Reg. No. :

Question Paper Code : 60045

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Second Semester

MA 3251 — STATISTICS AND NUMERICAL METHODS

(Common to All Branches (Except Marine Engineering))

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Statistical tables and calculators are permitted for use.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Define critical value of a test statistic.

2.   What do you mean by degree of freedom?

3.   What are the three basic principles of experimental design? Write short notes on Analysis of Variance.

4.   Compare randomized block design over Latin square design.

5.   Sate the criterion for convergence of Newton-Raphson method.

6.   Find all the Eigen values of $A = \begin{pmatrix} 2 & 3 \\ 3 & 2 \end{pmatrix}$ by Jacobi method.

7.   If $f(x) = \dfrac{1}{x^2}$, find the divided difference $f(a, b)$ and $f(a, b, c)$.

8.   Apply Trapezoidal method to evaluate $I = \int\limits_0^1 e^{x^2} dx$, taking $h = 0.2$.

9.   Use Euler's formula to find $y(0.2)$ and $y(0.4)$ given $y' = x + y$, $y(0) = 1$.

10.   Write down the Adam-Bashforth predictor and corrector formulae.

PART B — (5 × 16 = 80 marks)

11. (a) (i) In a random sample of size 500, the mean is found to be 20. In another independent sample of size 400, mean is 15. Could the samples have been drawn from the same population with S.D.4. Use 1% level of significance. (8)

(ii) Two independent samples of sizes 8 and 7 contained the following values : (8)

Sample I : 19, 17, 15, 21, 16, 18, 16, 14

Sample II : 15, 14, 15, 19, 15, 18, 16

Is the difference between the sample means significance? Use 5% level of significance.

Or

(b) (i) Fit a Poisson distribution for the following data and test the goodness of fit at 5% level of significance. (8)

x	0	1	2	3	4	5	Total
f	6	13	13	8	4	3	47

(ii) A total number of 3759 persons were interviewed in a public opinion survey on a political proposal. Of them, 1872 were men and the rest women. 2257 persons were favour of the proposal and 917 were opposed to it. 243 men were undecided and 442 women were opposed to the proposal. Justify or contradict the hypothesis that there is no association between sex of persons and their attitude at 5% level of significance. (8)

12. (a) Three varieties of a crop are tested in a randomized block design with four replications, the layout being given as below. The yields are given in Kilograms. Analyze for significance. (16)

C48	A51	B52	A49
A47	B49	C52	C51
B49	C53	A49	B50

Or

2

60045

(b) The following data resulted from an experiment to compare three burners B_1, B_2 and B_3. Use the Latin square design to test the hypothesis that there is no difference between the burners. (16)

	Engine-1	Engine-2	Engine-3
Day-1	B_1 - 16	B_2 - 17	B_3 - 20
Day 2	B_2 - 16	B_3 - 21	B_1 - 15
Day-3	B_3 - 15	B_1 - 12	B_2 - 13

13. (a) (i) Find a positive root of $f(x) = 2x - \log_{10} x - 7$ using iterative method. (6)

(ii) Use Gauss-Seidal iterative method to obtain the solution of the equations :

$28x + 4y - z = 32;\ x + 3y + 10z = 24;\ 2x + 17y + 4z = 35$, correct to 4 decimal accuracy. (10)

Or

(b) (i) Solve the following system of equations by Gauss-Jordan method. (6)

$x - y + z = 1;\ -3x + 2y - 3z = -6;\ 2x - 5y + 4z = 5$.

(ii) Find the dominant Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$ by Power method, correct to two decimal places. Choose the initial vector as $\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$. (10)

14. (a) (i) Find the number of students whose weight is between 60 and 70 lbs from the following data using Newton's forward difference interpolation formula. (8)

x Weight in lbs.	0-40	40-60	60-80	80-100	100-120
y No. of students	250	120	100	70	50

(ii) Find the first two derivatives of the function at $x = 1.5$ from the table below using Newton's forward formula : (8)

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.0	13.625	24.0	38.875	59.0

Or

3 60045

(b) (i) If $f(0) = 1$, $f(1) = 4$, $f(3) = 40$ and $f(4) = 85$, find $f(x)$ that satisfies this data using Newton's divided difference formula. Hence, find $f(5)$. (8)

(ii) Evaluate $\int_1^{1.2} \int_1^{1.4} \dfrac{dx\,dy}{x+y}$ by Simpson's y_3 Rule by taking $h = k = 0.1$. (8)

15. (a) (i) Solve $\dfrac{dy}{dx} = x^2 - y$, given $y(0) = 1$ and find values of $y(0.1)$ and $y(0.2)$ using Taylor series method, correct to four decimal places. (8)

(ii) Compute $y(0.1)$ given $\dfrac{dy}{dx} + y + xy^2 = 0$, $y(0) = 1$, by taking $h = 0.1$ using Runge-Kutta method of order four, correct to 4 decimal accuracy. (8)

Or

(b) (i) Use Euler's modified method to find $y(0.1)$, $y(0.2)$ given $\dfrac{dy}{dx} = x^2 + y^2$, $y(0) = 1$. (8)

(ii) Use Milne's predictor-corrector formula to find $y(0.4)$, given $\dfrac{dy}{dx} = 0.5(1 + x^2)y^2$, $y(0) = 1$, $y(0.1) = 1.06$, $y(0.2) = 1.12$ and $y(0.3) = 1.21$. (8)

---

4   60045

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

MECH

Question Paper Code : **70134**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Civil Engineering

MA 3251 – STATISTICS AND NUMERICAL METHODS

(Common to : All branches (Except Marine Engineering))

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Type-I and Type-II errors.

2. Write down the uses of χ^2 distribution.

3. What do you mean by two-way classification in analysis of variance?

4. Give the reason, why a 2×2 Latin square is not possible?

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

6. Solve $5x - 3y = 8$; $3x + y = 2$ by Gauss-Jordan method.

7. State the Newton forward formulae for the first and second order derivatives at $x = x_0$ upto the fourth order difference term.

