ST. ANNE'S COLLEGE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, New Delhi. Affiliated to Anna University, Chennai)
ANGUCHETTYPALAYAM, PANRUTI – 607 106.

MA 3251 –STATISTICS AND NUMERICAL METHODS

Unit 1 – Testing of Hypothesis Question Bank

PART –A

1. What is sampling distribution?
2. Mention the various steps involved in testing of hypothesis.
3. What are Type-I and Type-II errors?
4. What is the assumption of t-test?
5. What are the expected frequencies of 2x2 contingency table given below.

a	b
c	d

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

a	b
c	d

7. Write any two characteristics of χ^2 test.
8. Give two applications of χ^2 test.
9. Define the following terms: Statistic, parameter, standard error and Random sampling.
10. Define the terms sample size and sampling error in random sampling.

PART –B

1. The mean life time of a sample of 100 light bulbs produced by a company is computed to be 1570 hours with a standard deviation of 120 hours. If μ is the mean life time of all the bulbs produced by a company, test the hypothesis $\mu=1600$ hours, against the alternative hypothesis $\mu\neq1600$ hours with $\alpha=0.05$ and 0.01.
2. 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?
3. 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 in the following table. Test whether the average sales is same in the 2 states at 1% level.

	State A	State B
Average sales	2500	2200
S.D	400	550

4. In a sample of 1000 people in Maharashtra 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this state at 1% level of significance?
5. Given a sample mean of 83, a sample s.d 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. A test of the breaking strengths of 6 ropes manufactured by a company showed a mean breaking strength of 3515 kg and a s.d of 60 kg, whereas the manufacturer claimed a mean breaking strength of 3630 kg. Can we support the manufacturer's claim at a level of significance 0.05.
7. A random sample of 10 boys had the following I.Q's : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean I.Q of 100?
8. Two horses A and B were tested according to the time(in seconds) to run a particular race with the following results:

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	

9. A random sample of size 25 from a population gives the sample s.d 8.5. Test the hypothesis that the population s.d is 10.
10. It is believed that the precision(as measured by variance) of an instrument is no more than 0.16. Write down the null and alternative hypothesis for testing this belief. Carry out the test at 1% level 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.
11. 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

12. A company keeps records of accidents. During a recent safety review, a random sample of 60 accidents was selected and classified by the day of the week on which they occurred.

Day	Mon	Tue	Wed	Thu	Fri
No.of. accidents	8	12	9	14	17

Test whether there is any evidence that accidents are more likely on some days than others.

13. A sample analysis of examination results of 1000 students was made. It was found that **260** students had failed, **110** secured first class, 420 second class and rest obtained third class. Do these data support the general examination result in the ratio of **2:1:4:3** .
14. 1000 students at college level were graded according to their I.Q and their economic conditions. What conclusion can you draw from the following data:

Economic conditions	I.Q level	
	High	Low
Rich	460	140
Poor	240	160

15. Mechanical engineers testing a new era welding technique, classified welds both with respect to appearance and an X-ray inspection.

Appereance / 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.

16. 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

17. 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 if the variances are significantly different.

18. An instructor has two classes A and B , in a particular subject, class A has 16 students while class B has 25 students. On the same examination , although these was no significance difference in mean grade class A has standard deviation of 9, while class B had a standard deviation level of 12. Can we conclude at the 0.01 level of significance that the variability of class B is greater than that of class A.

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MA 3251 –STATISTICS AND NUMERICAL METHODS

Unit 2- Design of Experiments Question Bank

PART –A

1. What are the uses of ANOVA?
2. Define ANOVA.
3. Define experimental error.
4. What are the basic principles in the design of experiment?
5. What is the main aim of design of experiment?
6. What are the assumptions involved in ANOVA?
7. State the basic designs of experiment.
8. What is the aim of the design of experiment?
9. What is a completely randomized design?
10. What are the advantages/uses/applications of completely randomized experimental design.
11. What are the advantages/uses/applications of Latin square design over other designs.
12. What is the purpose of analysis of variance?
13. What are the assumptions made to validate the F-test in ANOVA?
14. Define a treatment and a yield in an experimental design.
15. What is the contrast and orthogonal contrast in a 2^2 factorial design?

