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COLLEGE OF ENGINEERING AND TECHNOLOGY

(An ISO 9001:2015 Certified Institution)
Anguchettypalayam, Panruti – 607106.

QUESTION BANK (R-2021)

MA3251

STATISTICS AND NUMERICAL METHODS

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ANGUCHETTYPALAYAM, PANRUTI – 607 106.

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

PERIOD: JAN – MAR-2022 **BATCH**: 2021 – 2025

BRANCH: MECH **YEAR/SEM:** I/02

SUB CODE/NAME: MA3251 STATISTICS AND NUMERICAL METHODS

UNIT I – TESTING OF HYPOTHESIS

PART – A

1. What are the expected frequencies of a 2×2 contingency table

a	b
c	d

(A/M 2015, M/J 2016, A/M 2017)

2. Write down the formula of test statistic t to test the significance of difference between the means of two large samples. (A/M 2015, N/D 2016)
3. What is random sampling? (N/D 2015)
4. Write about F-test. (N/D 2015)
5. What are type I and type II errors? (M/J 2016)
6. Give the main use of χ^2 test. (N/D 2016)
7. 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 kg per tin at 5% level of significance? (A/M 2017)
8. What is meant by level of significance and critical region? (N/D 2017)
9. State any two applications/uses of Chi-square test. (N/D 2017)
10. Define the following terms: Statistic, Parameter, Standard error and random sampling. (A/M 2018)
11. Mention the type of sampling.
12. Define the following terms: Population, Sample and sampling.
13. What is mean by null and alternative hypothesis?
14. Write down any two properties of Chi-square distribution.
15. Define Chi-square test of goodness of fit.
16. What are the assumptions of t test?

17. What are the properties of t distribution.
18. State the properties of F distribution.
19. What is mean by confidential limits?
20. What is mean by one-tail and two-tail test?
21. Write the applications of `t' test.
22. Write the test statistic formula for the significant difference of mean in a single large sample.
23. Write the test statistic formula for difference of means for a single small sample.
24. What are the applications of F-test?
25. Write the test statistic formula for the Chi-square test for goodness of fit.
26. What are the applications of large sample test?
27. Write the test statistic formula for difference of means for two small samples.
28. Write the test statistic formula for difference of variances in F-test
29. What is mean by attributes?
30. What is mean by contingency table?

PART – B
[First Half] (All are 8 marks)

I – Large sample test

1. Examine whether the different in the variability in yields is significant at 5% level of significance for the following.

	Set of 40 plots	Set of 60 plots
Mean yield per plot	1256	1243
S.D per plot	34	28

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

3. A sample of 900 members has a mean of 3.4 cms and s.d. is 2.61 cms. Is the sample from a large population of mean 3.25 cm and s.d. is 2.61 cms. If the population is normal and its mean is known, find the 95% fiducial limits of the mean.

4. A normal population has a mean of 6.48 and s.d. of 1.5. In a sample of 400 members, mean is 6.75. Is the difference significant?

II - Student t-Test

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

6. Test made on the breaking strength of 10 pieces of a metal gave following results 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 kg. Test if mean breaking strength of the wire can assumed as 577 kg.

7. A random sample of size 16 values from a normal population showed a mean of 53 and a sum of square of deviation from the mean equals to 150. Can this sample be regarded as taken from the population having 53 as mean obtain 95% confidence limits of the mean of the population?
8. The average numbers of articles produced by two machines per day are 200 and 250 with standard deviation 20 and 25 respectively on the basis of records of 25 days production. Can you regard both the machines equally efficient at *1%* level.

[Second Half] (All are 8 marks)

III - Ψ^2-test (or) chi-square test.

9. The demand for particular spare parts in a factory was found to vary from day-to-day. In a sample study the following information was obtained.

Days	Mon	Tue	Wed	Thu	Fri	sat
No. of spare parts demanded	1124	1125	1110	1120	1126	1115

Test the hypothesis that the number of parts demanded does not depend on the day of the week.

10. The number of automobile accidents in a certain locality was 12, 8, 20, 2, 14, 10, 15, 6, 9, 4. Are these frequencies in agreement with the belief that accident conditions were the same during this 10 week period?
11. The theory predicts the proportion of beans, in the four groups A, B, C, D should be 9:3:3:1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory?
12. Test whether the following attributes are independent at 5% level.

vaccination			
Small pox	Given	Not given	Total
Attacked	35	333	368
Not attacked	308	806	1114
Total	343	1139	1482

13. The following table gives the classification of 100 workers according to sex and nature of work. Test whether the nature of work is independent of the sex of the worker.