8. Evaluate $\int_{1}^{2} \frac{x}{1+x^2} dx$ using Trapezoidal rule, taking $h = 0.2$.

9. Using Euler's method find $y(0.2)$, given $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$.

10. What is the condition to apply Adams-Bash forth predictor corrector method?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Test whether the sample having the values 63, 63, 64, 55, 66, 69, 70, 70 and 71 has been chosen from a population with mean of 65 at 5% level of significance. (8)

(ii) Two random samples of 11 and 9 items show that the samples standard deviations of their weights as 0.8 and 0.5 respectively. Assuming the weight distributions are normal, test the hypothesis that the true variances are equal, against the alternative hypothesis that they are not. (8)

Or

(b) (i) To compare the prices of certain production in two cities, ten shops were selected at random in each town. The prices were noticed below.

City (x) : 61 63 56 63 56 63 59 56 44 61

City (y) : 55 54 47 59 51 61 57 54 64 58

Test whether the average prices can be said to be the same in two cities. (8)

(ii) The following data represents the monthly sales (in Rs.) of a certain retail stores in a leap year. Examine if there is any seasonality in the sales. 6,100, 5,600, 6,350, 6,050, 6,250, 6,200, 6,300, 6,250, 5,800, 6,000, 6,150 and 6,150. (8)

12. (a) In order to determine whether there is significant difference in the durability 3 makes of computers, sample of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows :

	A	5	6	8	9	7
Makes:	B	8	10	11	12	4
	C	7	3	5	4	1

In view of the above data, what conclusion can you draw? (16)

Or

(b) A variable trial was conducted on wheat with four varieties is a Latin square design. The plan of the experiment and the per plot yield are given below: (16)

C 25	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

Analyze data and interpret the result.

2   70134

13. (a) (i) Find a real root of the equation $\cos x = 3x - 1$ correct to 4 decimal places using fixed point iteration method. (8)

(ii) Using Jacobi method to find the eigen values and the corresponding eigen vectors of the matrix $\begin{pmatrix} 6 & \sqrt{3} \\ \sqrt{3} & 4 \end{pmatrix}$. (8)

Or

(b) (i) Solve the system of equations by Gauss-Seidal method $x - y + 4z = 4$, $x + 5y + 3z = 6$ and $5x - y - z = 1$. (8)

(ii) Using Power method find the largest eigen value and the corresponding eigen vector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. (8)

14. (a) (i) Using Newton's divided difference formula, find the polynomial $f(x)$ and hence find $f(4)$ from the following data : (8)

x :	−2	−1	1	2	6
$f(x)$:	−15	−10	0	29	1705

(ii) Using Newton's backward interpolation formula, find the polynomial $f(x)$ from the following data and hence find $f(5)$. (8)

x :	−2	0	2	4	6
$f(x)$:	31	−7	11	133	407

Or

(b) (i) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the final acceleration using the entire data : (8)

t :	0	5	10	15	20
v :	0	3	14	69	228

(ii) Evaluate $\int_{2}^{3}\int_{1}^{2} \dfrac{dx\,dy}{x^2 + y^2}$ using Simson's rule by four sub intervals. (8)

3 70134

15. (a) Apply Runge-Kutta method of order 4 to find an approximate value of y for $x = 0.2$ and $x = 0.4$, taking $h = 0.2$, if $\dfrac{dy}{dx} = \dfrac{y^2 - x^2}{y^2 + x^2}$ given that $y = 1$ when $x = 0$. (16)

Or

(b) (i) Using Modified Euler method, find $y(0.1)$ and $y(0.2)$ given $\dfrac{dy}{dx} = 1 - y$; $y(0) = 0$. (8)

(ii) Solve $\dfrac{dy}{dx} = y - x^2$ at $x = 0.8$ by Milne's predictor and corrector method, given $y(0) = 1$, $y(0.2) = 1.12186$, $y(0.4) = 1.46820$ and $y(0.6) = 1.7379$. (8)

_____

70134

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)
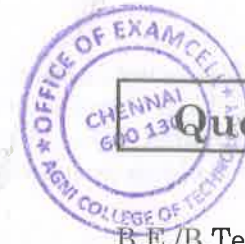
Or

(b) (i) Solve the equation $\dfrac{dy}{dx} = 1 - y$ 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)

4   80220

07/05/19

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 × 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 × 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

$$P[X = x] = f(x; \lambda) = \frac{e^{-\lambda} \cdot \lambda^x}{x!}, \quad x = 0, 1, 2, \ldots$$ 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)

90344   -4-

15. a) i) Solve $y^1 = x + y^2$ with $y(0) = 1$ by using Taylor's series method and find the value of $y(0.1)$.   (8)

    ii) Apply Runge-Kutta method of fourth order to determine $y(0.1)$ with $h = 0.1$ from $\dfrac{dy}{dx} = x^2 + y^2$, $y(0) = 1$.   (8)

(OR)

b) i) Using Modified Euler's method, find $y(0.1)$, $y(0.2)$ given that $y^1 = y + e^x$ with $y(0) = 0$.   (8)

    ii) Given $\dfrac{dy}{dx} = x^2 (1 + y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$, evaluate $y(1.4)$ by using Milne's method.   (8)

Question Paper Code : 90344

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Mechanical Engineering

MA 8452 – STATISTICS AND NUMERICAL METHODS

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

(Regulations 2017)

Time : Three Hours   Maximum : 100 Marks

(Statistical Tables are permitted)

Answer ALL questions.

PART – A   (10×2=20 Marks)

1. Explain the terms sample size and sampling error in random sampling.

2. Define Type I and Type II errors in testing of hypothesis.

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

4. What are the assumptions to be followed in the analysis of variance ?

5. Derive the Newton's iterative formula to find $\sqrt{N}$ where N is a positive real number.

6. Find the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ using power method.

7. Find the divided difference table for the following data.

x	2	3	5
y	0	14	102

8. For using Simpson's 1/3 rule, what is the condition about the intervals.

9. Using Euler's method, find y at $x = 0.1$ if $y^1 = 1 + xy$ given that $y(0) = 2$.

10. How many prior values are required in Milne's method to predict the next value ?

90344

90344

-2-

-3-

PART – B (5×16=80 Marks)