PART –B

One way classification (Completely Randomized Design-CRD)

1. The following are the numbers of mistakes made in 5 successive days of 4 technicians working for a photographic laboratory:

Technician I	Technician II	Technician III	Technician IV
6	14	10	9
14	9	12	12
10	12	7	8
8	10	15	10
11	14	11	11

Test at the level of significance 0.01whether the differences among the 4 sample means can be attributed to chance.

2. The accompanying data resulted from an experiment comparing the degree of soiling for fabric co-polymerized

with the three different mixtures of methacrcyclic acid. Analysis is the given classification.

Mixture 1	.56	1.12	.90	1.07	.94
Mixture 2	.72	.69	.87	.78	.91
Mixture 3	.62	1.08	1.07	.99	.93

3. The following table shows the lives in hours of four electrical lamps brand.

A	1610	1610	1650	1680	1700	1720	1800	-
B	1580	1640	1640	1700	1750	-	-	-
C	1460	1550	1600	1620	1640	1660	1740	1820
D	1510	1520	1530	1570	1600	1680	-	-

Perform an analysis of variance and test the homogeneity of the mean lives of four brands of lamps.

Two way classification (Randomized Block Design-RBD)

1. An experiment was designed to study the performance of 4 different detergents for cleaning fuel injectors. The following cleanliness readings were obtained with specially designed equipment for 12 tanks of gas distributed over 3 different models of engines:

	Engine 1	Engine 2	Engine 3	Total
Detergent A	45	43	51	139
Detergent B	47	46	52	145
Detergent C	48	50	55	153
Detergent D	42	37	49	128
Total	182	176	207	565

Perform the ANOVA and test at 0.01 level of significance whether there are differences in the detergents or in the engine.

2. 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.

	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

3. 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.

		Types of paddy			
		I	II	III	IV
Blocks	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

Three way classification (Latin Square Design-LSD)

1. 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	A	18
B	19	A	14	D	17	C	20
D	17	C	20	B	21	A	15

Analyze data and interpret the result.

2. 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.

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

3. The following data resulted from an experiment to compare 3 burners B1, B2, B3. A Latin square design was used as the tests were spread over 3 days. Perform an analysis of variance at 5% level of significance on the data.

		Engine		
		1	2	3
Day	1	B1- 16	B2 - 17	B3 - 20
	2	B2 - 16	B3 - 21	B1 - 15
	3	B3 - 15	B1 - 12	B2 - 13

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MA 3251 –STATISTICS AND NUMERICAL METHODS

Unit 3 – Solution of Equations and Eigen value Problems Question Bank

PART –A

1. What is the sufficient condition for the convergence of fixed point iteration method?
2. Write the order and condition for the convergence in Newton-Raphson method.
3. Write the iterative formula for Newton-Raphson method .
4. Find the Newton-Raphson formula to find $\sqrt{N}$, where N is a positive integer.
5. Find the Newton-Raphson formula to find 1/N , where N is a positive integer.
6. Distinguish between direct and iterative methods of solving simultaneous equations.
7. Solve 3x + 2y = 4, 2x – 3y = 7 using Gauss-Jordan method
8. Compare Gauss Jacobi and Gauss Seidel method
9. Compare Gauss elimination and Gauss Seidel method.
10. What are the various methods of solving simultaneous linear equations?
11. Why Gauss Seidel method is a better method than Gauss Jacobi method?
12. Write the sufficient condition for Gauss- Seidel and Gauss- Jacobi method to be converge.
13. What is mean by diagonally dominant?
14. Define power method.
15. Determine the largest Eigen value and the corresponding Eigenvector of the matrix $\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$ correct to two decimal places using power method.