	Stable	Unstable
Males	40	20
Females	10	30

14. Four coins were tossed 160 times and the following results were obtained. Under the assumption that the coins are unbiased and test the goodness of fit.

No. of heads	0	1	2	3	4

Observed frequency	17	52	54	31	6

15. On the basis of information given below about the treatment of 200 patients suffering from a disease, state whether the new treatment is comparatively superior to the conventional treatment.

	Favorable	Not favorable
New	60	30
Conventional	40	70

III - *F-Ratio test*

16. Two independent samples of sizes 9 and 7 from a normal population had the following values

Sample-I	18	13	12	15	12	14	16	14	15
Sample-II	16	19	13	16	18	13	15	-	-

Do the estimates of population variance difference at 5% significance.

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	-	-

Do the estimates of population variance difference from the samples are not significant different.

18. Do the following sample variances vary significantly at 5% level.

Sample-I	39	41	43	41	45	39	-
Sample-II	40	42	40	44	39	38	40

19. Test if the variances are significantly different for

X_1	24	27	26	21	25	-
X_2	27	30	32	36	28	23

20. Two random samples gave the following results

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

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DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

PERIOD: JAN – MAR-2022 **BATCH**: 2021 – 2025

BRANCH: MECH **YEAR/SEM:** I/02

SUB CODE/NAME: MA3251 STATISTICS AND NUMERICAL METHODS

UNIT II – DESIGN OF EXPERIMENTS

PART – A

1. What are the uses of ANOVA? (A/M 2017)
2. What are the basic principles in the design of experiment? (A/M 2017, M/J 2016)
3. What are the basic elements of an ANOVA table for one way classification? (A/M 2018)
4. What are the basic designs of experiment? (A/M 2018)
5. Is 2×2 Latin square design possible? Why? (N/D 2015, M/J 2016)
6. Write two advantages/uses/applications of completely randomized experimental design. (N/D 2015)
7. What is ANOVA? (N/D 2016)
8. Define experimental error. (N/D 2016)
9. What is the aim of the design of experiment? (N/D 2017)
10. What is a completely randomized design? (N/D 2017)
11. What is mean by randomization?
12. What is mean by replication?
13. What are the demerits of completely randomized design?
14. What are the demerits of Latin square design?
15. What are the assumptions made to validate the F-test in ANOVA?
16. What are the demerits of randomized block design?
17. What is mean by local control?
18. What are the merits of randomized block design?
19. What are the merits of Latin square design?
20. What is mean by 2^2 factorial design?

21. Write two advantages/uses/applications of randomized block design.
22. Write two advantages/uses/applications of Latin square design.
23. What is mean by one way classification?
24. What is mean by two way classification?
25. What is mean by three way classification?
26. Compare completely randomized design and randomized block design.
27. Compare randomized block design and Latin square design.
28. Compare completely randomized design and Latin square design.
29. What are the merits of 2^2 factorial design?
30. What are the demerits of 2^2 factorial design?

PART – B

[First Half] (All are 16 marks)

I-One way classification (Completely Randomized Design-CRD)

1. 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.

2. The following table shows the lies 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.

3. The three samples below have been obtained from normal population with equal variances. Test the hypothesis that the sample means are equal.

Samples		
8	7	12
10	5	19
7	10	13
14	9	12
11	9	14

II-Two way classification (Randomized Block Design-RBD)

4. 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

5. Given that:

Detergent	Engine		
	1	2	3
A	45	43	51
B	47	46	52
C	48	50	55
D	42	37	49

Perform ANOVA and test at 0.05 level of significance whether these are difference in the detergents or in the engines.

6. Three varieties of coal were analyzed by 4 chemists and the ash content is tabulated here. Perform an analysis of variance.

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

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

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

8. 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	36	36	21	35
winter	28	29	31	32
monsoon	26	28	29	29

9. Carry out ANOVA table.

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

10. Five doctors each test five treatments for a certain disease and observe the number of days each patient takes to recover.

Doctors	Treatments				
	1	2	3	4	5
1	10	14	23	18	20
2	11	15	24	17	21
3	9	12	20	16	19
4	8	13	17	17	20
5	12	15	19	15	22

[Second Half] (All are 16 marks)

III-Three way classification (Latin Square Design-LSD)

11. Analyze the variance in the following Latin square of yields of paddy where A, B, C and D denote the difference methods of calculation.

