Reg. No. :

Question Paper Code : 80220

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

Fourth Semester

Automobile Engineering

MA 8452 – STATISTICS AND NUMERICAL METHODS

(Common to Mechanical Engineering/Robotics and Automation Engineering/Mechatronics Engineering/Production Engineering)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Statistical Tables may be permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define type I and type II errors.

2. State any two applications of χ^2–test.

3. What are the basic principles of an experimental design?

4. What is the purpose of analysis of variance?

5. What is the condition for convergence of Gauss Jacobi and Gauss seidal methods?

6. Define a direct and an indirect methods of solving systems of simultaneous linear equations.

7. When do we use the divided difference methods and the Newton's forward and backward interpolation methods?

8. Write the formulae for trapezoidal and Simpson's $\frac{1}{3}^{rd}$ rules.

9. What are the various methods of solving ordinary differential equations?

10. What do you do in improved and modified Euler methods.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) The manufacturer of a medicine claimed that it was 90% effective in relieving an allergy for a period of 8 hours. In a sample of 200 people who had the allergy, the medicine provided relief for 160 people. Determine whether the manufacturer's claim is legitimate at 1% level of significance. (8)

(ii) A test of the breaking strengths of 6 ropes manufactured by a company showed a mean breaking strength of 3515 kg and a standard deviations of 60 kg, whereas the manufacturer claimed a mean breaking strength of 3630 kg. Can we support the manufacture's claim at a level of significance of 0.05. (8)

Or

(b) (i) Find the maximum likelihood estimate for the parameter λ of a poission distribution given by

$$P[X = x] = f(x;\lambda) = \frac{e^{-\lambda} \cdot \lambda^x}{x!},\ x = 0, 1, 2, \ldots$$ on the basis of a sample of size 'n'. Also find its variance. (8)

(ii) In the past the standard deviation of weights of certain 1135 gm. packages filled by a machine was 7.1 grams. A random sample of 20 packages showed a standard deviation of 9.1 grams. Is the apparent increase in variability significant at 0.05 level of significance? (8)

12. (a) A farmer wishes to test the effects of four different fertilizers A, B, C, D on the yield of wheat. In order to eliminate sources of error due to variability in soil fertility he uses the fertilizers in a Latin square arrangements as indicated below where the number indicate yields in Kilograms per unit area. Perform an analysis of variance to determine if there is a significant difference between the fertilizers at 0.01 level of significance. (16)

A 18	C 21	D 25	B 11
D 22	B 12	A 15	C 19
B 15	A 20	C 23	D 24
C 22	D 21	B 10	A 17

Or

(b) Table below shows the seeds of 4 different types of corns planted in 3 blocks. Test at 0.05 level of significance whether the yields in kilograms per unit area vary significantly with different types of corns. (16)

Types of Corns

	I	II	III	IV
Blocks A	4.5	6.4	7.2	6.7
B	8.8	7.8	9.6	7.0
C	5.9	6.8	5.7	5.2

13. (a) (i) Find by Newton-Raphson method, the real root of $3x - \cos x - 1 = 0$ correct to 4 decimal places. (8)

(ii) Solve the Gauss-Jordan method, the equations

$$2x + y + 4z = 12$$
$$8x - 3y + 2z = 20.$$
$$4x + 11y - z = 33$$ (8)

Or

(b) (i) Solve by Gauss-Seidal method of iteration the equations upto 4 decimal places.

$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$ (8)

(ii) Find the numerically largest eigen value of $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ by Power method. (8)

14. (a) (i) Find the third divided differences with arguments a, b, c, d of the function $\frac{1}{x}$. (8)

(ii) Dividing the range into 10 equal parts, find the approximate value of $\int_0^{\pi} \sin x \, dx$ by Simpson's $\frac{1}{3}^{rd}$ rule. Also compute the true value. (8)

Or

(b) (i) The following data gives the melting point of an alloy of lead and zinc where t is the temperature in degree centigrade and p is the percentage of lead in the alloy.

p :	40	50	60	70	80	90
t :	184	204	226	250	276	304

Using Newton's interpolation formula, find the melting point of the alloy containing 84 percent of lead. (8)

(ii) Given the values :

x :	14	17	31	35
$f(x)$:	68.7	64.0	44.0	39.1

Find the value of $f(x)$ corresponding to $x = 27$. (8)

15. (a) Apply the Taylor's series method to find the value of $y(1.1)$, $y(1.2)$ and $y(1.3)$ correct to three decimal places given that $y' = xy^{1/3}$, $y(1) = 1$, taking the first three terms of the Taylor series expansion get the closed form solution of the differential equation and compare the actual values of y to the approximate values calculated. (16)

Or

(b) (i) Solve the equation $\frac{dy}{dx} = 1 - y$ with the initial condition $x = 0$, $y = 0$ using Euler's algorithm and by Euler's improved method, tabulate the solutions at $x = 0.1$, 0.2 and 0.3. (8)

(ii) Apply the fourth order Runge-Kutta method to find an approximate value of y when $x = 0.2$, given that $y' = x + y$, $y(0) = 1$. Correct to 4 decimal places. (8)