PART –B

1. Find a real root of the equation $x^3 + x^2 - 1 = 0$ by iteration method.
2. Find the real root of cosx – 2x + 3 = 0 correct to 3 decimal places using iteration method.
3. Fin the smallest positive root of $3x=\sqrt{1 + sinx}$ correct to three decimal places by iterative method.
4. Find the positive root of $x^4 = x + 10$ correct to three decimal places using N-R method.
5. Find the real positive root of $x\log_{10} x = 1.2$ using N-R method correct to 4 decimal places.
6. Find an iterative formula to fine $\sqrt{N}$ where N is a positive integer using Newton's method and hence find $\sqrt{26}$.
7. Find an iterative formula to fine 1/N where N is a positive integer using Newton's method and hence find $\sqrt{11}$.
8. Find the real positive root of $3x - \cos x - 1 = 0$ correct to 4 decimal places using Newton's method.
9. Solve the system by Gauss-elimination method x +2y + z = 3 , 2x +3y + 3z = 10, 3x – y +2z = 13.
10. Solve the system by Gauss- Jordan method 2x +y + 4z =12 , 8x -3y + 2z = 20, 4x +11y -z = 33.
11. Solve the system by Gauss – Seidel method 27x+6y-z = 85; x+y+54z =110; 6x+15y+2z = 72.
12. Solve, by Gauss – Seidel method 20x + y – 2z = 17; 3x + 20y –z = -18; 2x – 3y + 20z = 25.

13. Solve, by Gauss – Seidel method 20x +4y –z = 32; x + 3y +10z = 24; 2x +17y + 4z = 35.

14. Solve, by Gauss – Seidel method 4x +2y+z = 14; x + 5y –z = 10; x +y +8z = 20.

15.Find the numerically largest Eigen value of $A=\begin{pmatrix}1 & 6 & 1\\ 1 & 2 & 0\\ 0 & 0 & 3\end{pmatrix}$ by power method .

16. Find the numerically largest Eigen value of $A=\begin{pmatrix}1 & -3 & 2\\ 4 & 4 & -1\\ 6 & 3 & 5\end{pmatrix}$ by power method .

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MA 3251 –STATISTICS AND NUMERICAL METHODS

Unit 4 – Interpolation, Numerical Differentiation and Numerical Integration Question Bank

PART –A

1. State Lagrange's interpolation formula.
2. Given f(2) = 5, f(2.5) = 5.5 find the linear interpolating polynomial using Lagrange interpolation.
3. Find the divided difference of $f(x) = x^3 + x + 2$ for the arguments 1, 3, 6, 11.
4. Write down Newton's forward and backward difference formula.
5. Give the Newton's divided difference interpolation formula.
6. When will we use Newton's forward interpolation formula?
7. When Newton's backward interpolation formula is used?
8. Find the polynomial which takes the following values given f(0)=-1, f(1)=1 and f(2)=4 using Newton's interpolating formula.
9. What is the order of error in Trapezoidal formula.
10. What is the order of error in Simpson's formula.
11. Write Trapezoidal rule to evaluate $\int_{x_0}^{x_n} f(x)dx$.
12. Write Simpson's 1/3 rule to evaluate $\int_{x_0}^{x_n} f(x)dx$.
13. Write Trapezoidal rule to evaluate $\int_a^b \int_c^d f(x,y)dxdy$.
14. Write Simpson's 1/3 rule to evaluate $\int_a^b \int_c^d f(x,y)dxdy$.
15. For using Simpson's 1/3 rule, what is the condition about the intervals.

PART –B

Lagrange's Interpolation Method for unequal intervals:

1. Using Lagrange's formula, find f(3) for

x	0	1	2	5
f(x)	2	3	12	147

2. Using Lagrange's interpolation formula, find y(10) given that y(5)=12, y(6)=13, y(9)=14, y(11)=16.

3. Find x when y = 20 using Lagrange's interpolation formula for the data:

x:	1	2	3	4
y:	1	8	27	64

Newton's Divided Difference Method for unequal intervals:

1. Using Newton's divided difference formula, find the value of f(8) and from the following table:

x:	4	5	7	10	11	13
f(x):	48	100	294	900	1210	2028

2. Using Newton's divided difference formula find f(x) and f(6) from the following data:

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

Newton's Forward And Backward Method for equal intervals:

1. Using Newton's forward interpolation formula,

x	4	6	8	10
Y	1	3	8	10

Evaluate y at x = 5.

2. From the following data, find θ at x = 43 and x = 84

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

3. From the data given below, find the number of students whose weight is between 60 and 70 , using Newton's formula

weight	0 - 40	40 - 60	60 - 80	80 - 100	100-120
Number of students	250	120	100	70	50

4. From the following table, find the value of tan 45 º15' by Newton's forward interpolation formula

x º	45	46	47	48	49	50
tan x º	1.00000	1.03553	1.07237	1.11061	1.15037	1.19175

5. Find the first, second and third derivatives of f(x) at x=1.5 if

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7.000	13.625	24.000	38.875	59.000

Single and double integrals by Trapezoidal and Simpson's rule:

1. By dividing the range into 10 equal parts, evaluate $\int_0^{\pi} \sin x dx$ by using Trapezoidal and Simpson's rule .