D 122	A 121	C 123	B 122
B 124	C 123	A 122	D 125
A 120	B 119	D 120	C 121
C 122	D 123	B 121	A 122

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

12. A variable trail 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 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

13. Given that

Routes	Drivers			
	1	2	3	4
1	18 (C)	12 (D)	16(A)	20 (B)
2	26 (D)	34 (A)	25 (B)	31 (C)
3	15 (B)	22 (C)	10(D)	28 (A)
4	30 (A)	20 (B)	15 (C)	9 (D)

14. In a Latin square experiment given below are the yields in quintals per acre on the paddy crop carried out for testing the effect of five fertilizers A, B, C and D. Analyze the data for variations.

B 25	A 18	E 27	D 30	C 27
A 19	D 31	C 29	E 26	B 23
C 28	B 22	D 33	A 18	E 27
E 28	C 26	A 20	B 25	D 33
D 32	E 25	B 23	C 28	A 20

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PERIOD: JAN – MAR-2022 **BATCH**: 2021 – 2025

BRANCH: MECH **YEAR/SEM:** I/02

SUB CODE/NAME: MA3251 STATISTICS AND NUMERICAL METHODS

UNIT III – SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

PART – A

1. Write the formula for Newton-Raphson method.
2. Write the order and condition for the convergence in Newton-Raphson method. (A/M 2015)
3. What is the sufficient condition for the convergence of fixed point iteration method? (N/D 2015)
4. Write the formula for fixed point iteration method.
5. What are the two major types of methods to solve the system of equations?
6. What are the iterative methods available to solve a system of equations?
7. What are the direct methods available to solve a system?
8. Write the sufficient condition for the convergence of iterative or indirect methods. (A/M 2015)
9. What is mean by diagonally dominant? (A/M 2016)
10. Write the procedure to solve a system of equations by Gauss elimination method.
11. Write the working procedure for the power method.
12. Write the procedure to solve a system of equations by Gauss Jordan method.
13. Write the principles used in Gauss elimination method and Gauss –Jordan method.
14. Distinguish between Gauss elimination method and Gauss –Jordan method. ? (N/D 2016)
15. Write the difference between direct method and indirect method. (N/D 2015)
16. Explain why the Newton's method is better than fixed point iteration method.
17. Compare Gauss Jacobi and Gauss Seidel method.
18. What are the applications of Newton's method? (A/M 2016)
19. Explain briefly the power method.
20. What are the applications of Gauss –Jordan method?

21. The convergence in Gauss Seidel method in more when compared to Gauss Jacobi method. Why? (N/D 2016)
22. What are the applications of Gauss elimination method?
23. What are the applications of power method?
24. What are the applications of Jacobi's method to find the eigenvalue?
25. Write the disadvantage of fixed point iteration method over Newton-Raphson method.
26. Write the disadvantage of Gauss Jacobi method over Gauss Seidel method.
27. Write the procedure to solve a system of equations by Gauss Jacobi method.
28. Write the procedure to solve a system of equations by Gauss Seidel method.
29. Write the procedure to find eigenvalues by Jacobi's method.
30. Compare power method and Jacobi's method to find eigenvalues.

PART – B

[First Half] (All are 8 marks)

I - Fixed Point Iteration method

1. Solve by iteration method, $f(x) = x^4 - x - 10$
2. Solve by iteration method, $f(x) = x^4 - x - 9$

II - Newton- Raphson method

3. Solve by Newton- Raphson method, $f(x) = x^3 - 6x + 4$
4. Solve by Newton $-$ Raphson method, $x^2 = -4\,sinx$
5. Evaluate $\sqrt{12}$ (or) $x = \sqrt{12}$ by Newton- Raphson method.
6. Find the root of the equations $e^x = 4x$ by Newton- Raphson method.
7. Find the Newton's Raphson formula to find the value of $\frac{1}{N}$, where N is a real number and hence evaluate $\frac{1}{26}$ correct to 4-decimal places.