11. a) i) A sample of heights of 6400 Englishmen has a mean of 67.85 inches and a S.D. of 2.56 inches, while a sample of heights of 1600 Australians has a mean of 68.55 inches and a S.D. of 2.52 inches. Do the data indicate that Australians are on the average taller than Englishmen. (8)

 ii) A sample analysis of examination results of 1000 students were made and it was found that 260 failed, 110 first class, 420 second class and rest obtained third class. Do these data support the general examination result in the ratio 2 : 1 : 4 : 3. (8)

(OR)

b) i) The independent samples from normal populations with equal variance gave the following : (8)

Sample	Size	Mean	S.D.
1	16	23.4	2.5
2	12	24.9	2.8

Is the difference between the means significant ?

 ii) Two samples of sizes 9 and 8 give the sum of the squares of deviations from their respective means equal to 160 and 91 respectively. Can they be regarded as drawn from the same normal population ? (8)

12. a) The table shows the yield of paddy in arbitrary units obtained from four different varieties planted in five blocks where each block is divided into four plots. Test at 5% level whether the yields vary significantly with (i) soil differences (ii) differences in the type of paddy. (16)

Blocks	Types of Paddy			
	I	II	III	IV
A	12	15	10	14
B	15	19	12	11
C	14	18	15	12
D	11	16	12	16
E	16	17	11	14

(OR)

b) Analyse the variance in the Latin square of yields (in kgs) of paddy where P, Q, R, S denote the different methods of cultivation. (16)

S122	P121	R123	Q122
Q124	R123	P122	S125
P120	Q119	S120	R121
R122	S123	Q121	P122

Examine whether the different methods of cultivation have given significantly different yields.

13. a) i) Find the positive root of $f(x) = 2x^3 - 3x - 6 = 0$ by Newton's method correct to 5 decimal places. (8)

 ii) Solve the system of equations by Gauss elimination method.

 $x + 2y + z = 3$; $2x + 3y + 3z = 10$ & $3x - y + 2z = 13$. (8)

(OR)

b) i) Solve the equation $x^3 + x^2 - 1 = 0$ by using fixed point iteration method. (8)

 ii) Solve the following system of equations by Gauss-Jacobi method. (8)

 $4x_1 + x_2 + x_3 = 6$; $x_1 + 4x_2 + x_3 = 6$; $x_1 + x_2 + 4x_3 = 6$.

14. a) i) Use Lagrange's formula for the following data and hence find the value of y at x = 1. (8)

x	−1	0	2	3
y	−8	3	1	12

 ii) Evaluate $\int_0^1 \int_0^1 e^{x+y} dx\,dy$ by using Trapezoidal rule with h = k = 0.5. (8)

(OR)

b) i) Using Newton's divided difference formula, find the polynomial equation for the given data. (8)

x	−1	0	1	3
y	2	1	0	−1

 ii) Evaluate $\int_0^1 \left(\frac{1}{1+x^2} \right) dx$ with $h = \frac{1}{6}$ by using Simpson's rule. (8)

15. (a) If $\dfrac{dy}{dx} = x^2 + y^2$, y(0) = 1, find y(0.1), y(0.2) and y(0.3) by Taylor series method.

Hence find y(0.4) by Milne's Predictor-Corrector method.

OR

(b) If $\dfrac{dy}{dx} = \dfrac{y^2 - x^2}{y^2 + x^2}$, y(0) = 1, find y(0.2), y(0.4), y(0.6) by Runge-Kutta method.

Hence find y(0.8) by Milne's method.

———————

Question Paper Code : 57506

10|6|16
FN

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Mechanical Engineering

MA 6452 – STATISTICS AND NUMERICAL METHODS

(Common to Fourth Semester Automobile Engineering and Mechatronics Engineering)

[Also common to Fifth Semester for Mechanical Engineering (Sandwich)]

Time : Three Hours   **Maximum : 100 Marks**

Use of statistical tables is permitted.

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What are Type – I and Type – II errors ?

2. Give the formula for the χ^2 – test of independence for

a	b
c	d

3. State the principles of Design of Experiments.

4. Is 2 × 2 Latin square Design possible ? Why ?

5. Mention the order and condition for the convergence of Newton-Raphson method.

6. What is the procedure of Gauss-Jordan method ?

7. Specify the Newton's backward difference formulae for $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$

8. Write down the errors in Trapezoidal and Simpson's rules of numerical integration.

9. Find y(0.1) by Euler's method, if $\dfrac{dy}{dx} = x^2 + y^2$, y(0) = 0.1

10. Give the central difference approximations for y'(x), y"(x).

PART – B (5 × 16 = 80 Marks)

11. (a) (i) A mathematics test was given to 50 girls and 75 boys. The girls made an average grade of 76 with an SD of 6 and the boys made an average grade of 82 with an SD of 2. Test whether there is any difference between the performance of boys and girls.

    (ii) Theory predicts the proportion of beans in the groups A, B, C, D as 9 : 3 : 3 : 1. In an experiment among beans the numbers in the groups were 882, 313, 287 and 118. Does the experiment support the theory ?

OR

(b) (i) 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test whether these two proportions are same.

    (ii) The IQ's of 10 girls are respectively 120, 110, 70, 88, 101, 100, 83, 98, 95, 107. Test whether the population mean IQ is 100.

12. (a) Three varieties of coal were analysed by 4 chemists and the ash content is tabulated here. Perform an analysis of variance. **(16)**

		Chemists			
		A	B	C	D
Coal	I	8	5	5	7
	II	7	6	4	4
	III	3	6	5	4

OR

(b) The result of an RBD experiment on 3 blocks with 4 treatments A, B, C, D are tabulated here. Carry out an analysis of variance.

Blocks	Treatment effects			
I	A36	D35	C21	B36
II	D32	B29	A28	C31
III	B28	C29	D29	A26

2

57506

13. (a) (i) Solve the following equations by Gauss elimination method :

$$2x + y + 4z = 12,$$
$$8x - 3y + 2z = 20,$$
$$4x + 11y - z = 33,$$

    (ii) Using power method find the dominant eigen value of the matrix

$$\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$$

OR

(b) (i) If $A = \begin{pmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{pmatrix}$, find A^{-1} by Gauss-Jordan method.