2. By dividing the range into 10 equal parts, evaluate $\int_0^{\pi/2} \sin x dx$ by using Trapezoidal and Simpson's rule .

3. Evaluate $\int_0^6 \frac{1}{1+x} dx$ by using Trapezoidal and Simpson's rule .

4. Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ by using Trapezoidal and Simpson's rule .

5. Evaluate $\int_1^{1.4} \int_2^{2.4} \frac{1}{xy} dxdy$ using Trapezoidal and Simpson's one-third rule. Verify your result by actual integration.

6. Evaluate $\int_1^2 \int_3^4 \frac{1}{(x+y)^2} dxdy$ taking h=k= 0.5 by both Trapezoidal and Simpson's one-third rule.

7. Evaluate $\int_0^{\frac{\pi}{2}} \int_{\frac{\pi}{2}}^{\pi} \cos(x+y) dxdy$ by using Trapezoidal and Simpson's one-third rule by taking h=k= $\frac{\pi}{4}$.

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MA 3251 –STATISTICS AND NUMERICAL METHODS

Unit 5 - Numerical Solution of Ordinary Differential Equations Question Bank

PART –A

1. State Taylor's series algorithm for the first order differential equation.
2. Solve $\frac{dy}{dx} = x + y$, given y = 0 when x = 1 upto x = 1.1 by Taylor's series method.
3. Solve $\frac{dy}{dx} = x + y$, given y = 0 when x = 1 upto x = 1.2 with h = 0.2 by Taylor's series method.
4. Name some multi-step methods.
5. Name some single-step methods.
6. Write the formula for Euler's method.
7. State modified Euler's formula.
8. Write the difference between Euler and Modified Euler method.
9. Using Euler's method, find y at x=0.1, if y'=1+xy given that y(0)=2.
10. What are the various methods of solving ordinary differential equations?
11. How many prior values are required in Milne's method to predict the next value?
12. Define fourth order R-K method.
13. What is the use/advantage of Runge-Kutta method over Taylor's series method?
14. Write down Milne's predictor and corrector formulae.
15. Write down Adam's- Bashforth predictor and corrector formulae.

PART –B

1. By means of Taylor series expansion, find y at x = 0.1 and x = 0.2 correct to three decimal places, given $\frac{dy}{dx} - 2y = 3e^x$, y(0) = 0.
2. Solve $y' = x + y$, y(0) = 1, by Taylor's series method. Find the values y at x = 0.1 .
3. Using Taylor series method, find y at x=1.1 by solving the equation $\frac{dy}{dx} = x^2 + y^2$ and y(1) = 2.
4. Find by Taylor series method, the value of y at x = 0.1 from $dy/dx = y^2 + x$, y(0)=1.
5. If $dy/dx = x^2 + y^2$, y(0) = 1 using modified Euler's method , find y(0.1).

6. Using modified Euler method, find $y(0.1)$ and $y(0.2)$ given y' = y + e^x with y(0) = 0.

7. Using R-K method of fourth order to find y(0.2) and y(0.4) given that $y\,dy/dx = y^2 - x$ with y(0) = 2 by taking h=0.2.

8. Using R-K 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

9. Using R-K method of fourth order to find y(0.1) and y(0.2) for the initial value problem $dy/dx = x + y^2$, y(0) = 1.

10. Apply fourth order R-K method to determine y(0.1) and y(0.2) with h=0.1 from $dy/dx = x^2 + y^2$, y(0)=1.

11. Using Milne's method find y(4.4) given $5xy' + y^2 - 2 = 0$ given y(4) = 1, y(4.1) = 1.0049, y(4.2) = 1.0097 and y(4.3) = 1.0143.

12. Using R-K method of fourth order 4, find y for x=0.1, 0.2, 0.3 given that $\frac{dy}{dx} = xy + y^2$, y(0)=1 and also find the Solution at x=0.4 using Milne's method.

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