III - Gauss-Elimination Method

1. Solve by Gauss elimination method, $10x - y + 2z = 4,\ x + 10y - z = 3,\quad 2x + 3y + 20z = 7$
2. Solve by Gauss elimination method, $2x + y + 4z = 12,\quad 8x - 3y + 2z = 20,\quad 4x + 11y - z = 33$

3. Solve by Gauss elimination method, $5x - 2y + z = 4, \quad 7x + y - 5z = 8, \quad 3x + 7y + 4z = 10$

IV - Gauss-Jordan Method

4. Solve by Gauss elimination method, $2x + y + z = 10, \quad 3x + 2y + 3z = 18, \quad x + 4y + 9z = 16$

5. Solve by Gauss elimination method, $x + y + z = 9, \quad 2x - 3y + 4z = 13, \quad 3x + 4y + 5z = 40$

[Second Half] (All are 8 marks)

V - Gauss-Jacobi's Method

1. Solve by Gauss – Jacobi's method, $5x + 2y + z = 12, \quad x + 4y + 2z = 15, \quad x + 2y + 5z = 20$
2. Solve by Gauss – Jacobi's method, $28x + 4y - z = 32, \quad x + 3y + 10z = 24, \quad 2x + 17y + 4z = 35$
3. Solve by Gauss – Jacobi's method, $20x + y - 2z = 17, \quad 3x + 20y - z = -18, \quad 2x - 3y + 20z = 25$
4. Solve by Gauss – Jacobi's method, $30x - 2y + 3z = 75, \quad x + 17y - 2z = 48, \quad x + y + 9z = 15$

VI-Gauss - Seidel Method

1. Solve by Gauss - Seidel Method, $5x + 2y + z = 12, \; x + 4y + 2z = 15, \; x + 2y + 5z = 20.$
2. Solve by Gauss - Seidel Method, $x + y + 9z = 15, \; x + 17y - 2z = 48, \; 30x - 2y + 3z = 75.$
3. Solve by Gauss $-$ Seidel Method, $5x - 2y + z = -4, \; x + 6y - 2z = -1, \; 3x + y + 5z = 13.$
4. Solve by Gauss Seidel Method, $8x - y + z = 18, \; 2x + 5y - 2z = 3, \; x + y - 3z = -6.$

VII-Eigenvalue of a matrix by Power Method

1. Find the dominant eigenvalue by power method, $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$
2. Find the dominant eigenvalue by power method, $A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$
3. Find the dominant eigenvalue by power method, $A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$

VIII-Eigenvalue of a matrix by Jacobi's Method

4. Find the eigenvalue by Jacobi's method, $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$
5. Find the eigenvalue by Jacobi's method, $A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$

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SUB CODE/NAME: MA3251 STATISTICS AND NUMERICAL METHODS

UNIT IV – INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

PART – A

1. State Lagrange's interpolation formula.
2. What is the assumption we make when Lagrange's formula is used? (A/M 2015)
3. What advantage has Lagrange's formula over Newton?
4. What is the disadvantage in practice in applying Lagrange's interpolation formula?
5. What is 'inverse interpolation'? (N/D 2017)
6. Give the inverse of Lagrange's interpolation formula?
7. Use Lagrange's formula, to find the quadratic polynomials that take these values.

   X: 0 1 3

   Y: 0 1 0

   Then find y(2). (A/M 2016)

8. Explain briefly interpolation.
9. Find the divided difference table for the following data (A/M 2015)

X:	2	5	10
Y:	5	29	109

10. From the divided difference table for the following table

X:	2	5	10
Y:	5	29	109

11. Give the Newton's divided difference interpolation formula.
12. State any 2 properties of divided differences. (A/M 2016)
13. Using Newton's divided difference formula determine f(3) from the data

x:	0	1	2	4	5
f(x):	1	14	15	5	6

14. Using Newton's divided difference interpolation formula. find the missing value

x:	1	2	4	5	6
f(x):	14	15	5	-	9

15. State the Order of Convergence of cubic spline.
16. State the properties of Cubic spline.
17. Derive Newton's backward difference formula by using operator method.
18. Derive Newton's forward difference formula by using operator method.
19. State Newton's backward formula.
20. State Gregory-Newton's forward difference formula.
21. When Newton's backward Interpolation formula is used. (N/D 2016)
22. Obtain the interpolation quadratic polynomial for the given data by using Newton's forward difference formula.

X:	0	2	4	6
Y:	-3	5	21	4

23. Obtain the divided difference table for the following table (N/D 2015)

X:	2	3	5
Y:	0	14	102

24. Find the polynomial for the following data by Newton's backward difference formula.

x:	0	1	2	3
f(x):	-3	2	9	18

25. Find the divided difference table for the following data (N/D 2017)

X:	-1	0	2	3
Y:	-8	3	1	12

26. Using Lagrange's interpolation, find the polynomial through (0,0),(1,1) and (2,2)
27. Show that the divided differences are symmetrical in their arguments. (N/D 2015)
28. What is the nature of nth divided differences of a polynomial of nth degree?
29. Find the second divided differences with arguments a,b,c if $f(x) = \frac{1}{x}$.(N/D 2016)
30. Show that $\Delta^3_{bcd}\left(\frac{1}{a}\right) = -\frac{1}{abcd}$.

