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

Question Paper Code : 31270

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Mechanical Engineering

MA 2266 — STATISTICS AND NUMERICAL METHODS

(Common to Production Engineering and Automobile Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

(Use of Statistical Tables may be permitted)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is meant by a Null hypothesis?

2. What is meant by a level of significance?

3. Distinguish between experimental and extraneous variables.

4. Is a 2×2 Latin square design possible? Why?

5. State the order of convergence and convergence condition for Newton's Raphson method.

6. State the principle used in Gauss-Jordan method.

7. Distinguish between interpolation and extrapolation.

8. Write down the Trapezoidal rule to evaluate $\int_0^6 f(x)\,dx$ with $h = 0.5$.

9. Write Taylor's series formula to solve $y' = f(x, y)$ with $y(x_0) = y_0$.

10. State Milne's predictor formula.

PART B — (5 × 16 = 80 marks)

11. (a) (i) In a certain city 380 men out of 800 are found to be smokers. Discuss whether this information supports the view that majority of men in this city are non-smokers? (8)

(ii) A filling machine is expected to fill 5 kg of powder into bags. A sample of 10 bags gave the weights 4.7, 4.9, 5, 5.1, 5.4, 5.2, 4.6, 5.1, 4.6 and 4.7. Test whether the machine is working properly. (8)

Or

(b) (i) Time taken by workers in performing a job are given below : (8)

Method I	20	16	26	27	23	22	
Method II	27	33	42	35	32	34	38

Test whether there is any significant difference between the variances of time distribution.

(ii) A set of 5 identical coins is tossed 320 times and the number of heads appearing each time is recorded. (8)

No. of heads	0	1	2	3	4	5
Frequency	14	45	80	112	61	8

Test whether the coins are unbiased at 5% level of significance.

12. (a) The following data represent the number of units of production per day turned out by 5 different workers using four different types of machines. (16)

		Machine type			
		A	*B*	*C*	*D*
	1	44	38	47	36
	2	46	40	52	43
Workers	3	34	36	44	32
	4	43	38	46	33
	5	38	42	49	39

(i) Test whether the five men differ with respect to mean productivity.

(ii) Test whether the mean productivity is the same for the four different machine types.

Or

(b) A varietal trial was conducted on wheat with four varieties *A, B, C, D* in a Latin Square design. The plan of the experiment and the per plot yield are given below :

C25	B23	A20	D20
A19	D19	C21	B18
B19	A14	D17	C20
D17	C20	B21	A15

Analyse the data and interpret the result. (16)

13. (a) (i) Find the positive root of $x = \cos x$ using Newton's method. (8)

(ii) Solve by Gauss-Seidel method, the following system : (8)

$$28x + 4y - z = 32$$
$$x + 3y + 10z = 24$$
$$2x + 17y + 4z = 35.$$

Or

(b) (i) Solve by Gauss-Elimination method : (8)

$$3x + 4y + 5z = 18$$
$$2x - y + 8z = 13$$
$$5x - 2y + 7z = 20.$$

(ii) Using Power method, find the dominant eigen value and its eigen vector of $A = \begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$. (8)

14. (a) (i) Using Lagrange's formula, find $f(6)$ given. (8)

x	2	5	7	10	12
$f(x)$	18	180	448	1210	2028

(ii) From the following data, find θ at $x = 43$ and $x = 84$. (8)

x	40	50	60	70	80	90
θ	184	204	226	250	276	304

Also express θ in terms of x.

Or

(b) (i) Find $f'(8)$ given $f(6)=1.556$, $f(7)=1.69$, $f(9)=1.908$, $f(12)=2.158$. (8)

(ii) Evaluate $\int_1^2 \frac{dx}{1+x^2}$ taking $h=0.2$ using Trapezoidal rule. Can you use Simpson's rule? Give reasons. (8)

15. (a) (i) Solve the equation $\frac{dy}{dx}=1-y$ given $y(0)=0$ using Modified Euler's method and tabulate the solutions at $x=0.1, 0.2$ and 0.3. Compare your results with the exact solutions. (8)

(ii) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx}=\frac{y^2-x^2}{y^2+x^2}$ given $y(0)=1$ at $x=0.2, 0.4$. (8)

Or

(b) Given $y'=x^2-y$, $y(0)=1$, $y(0.1)=0.9052$, $y(0.2)=0.8213$ find $y(0.3)$ by Taylor series. Also find $y(0.4)$ and $y(0.5)$ by Milne's method. (16)