    (ii) Solve the following equations by Gauss-Seidel method

$$x + y + 9z = 15,$$
$$x + 17y - 2z = 48,$$
$$30x - 2y + 3z = 75$$

14. (a) (i) Interpolate y(12), if

x :	10	15	20	25	30	35
$y(x)$:	35	33	29	27	22	14

    (ii) Evaluate $\int_0^1 \dfrac{dx}{1 + x^2}$ by Simpson's (1/3) rule, dividing the range into four equal parts.

OR

(b) (i) Find y'(1), if

x :	−1	0	2	3
$y(x)$:	−8	3	1	12

    (ii) Using Trapezoidal rule, evaluate $\int_1^2 \int_1^2 \dfrac{dx\,dy}{x + y}$ with h = K = 0.5.

3

57506

14. (a) (i) Given $\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2.8182$, $\log_{10} 659 = 2.8189$ and $\log_{10} 661 = 2.8202$. Find the value of $\log_{10} 656$ using Newton's divided difference formula. (8)

(ii) Find the first, second and third derivatives of the function $f(x)$ at $x = 1.5$. (8)

x :	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$:	3.375	7.0	13.625	24.0	38.875	59.0

Or

(b) (i) The velocity V of a particle at distances from a point on it's path is given by the table

T feet :	0	10	20	30	40	50	60
V feet/s :	47	58	64	65	61	52	38

Estimate the time taken to travel 60 feet by using Trapezoidal and Simpson's 1/3 rule. Compare the result with Simpson's 3/8 rule. (9)

(ii) A rod is rotating a plane. The following table gives the angle θ with respect to time 't' seconds.

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

Calculate the angular velocity and angular acceleration of the rod when $t = 0.6$ seconds. (7)

15. (a) (i) By fourth order Runge-Kutta method find $y(0.2)$ from $\dfrac{dy}{dx} = y - x$, $y(0) = 2$ taking $h = 0.1$. (8)

(ii) Solve the differential equation $\dfrac{d^2 y}{dx^2} - y = x$ with $y(0) = 0$, $y(1) = 0$ and $h = \dfrac{1}{4}$ by finite difference method. (8)

Or

(b) Using Taylor's series method, solve $\dfrac{dy}{dx} = xy + y^2$, $y(0) = 1$ at $x = 0.1, 0.2, 0.3$. Continue the solution at $x = 0.4$ by Milne's Predictor-Corrector method. (16)

———————

4   72071

1. What are the expected frequencies of 2×2 contingency table $\begin{array}{|c|c|} \hline a & b \\ \hline c & d \\ \hline \end{array}$?

2. A standard 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 of significance?

3. What are the uses of ANOVA?

4. What are the basic principles in the design of experiment?

5. Find the smallest positive root of $x^3 - 2x + 0.5 = 0$.

6. Evaluate $\Delta[x(x+1)(x+2)(x+3)]$.

7. Solve the following by Gauss Elimination method $10x + y = 18.141$; $x + 10y = 28.140$.

8. Apply Newton's backward formula to find a polynomial of degree 3.

x :	3	4	5	6
y :	6	24	60	120

9. Compute $y(0.1)$ correct to 4 decimal places if $y(x)$ satisfies $y' = x + y$, $y(0) = 1$, by Taylor's series method.

10. Write down the modified Euler formulae for $y' = f(x, y)$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) The sales manager of a large company conducted a sample survey in states A and B taking 400 samples in each case. The results were

	State A	State B
Average Sales	Rs. 2,500	Rs. 2,200
S.D.	Rs. 400	Rs. 550

Test whether the average sales is the same in the 2 states at 1% level of significance. (8)

(ii) A certain medicine administered to each of 10 patients resulted in the following increases in the B.P. 8, 8, 7, 5, 4, 1, 0, 0, −1, −1. Can it be concluded that the medicine was responsible for the increase in B.P. 5% level of significance. (8)

Or

(b) (i) It is believed that the precision of an instrument is no more than 0.16. Write down the null and alternative hypotheses for testing this belief. Carry out the test at 1% level of significance, given 11 measurements of the same subject on the instrument.
2.5, 2.3, 2.4, 2.3, 2.5, 2.7, 2.5, 2.6, 2.6, 2.7, 2.5. (8)

(ii) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables.

Sample 1	18	13	12	15	12	14	16	14	15
Sample 2	16	19	13	16	18	13	15		

Do the estimates of the population variance differ significantly at 5% level of significance? (8)

12. (a) (i) The accompanying data resulted from an experiment comparing the degree of soiling for fabric copolymerized with the 3 different mixtures of methacrylic acid. Analyse the classification. (6)

Mixture 1	0.56	1.12	0.90	1.07	0.94
Mixture 2	0.72	0.69	0.87	0.78	0.91
Mixture 3	0.62	1.08	1.07	0.99	0.93

(ii) A variable trial was conducted on wheat with 4 varieties in a Latin square design. The plan of the experiment is given below. Analyse data and interpret the result. (10)

C	25	B	23	A	20	D	20
A	19	D	19	C	21	B	18
B	19	A	14	D	17	C	20
D	17	C	20	B	21	A	15

Or

(b) (i) A set of data involving 4 tropical food stuffs A, B, C, D tried on 20 chicks is given below. All the 20 chicks are treated alike in all respects except the feeding treatments and each feeding treatment is given to 5 chicks. Analyse the data : (7)

A	55	49	42	21	52
B	61	112	30	89	63
C	42	97	81	95	92
D	169	137	169	85	154

(ii) Perform a 2-way ANOVA on the data given below : (9)

		Treatment 1		
		1	2	3
Treatment 2	1	30	26	38
	2	24	29	28
	3	33	24	35
	4	36	31	30
	5	27	35	33

Use the coding method subtracting 30 from the given number.