PART – B

[First Half] (All are 8 marks)

I-Lagrange's Method

1. Using Lagrange formula, fit a polynomial to the data and hence find $y\ at\ x = 1.5\ and\ x = 1$

x	-1	0	2	3
Y	-8	3	1	12

2. Use Lagrange's formula to fit a polynomial to the data:

x:	-1	0	2	3
y:	-8	3	1	12

and hence find y at x = 1. (8) (N/D 2016)

3. Find x when y = 20 using Lagrange's interpolation formula for the data: (8) (N/D 2017)

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

4. Find the Lagrange's polynomial of degree 3 to fit the data: y(0) = -12, y(1) = 0, y(3) = 6 and y(4) = 12. Hence, find y(2). (8)

II - Newton's Divided Difference Method

1. Find $y(10), y'(6)$ using Newton's divided difference formula

x	0	2	3	4	7	9
y	4	26	58	112	466	922

2. Using Newton's divided difference formula, find the value of f(8) and from the following table: (8) (N/D 2016)

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

3. Uing Newton's divided difference formula find f(x) and f(6) from the following data: (8)

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

4. Iff(0) = 0, f(1) = 0, f(2) = -12, f(4) = 0, f(5) = 600 and f(7) = 7308, find a polynomial that satisfies this data using Newton's divided difference interpolation formula. Hence, find f(6). (8)

III-Newton's Forward and Backward Mehod

1. Find the value of $y, when\ x = 43\ and\ x = 84$. From the following data.

X	40	50	60	70	80	90
y	184	204	226	250	276	304

2. The following table gives the values of a function at equal intervals, Evaluate $f(1.8)$

x	0.0	0.5	1.0	1.5	2.0
f(x)	0.3889	0.3521	0.2420	0.1295	0.0540

3. Interpolate $y(12), if$

x	10	15	20	25	30	35
Y(x)	35	33	29	27	22	14

4. The table gives the distances I nautical miles of the visible horizon for the given heights in feet above the earth's surface.

x	100	150	200	250	300	350	400
y	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the values of y when $x = 118\ ft\ and\ 390\ ft$

5. Given that the table, and find $y(175)$

x	140	150	160	170	180
y	3.685	4.854	6.302	8.076	10.225

6. Find $y(22)$, given that

x	20	25	30	35	40	45
Y(x)	354	332	291	260	231	204

7. Estimate the premium for policies maturing at age 46

Age(x)	45	50	55	60	65
Premium(y)	114.84	96.16	83.32	74.48	68.48

[Second Half] (All are 8 marks)

IV-*Differentiation of Newton's Forward and Backward* (or) To find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$

1. Given that :

X	1	1.1	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find $\frac{dy}{dx}\ and\ \frac{d^2y}{dx^2}\ at\ x = 1.1\ and\ x = 1.6$

2. Find the $\left(\frac{dy}{dx}\right)$ and $\left(\frac{d^2y}{dx^2}\right)$ $at\ x = 51, from$ the data given below

x	50	60	70	80	90
y	19.96	36.65	58.81	77.21	94.61

3. For the following table obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ $for\ x = 1.2$

x	1.0	1.2	1.4	1.6	1.8	20.	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

4. Compute $f'(0) and\ f''(4)$ from the following table.

x	0	1	2	3	4
f(x)	1	2.718	7.381	20.086	54.598

V-Trapezoidal and Simpson's $\frac{1}{3}$ rule (Single integral)

1. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using the trapezoidal and Simpson's $\frac{1}{3}$ rule and compare with its exact solution.
2. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using the trapezoidal and Simpson's $\frac{1}{3}$ rule by taking $h = \frac{1}{4}$ (or) h=0.25
3. Evaluate $\int_{-3}^{3} x^4\, dx$ using the trapezoidal and Simpson's $\frac{1}{3}$ rule, correct the three decimals dividing the range of integration into 8-equal parts. Also compare with exact solution.
4. Evaluate $\int_0^1 \frac{dx}{1+x}$ using the trapezoidal and Simpson's $\frac{1}{3}$ rule by taking $h = \frac{1}{4}$ (or) h=0.25
5. By dividing the range into ten equal parts, Evaluate $\int_0^{\pi} \sin x\, dx$ by using trapezoidal and Simpson's $\frac{1}{3}$ rule

