raphson formula to find the p^{th} root of positive number N and hence find the cube root of 17.

6. Solve the system by Gauss-Elimination method $2x + 3y = 5$ and $x - y = 0$.

7. Use Lagrange's interpolation formula to find $y(10)$ from the following table.

X :	5	6	9	11
Y :	12	13	14	16

8. Find $\Delta(\log x)$.

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

10. Using Taylor series method, find $y(1.1)$ given $\frac{dy}{dx} = x + y$ and $y(1) = 0$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Two groups of 100 people each were taken for testing the use of vaccine 15 person contracted the disease out of the inoculated persons, while 25 contracted the disease in the other group. Test the efficiency of the vaccine using χ^2 value. (8)

(ii) In a large city A, 20% of a random sample of 900 school boys had a slight physical defect. In another large city B 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant? (8)

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 number 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) (i) 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. (8)

(ii) 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. (8)

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

Or

(b) Find out the main effects and interaction in the following 2^2 factorial experiment and write down the analysis of variances table. (16)

Block	Treatments			
I	(1)	kp	k	p
	64	6	25	30
II	k	(1)	kp	p
	14	75	33	50
III	kp	p	k	(1)
	17	41	12	76
IV	p	k	(1)	kp
	25	33	75	10

13. (a) (i) Solve the following system of equations by Gauss Jordan elimination method $10x + y - z = 11.19$; $x + 10y + z = 20.08$; $-x + y + 10z = 35.61$. (8)

(ii) Solve the following system of equations correct to two places of decimals Jacob's iteration method. $30x - 2y + 3z = 75$; $x + 17y - 2z = 48$; $x + y + 9z = 15$. (8)

Or

(b) (i) Find the numerical largest eigenvalue of $A = \begin{pmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{pmatrix}$ by power method. (8)

(ii) Find A^{-1} by Gauss Jordan method if $A = \begin{pmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{pmatrix}$. (8)

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 $I = \int_0^6 \frac{1}{1+x} dx$ 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 at 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 Taylor's series method of the fourth order, find y at $x = 1.1$ and 1.2 by solving the equation $\frac{dy}{dx} = x^2 + y^2$; $y(1) = 2$. (6)

(ii) Given that $\frac{dy}{dx} = 1 + y^2$; $y(0.6) = 0.6841$, $y(0.4) = 0.4228$, $y(0.2) = 0.2027$, $y(0) = 0$, find $y(-0.2)$, using Milne's predictor-corrector method. (10)

Or

(b) (i) Find the value of $y(1.2)$, $y(1.4)$, using Runge-Kutta method of the fourth order, given that $\frac{dy}{dx} = y^2 + xy$; $y(1) = 1$. (8)

(ii) Solve the equation $y''(x) - y(x) = x$ for $y(0) = 0$, $y(1) = 0$ with $h = 1/4$. (8)