13. (a) (i) Using Gauss-Seidel method solve the system of the following equations correct to a decimal places. (10)
$$10x_1 - 2x_2 - x_3 - x_4 = 3$$
$$-2x_1 + 10x_2 - x_3 - x_4 = 15$$
$$-x_1 - x_2 + 10x_3 - 2x_4 = 27$$
$$-x_1 - x_2 - 2x_3 + 10x_4 = -9.$$

(ii) Find the inverse of the matrix $\begin{pmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{pmatrix}$ using Gauss Jordan method. (6)

Or

(b) (i) Solve the system of the following equations using Gauss Jordan method correct to two decimal places. (8)
$$2x_1 + 2x_2 - x_3 + x_4 = 4$$
$$4x_1 + 3x_2 - x_3 + 2x_4 = 6$$
$$8x_1 + 5x_2 - 3x_3 + 4x_4 = 12$$
$$3x_1 + 3x_2 - 2x_3 + 2x_4 = 6.$$

(ii) Determine by Power method the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$. (8)

2   72071

3   72071

41313   -4-

Reg. No. :

14/05/18

b) i) Solve the following system of equations by Gauss Elimination Method.

$2y - 3z = -5$

$x + 4y - 7z + t = -8$

$2x - y - t = -4$

$x + y + z = 6$ **(8)**

ii) Using the power method, find the largest Eigenvalue and the corresponding eigenvector for the matrix

$A = \begin{pmatrix} 1 & 4 \\ 3 & 2 \end{pmatrix}$. Let $X_0 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ **(8)**

14. a) i) Find the first derivative of f(x) at x = 0.4 from the following table :   **(8)**

x	0.1	0.2	0.3	0.4
f(x)	1.10517	1.22140	1.34986	1.49182

ii) Using Simpson's ⅓ rule, to evaluate $\int_0^1 \int_0^1 \dfrac{dxdy}{1+xy}$ with $\Delta x = \Delta y = 0.25$.   **(8)**

(OR)

b) i) Find the first two derivatives of $x^{1/3}$ at x = 56, given the table below :   **(8)**

x	50	51	52	53	54	55	56
y = x^{1/3}	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

ii) Evaluate $\int_0^2 e^x dx$ by using trapezoidal rule taking 6 sub intervals.   **(8)**

15. a) i) Given $\dfrac{dy}{dx} = y - x^2 + 1$, y(0) = 0.5. Find y(0.2) by modified Euler's Method.   **(6)**

ii) Given $5x \dfrac{dy}{dx} + y^2 - 2 = 0$, y(4) = 1, y(4.1) = 1.0049 y (4.2) = 1.0097, y (4.3) = 1.0143. Compute y(4.4) by Milne's Predictor-Corrector Method.   **(10)**

(OR)

b) i) Solve $y^1 = y^2 + x$, y(0) = 1 using Taylor Series Method for y(0.1) and y(0.2).   **(6)**

ii) Using Runge-Kutta Method of Order four, solve $y^1 = x + y$, y(0) = 1 to find y(0.1).   **(10)**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fourth/Fifth Semester

Mechanical Engineering

MA 6452 – STATISTICS AND NUMERICAL METHODS

(Common to Mechanical Engineering (Sandwich)/Automobile Engineering/ Mechatronics Engineering)

(Regulations 2013)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions.

PART – A   (10×2=20 Marks)

1. Define the following terms : Statistic, Parameter, Standard Error and Random Sampling.

2. For the following cases, specify which probability distribution to use in a hypothesis test.

   a) $H_0 : \mu = 27$, $H_1 : \mu \neq 27$, $\overline{X} = 20.1$, $\sigma = 5$, n = 12

   b) $H_0 : \mu = 98.6$, $H_1 : \mu > 98.6$, $\overline{X} = 65$, s = 12, n = 42

3. What are the basic elements of an ANOVA table for one way classification ?

4. What are the Basic designs of Experiment ?

5. State the Newton-Raphson method formula and the criteria for convergence.

6. Write a sufficient condition for Gauss-Seidel method to converge.

7. Find the divided difference table for the following data.

x	2	5	10
y	5	29	109

8. Obtain Lagrangian interpolation polynomial from the data.

x	0	1	3
f(x)	5	6	14

9. Using Euler's method, find y of x = 0.1 if $\frac{dy}{dx} = 1 + xy$, y(0) = 2.

10. Write down the finite difference scheme for solving y" + x + y = 0, y(0) = y(1) = 0.

PART – B (5×16=80 Marks)

11. a) i) The nicotine content in milligram of 2 samples of tobacco were found to be as follows :

| Sample A | 24 | 27 | 26 | 21 | 25 | |
| Sample B | 27 | 30 | 28 | 31 | 22 | 36 |

Can it be said that these samples were from normal population with the same mean. (6)

ii) Five coins are tossed 320 times. The number of heads observed is given below :

Number of Heads	0	1	2	3	4	5
Frequency	15	45	85	95	60	20

Examine whether the coin is unbiased. Use 5% level of significance. (10)

(OR)

b) i) Mechanical engineers testing a new arc welding technique, classified welds both with respect to appearance and an X-ray inspection.

	Appearance		
X-ray	Bad	Normal	Good
Bad	20	7	3
Normal	13	51	16
Good	7	12	21

Test for independence using 0.05 level of significance. (10)

ii) Given a sample mean of 83, a sample standard deviation of 12.5 and a sample size of 22, test the hypothesis that the value of the population mean is 70 against the alternative that it is more than 70. Use the 0.025 significance level. (6)

12. a) A chemist wishes to test the effect of four chemical agents on the strength of a particular type of cloth. Because there might be variability from one bolt to another, the chemist decides to use a randomised Block design, with the bolts of cloth consider as blocks, she selects five bolts and applies all four chemicals in random order to each bolt. The resulting tensile strengths follows :

	Bolt				
Chemical	1	2	3	4	5
1	73	68	74	71	67
2	73	67	75	72	70
3	75	68	78	73	68
4	73	71	75	75	69

Does the tensile strength depend on chemical ? Test at $\alpha = 0.10$. (16)

(OR)

b) A Latin square design was used to compare the bond strengths of gold semi conductor lead wires bounded to the lead terminal by 5 different methods, A, B, C, D and E. The bonds were made by 5 different operators and the devices were encapsulated using 5 different plastics. With the following results, expressed as pounds of force required to break the bond.

