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 —  $(10 \times 2 = 20 \text{ marks})$ 

- 1. Define type I and type II errors.
- 2. State any two applications of  $\chi^2$ -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  $\frac{1}{3}$  rules.
- 9. What are the various methods of solving ordinary differential equations?
- 10. What do you do in improved and modified Euler methods.

- 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.

Or

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

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

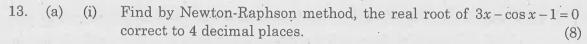
A 18 C 21 D 25 B 11 D 22 B 12 A 15 C 19 B 15 A 20 C 23 D 24 C 22 D 21 B 10 A 17

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



(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)