	Operator				
Plastics	1	2	3	4	5
1	A 3	B 2.4	C 1.9	D 2.2	E 1.7
2	B 2.1	C 2.7	D 2.3	E 2.5	A 3.1
3	C 2.1	D 2.6	E 2.5	A 2.9	B 2.1
4	D 2.0	E 2.5	B 3.2	B 2.5	C 2.2
5	E 2.1	A 3.6	B 2.4	C 2.4	D 2.1

Analyse these results and test with 0.01 level of significance. (16)

13. a) i) Solve the following system of equations by Gauss-Seidel method correct to three decimal places.
x + y + 54z = 110
27 x + 6y – z = 85
6x + 15y + 2z = 72 (8)

ii) Solve the following system of equations by Gauss Jordan method.
2x + y + 4z = 12
8x – 3y + 2z = 20
4x + 11y – z = 33 (8)

(OR)

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

| Question Paper Code : **53250** |

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

Fourth/Fifth Semester

Mechanical Engineering

MA 6452 – STATISTICS AND NUMERICAL METHODS

(Common to Mechanical Engineering(Sandwich)/Automobile Engineering/Mechatronics Engineering)

(Regulation 2013)

Time : Three hours   Maximum : 100 marks

Use of statistical tables is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Write any two importance uses of normal curve.

2.   Write any two Characteristics of χ^2 test.

3.   State about advantages of a completely randomized experimental design

4.   How to construct Latin square?

5.   Write Newton Raphson method for the solution of $f(x) = 0$.

6.   Define power method.

7.   State Newton's divided difference interpolation formulae.

8.   Write trapezoidal rule.

9.   State modified Euler formula.

10. Define fourth order R.K method.

PART B — (5 × 16 = 80 marks)

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

Or

(b)   Machinist is making engine parts with arc diameters of 0.7 inch. A random sample of 10 parts shows a mean diameter of 0.742 inch with a standard deviation of 0.040 inch. Compute the statistic to test the work is meeting the specification.

12. (a) Three varieties A, B, C of a crop are tested in a randomized block design with 4 replications. The plot yields in pounds are as follows.

   A 6 C 5 A 8 B 9

   C 8 A 4 B 6 C 9

   B 7 B 6 C 10 A 6

   Analyze experiential yield and start your conclusion.

   Or

   (b) The following table gives the number of refrigerators sold by 4 salesmen in 3 months May, June, July.

Month	Salesman			
May	50	40	48	39
June	46	48	50	45
July	39	44	40	39

   Is this a significant difference in the sales made by 4 salesmen?

   Is this a significant difference in the sales during different month?

13. (a) Solve the system of equations by Gauss elimination method $x + 2y + z = 3$, $2x + 3y + 3z = 10$, $3x - y + 2z = 13$.

   Or

   (b) Find the real positive root $3x - \cos x - 1 = 0$ by Newton Raphson method. Correct to three decimal places.

14. (a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using trapezoidal rule with $h = 0.2$. Hence obtain an approximate value of π.

   Or

   (b) From the following table find $f(x)$ using Newton's interpolation formula

x :	1	2	7	8
$f(x)$:	1	5	5	4

15. (a) Apply fourth order R-K method to find $y(0.2)$ given $y' = x + y$, $y(0) = 1$.

   Or

   (b) Given $y' = y$ and $y(0) = 1$ determine the values of y at $x = 0.01(0.01)(0.04)$ by Euler method.

———————————

2   53250

14. (a) (i) Using Lagrange's formula, fit a polynomial to the data (6)

$$x: \quad -1 \quad 0 \quad 2 \quad 3$$
$$y: \quad -8 \quad 3 \quad 1 \quad 12$$

Hence find y at $x = 1.5$ and $x = 1$.

(ii) Evaluate $\int_{-3}^{3} x^4 \, dx$ correct to three decimals dividing the range of integration into 8 equal parts using Trapezoidal rule. Simpson's 1/3rd rule and 3/8 rule. Also compare the results with actual integration. (10)

Or

(b) (i) From the data given below, find θ at $x = 43$ and at $x = 84$ (8)

$$x: \quad 40 \quad 50 \quad 60 \quad 70 \quad 80 \quad 90$$
$$\theta: \quad 184 \quad 204 \quad 226 \quad 250 \quad 276 \quad 304$$

(ii) Evaluate $\int_{0}^{2} \int_{1}^{2} \sin(9x + y) \, dx \, dy$ by Simpson's 1/3rd rule and Trapezoidal rule with $h = 0.25$ and $k = 0.5$. (8)

15. (a) (i) Consider the IVP $y' = 1 - y$, $y(0) = 0$. Using the Euler's method find $y(0.2)$ and Modified Euler method find $y(0.4)$ and $y(0.6)$ then by using Milne's method obtain $y(0.8)$. (10)

(ii) Solve the following by finite difference method $y'' - y = 0$ given $y(0) = 0, y(1) = 1$ with $h = 0.25$. (6)

Or

(b) Given $y' = y - x^2$, $y(0.6) = 1.7379$ find $y(0.7), y(0.8)$ using R.K method of Fourth order. (16)

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 80610

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Mechanical Engineering

MA 6452 — STATISTICS AND NUMERICAL METHODS

(Common to Fourth Semester Automobile Engineering, Mechatronics Engineering and Fifth Semester for Mechanical Engineering (Sandwich))

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Use of statistical tables is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the main use of χ^2 test.

2. Write down the formula of test statistic t to the significance of difference between the mean (large samples).

3. What is ANOVA?

4. Define experimental error.

5. Derive a formula to find the value of $N^{1/2}$ and $1/N$ where $N \neq 0$, using Newton Raphson method.

6. Solve the equations $5x - 2y = 1$, $4x + 28y = 23$ using the Gauss elimination method.

7. Find the polynomial which takes the following values given $f(0) = -1$, $f(1) = 1$ and $f(2) = 4$ using the Newton's interpolating formula.

8. State any two properties of divided differences.

9. Write down the Euler formula for $y' = f(x, y)$, $y(x_0) = y_0$.

10. Using Taylor's method find y at $x = 0.1$ when $y' = x^2 - y$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A sample of 900 members has a mean 3.4 and standard deviation 261 cms. Is the sample from a large population of mean 3.25 cms and standard deviation 2.61 cms? (8)

(ii) Two random samples gave the following results :

Sample	Size	Sample mean	Sum of squares of deviation from the mean
1	10	15	90
2	12	14	108

Test whether the samples come from the same normal population at 5% level of significance (given $F_{0.05}(9,11) = 2.90$, $F_{0.05}(11,9) = 3.10$, $t_{0.05}(20) = 2.086$, $t_{0.05}(22) = 2.07$ approximately). (8)

Or

(b) (i) The mean height of 50 male students who showed above average participation in college athletics was 68.2 inches with a standard deviation of 2.5 inches; while 50 male students who showed no interest in such participation had a mean height of 67.5 inches with a standard deviation of 2.8 inches

(1) Test the hypothesis that male students who participate in college athletics are taller than other male students.

(2) By how much should the sample size of each of the two groups be increase in order that the observed difference of 0.7 inches in the mean height be significant at the 5% level of significance. (8)

(ii) A group of 10 rats fed on diet A and another group of 8 rats fed on diet B. recorded the following increase in weight.

Diet A 5 6 8 1 12 4 3 9 6 10

Diet B 2 3 6 8 10 1 2 8

Find the variances are significantly different. (8)

12. (a) (i) The following table gives the yields of 15 samples of plot under three varieties of seed.

A 20 21 23 16 20

B 18 20 17 15 25

C 25 28 22 28 32

Test using analysis of variance whether there is a significant difference in the average of yield of seeds. (8)

(ii) A variable trial was conducted on wheat with 4 varieties in a latin square design. The plan of the experiment and the per plot yield are given below.

C 25 B 23 A 20 D 20

A 19 D 19 C 21 B 18

B 1 A 14 D 17 C 20

D 17 C 20 B 21 A 15

Analyse data and interpret the result. (8)

Or

(b) A company appoints 4 salesmen A, B, C and D and observes their sales in 3 seasons, summer winter and monsoon. The figures are given in the following table :

Season	Salesmen			
	A	B	C	D
Summer	45	40	28	37
Winter	43	41	45	38
Monsoon	39	39	43	41

Carry out an analysis of variances. (16)

13. (a) (i) Find the largest eigenvalue and eigenvector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$, by power method. (8)

(ii) Using Gauss-Jordon method, find the inverse of the matrix $\begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{pmatrix}$. (8)

Or

(b) (i) Solve the following system of equations using Gauss — Seidel iterative method $8x - y + z = 18$, $2x + 5y - 2z = 3$, $x + y - 3z = -6$. (8)

(ii) Solve the following equations using Jacobi's iteration method $28x + 4y - z = 32$, $x + 3y + 10z = 24$, $2x + 17y + 4z = 35$. (8)

06/11/17 – (FN)

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

14. a) i) Using Lagrange's interpolation formula, find the polynomial f(x) form the
following data : **(8)**

x :	0	1	4	5
f(x) :	4	3	24	39

ii) Find the value of cos(1.74), using suitable formula from the following data. **(8)**

x : 1.7	1.74	1.78	1.82	1.86
sin(x) : 0.9916	0.9857	0.9781	0.9691	0.9584

(OR)

b) i) From the following values, find f(x) and hence find f (6) by Newton's
divided difference formula. **(8)**

x :	1	2	7	8
f(x) :	1	5	5	4

ii) Evaluate $\int_{1}^{1.2}\int_{1}^{1.4}\dfrac{1}{1+x}\,dxdy$ by Trapezoidal rule with h = k = 0.1. **(8)**

15. a) i) Using Taylor series method, find the value of y at x = 0.1, if y satisfies the
equation $\dfrac{dy}{dx}=x^2-y$ given that y = 1 when x = 0, correct to 3 decimal places. **(8)**

ii) Solve the equation $\dfrac{d^2y}{dx^2}=x+y$ with boundary conditions y (0) = 1 = y(1) by
finite difference method, by taking 4 subintervals. **(8)**

(OR)

b) i) Using R-K method of fourth order, find the value of y at x = 0.1, if y satisfies
the equation $\dfrac{dy}{dx}=x+y^2$ given that y = 1 when x = 0, correct to 3 decimal
places. **(8)**

ii) Given $\dfrac{dy}{dx}=x^3+y, y(0)=2, y(0.2)=2.073, y(0.4)=2.452, y(0.6)=3.023$,
compute y (0.8) by Milne's method. **(8)**

Question Paper Code : 50782

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fourth/Fifth Semester
Mechanical Engineering
MA 6452 – STATISTICS AND NUMERICAL METHODS
(Regulations 2013)

(Common to Mechanical Engineering (Sandwich), Automobile Engineering,
Mechatronics Engineering)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. What is meant by level of significance and critical region ?

2. State any two applications of Chi-square test.

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

4. What is a completely randomized design ?

5. What are the merits of Newton-Raphson method ?

6. Distinguish between Gauss elimination and Gauss-seidel methods.

7. What is meant by interpolation ?

8. What is the order of error in Trapezoidal and Simpson's one-third rules ?

9. What is main difference between single and multistep methods in solving first order
ordinary differential equation ?

10. State the modified Euler's formula for first order ordinary differential equation.

PART – B   (5×16=80 Marks)

11. a) i) A random sample of 100 bulbs from a company P shows a mean life 1300 hours and standard deviation of 82 hours. Another random sample of 100 bulbs from company Q showed a mean life 1248 hours and standard deviation of 93 hours. Are the bulbs of company P superior to bulbs of company Q at 5% level of significance ?   (8)

     ii) A random sample of 10 boys has the following IQ's 70, 83, 88, 95, 98, 100, 101, 107, 110 and 120. Do these data support the assumption of a population mean IQ of 100 at 5% level of significance ?   (8)

     (OR)

   b) i) Time taken by workers in performing a job is given below :

Method 1   20   16   26   27   23   22

Method 2   27   33   42   35   34   38

Test whether there is any significant difference between the variances of the time distribution at 5% level of significance.   (8)

     ii) Using the data given in the following table to test at 1% level of significance whether a person's ability in Mathematics is independent of his/her interest in Statistics.

		Ability in Mathematics		
		Low	Average	High
Interest in Statistics	Low	63	42	15
	Average	58	61	31
	High	14	47	29

   (8)

12. a) The following data represent a certain person to work from Monday to Friday by four different routes.

		Days				
		Mon	Tue	Wed	Thu	Fri
Routes	1	22	26	25	25	31
	2	25	27	28	26	29
	3	26	29	33	30	33
	4	26	28	27	30	30

Test at 5% level of significance whether the differences among the means obtained for the different routes are significant and also whether the differences among the means obtained for the different days of the week are significant.   (16)

     (OR)

   b) Four air-conditioning compressor designs were tested in four different regions of India. The test was repeated by installing additional air conditioners in a second cooling season. The following are the times to failure (to the nearest month) of each compressor tested.

		Replicate 1				Replicate 2			
		A	B	C	D	A	B	C	D
Design	Northeast	58	35	72	61	49	24	60	64
	Southeast	40	18	54	38	38	22	64	50
	Northwest	63	44	81	52	59	16	60	48
	Southwest	36	09	47	30	29	13	52	41

   (16)

Test at the 0.05 level of significance whether the differences among the means determined for designs, for regions, and for replicates are significant and for significance of the interaction between compressor designs and regions.   (16)

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

     ii) Using Gauss-Jordan method, find the inverse of $A = \begin{pmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{pmatrix}$.   (8)

     (OR)

   b) i) Solve, by Gauss-Seidel method, the system of following equations, correct to three decimal places.

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

     ii) Find the numerically largest Eigenvalue and the corresponding eigenvector of a matrix $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$.   (8)

(b) (i) Use Newton's backward difference formula to fit a third degree polynomial for the following data: (8)

x : -0.75 -0.5 -0.25 0

$f(x)$: -0.0718125 -0.02475 0.3349375 1.10100

(ii) Evaluate $\int_0^1 \dfrac{1}{1+x}\,dx$, using

   (1) Trapezoidal rule and

   (2) Simpson's $\dfrac{1}{3}$ rule with $h = 0.125$ and compare the values with exact value. (8)

15. (a) Given $\dfrac{dy}{dx} = xy + y^2$, $y(0) = 1$, $y(0.1) = 1.1169$, $y(0.2) = 1.2773$, find

   (i) $y(0.3)$ by Runge- Kutta method of fourth order and

   (ii) $y(0.4)$ by Milne's method. (16)

Or

(b) (i) Using Taylor series method find the value of y at $x = 0.1$, if y satisfies the equation $\dfrac{dy}{dx} = x^2 - y$ given that $y = 1$ when $x = 0$, correct to 3 decimal places. (8)

   (ii) Solve $\dfrac{dy}{dx} = x + y$, $y(0) = 1$ by modified Euler's method to find $y(0.2)$ with $h = 0.1$. (8)

4   20753

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : **20753**

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

Fourth Semester

Mechanical Engineering

MA 6452 — STATISTICS AND NUMERICAL METHODS

(Common to Fourth Semester Automobile Engineering, Mechatronics Engineering and Fifth Semester for Mechanical Engineering (Sandwich))

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Use of Statistical tables is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the procedure followed in testing of hypothesis.

2. Define Type I error and Type II error in the sampling distribution.

3. What are basic principles of design of experiment?

4. What is a 2^2 factorial design?

5. Find the iterative formula by Newton's method for $\dfrac{1}{N}$, where N is a positive integer.

6. What kind of an eigenvalue and eigenvector of a matrix would be obtained by Power method?

7. Find the third divided differences of $f(x) = x^3 + x + 2$ for the arguments 1, 3, 6, 11.

8. Write Newton's backward difference formula to find the derivatives $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ at $x = x_n$.

9. Find $y(0.01)$ by using Euler's method, given that $\dfrac{dy}{dx} = -y$, $y(0) = 1$.

10. Write the finite difference approximation for the equation $\dfrac{d^2y}{dx^2} = x + y$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) The mean height of two samples of 1000 and 2000 members are respectively 67.5 and 68.0 inches. Can they be regarded as drawn from the same population with standard deviation 2.5 inches at 5% level of significance? (8)

   (ii) A random sample of 10 boys has the following IQ's 70, 83, 88, 95, 98, 100, 101, 107, 110 and 120. Do these data support the assumption of a population mean IQ of 100 at 5% level of significance? (8)

Or

   (b) (i) Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins show the sample standard deviations of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, test the hypothesis that the true variances are equal, against the alternative hypothesis that they are not at the 10% level of significance. (8)

   (ii) Using the data given in the following table to test at the 0.01 level of significance whether a person's ability in Mathematics is independent of his/her interest in Statistics. (8)

		Ability in Mathematics		
		Low	Average	High
	Low	63	42	15
Interest in Average		58	61	31
Statistics High		14	47	29

12. (a) The following data represent a certain person to work from Monday to Friday by four different routes.

		Days				
		Mon	Tue	Wed	Thu	Fri
	1	22	26	25	25	31
Routes	2	25	27	28	26	29
	3	26	29	33	30	33
	4	26	28	27	30	30

Test at the 0.05 level of significance whether the differences among the means obtained for the different routes are significant and also whether the differences among the means obtained for the different days of the week are significant. (16)

Or

   (b) The following is the Latin square layout of a design when 4 varieties of seeds are tested. Set up the ANOVA table and state your conclusions. (16)

   A18 C21 D25 B11
   D22 B12 A15 C19
   B15 A20 C23 D24
   C22 D21 B10 A17

13. (a) (i) Using Gauss-Jordan method, find the inverse of $A = \begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$. (8)

   (ii) Solve, by Gauss-Seidel method, the system of following equations correct to three decimal places $x + 3y + 10z = 24$, $28x + 4y - z = 32$, $2x + 17y + 4z = 35$. (8)

Or

   (b) (i) Solve, by Gauss-Elimination with partial pivoting method, the system of following equations correct to three decimal places
   $2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$. (8)

   (ii) Solve, by Gauss-Jacobi method, the system of following equations correct to three decimal places
   $x + y + 54z = 110$, $27x + 6y - z = 85$, $6x + 15y + 2z = 72$. (8)

14. (a) (i) Use Lagrange's interpolation formula to find $f(10)$ from the following data: (8)

x :	5	6	9	11
$f(x)$:	12	13	14	16

   (ii) Find the value of $\cos(1.74)$ using suitable formula from the following data: (8)

x :	1.7	1.74	1.78	1.82	1.86
$\sin x$:	0.9916	0.9857	0.9781	0.9691	0.9584

Or