VI-Trapezoidal and Simpson's $\frac{1}{3}$ rule (Double integral)

1. Evaluate the integral $\int_1^2 \int_1^2 \frac{dx\, dy}{x+y}$, using the trapezoidal and Simpson's $\frac{1}{3}$ rule with $h = 0.5\ and\ k = 0.25$
2. Evaluate the integral $\int_1^2 \int_1^2 \frac{dx\, dy}{x+y}$, using the trapezoidal and Simpson's $\frac{1}{3}$ rule with $h = 0.25\ and\ k = 0.25$
3. Evaluate the integral $\int_1^2 \int_1^2 \frac{dx\, dy}{x^2+y^2}$, using the trapezoidal and Simpson's $\frac{1}{3}$ rule with $h = 0.2\ and\ k = 0.25$
4. Evaluate the integral $\int_0^2 \int_1^2 sin(9x + y)dxdy$, using the trapezoidal and Simpson's $\frac{1}{3}$ rule with $h = 0.25\ and\ k = 0.5$

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ST. ANNE'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

PERIOD: JAN – MAR-2022 **BATCH**: 2021 – 2025

BRANCH: MECH **YEAR/SEM:** I/02

SUB CODE/NAME: MA3251 STATISTICS AND NUMERICAL METHODS

UNIT V – NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

PART – A

1. Define initial conditions and initial value problem.
2. Write the formula for Taylor's series method.
3. Write the working procedure for Taylor's series method.
4. Write the difference between Euler and Modified Euler method. (N/D 2017)
5. Solve $\frac{dy}{dx} = x + y$, given y = 0 when x = 1 upto x = 1.1 with h = 0.1 by Taylor's series method. (A/M 2015)
6. Name some multi-step methods.
7. Write the formula for Euler's method.
8. How many previous values should be given for multi-step methods?
9. Write the formula for Modified Euler's method.
10. Write the working procedure for Modified Euler's method.
11. What is Adam – Bash Forth Predictor – Corrector method?
12. What are the two types of methods of obtaining the solution of initial value problem?
13. What is the use of Runge–Kutta method and what is its working rule for fourth order?
14. 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. (N/D 2017)
15. Solve $y' = \sin x + y$, y(0) = 2 by the modified Euler's method to get y at x = 0.1 (0.1) 0.3. (N/D 2015)
16. Define Predictor – Corrector methods and what are the types of it?

17. Name some single-step methods. (N/D 2016)
18. Given $\frac{dy}{dx} = x + y^2$ and y(0) = 1. Find an approximate value of y at x=0.5 by modified Euler's method. Taking h=0.1. (A/M 2015)
19. Write the working procedure for Adam's method.
20. Write the working procedure for Milne's method.
21. What do you mean by single – step method? (N/D 2015)
22. Write the difference between Taylor and Euler method.
23. What is Milne's Predictor - Corrector method?
24. What is the use of Runge-Kutta method and what is its working rule for fourth order?
25. What are the uses of Taylor's series method? (N/D 2016)
26. What are the applications of Adam's method?
27. Compare Milne's method and Adam's method.
28. Compare Runge-Kutta method of fourth order and Taylor's series method.
29. Compare Runge-Kutta method of fourth order and Euler's method.
30. Compare Runge-Kutta method of fourth order and Modified Euler's method.

PART – B

[First Half] (All are 8 marks)

I-Taylor's Series Method

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. (N/D 2016)
2. Find by Taylor's series method, the values of y at x = 0.1 and x = 0.2, to four decimal places from $\frac{dy}{dx} = x^2 y - 1,\ y(0) = 1$.
3. Solve numerically $\frac{dy}{dx} = x + y$ when y(1) = 0 using Taylor's series upto x = 1.2 with h = 0.1. (N/D 2017)
4. Using Taylor series method, find correct to four decimal places, the value of y(0.1), given $\frac{dy}{dx} = x^2 + y^2$ and y(0) = 1. (A/M 2015)

5. Using Taylor series method, find y at x =1 , given $\frac{dy}{dx} = x^2 - y,\ y(0) = 1$, correct to 4 decimal places.

6. Solve $\frac{dy}{dx} = xy + y^2$, y(0) = 1, using Milne's predictor-corrector formulae and find y(0.4). Use Taylor series method to find y(0.1), y(0.2) and y(0.3). (16 m) (N/D 2015)

II-Euler's Method

7. Using Euler's method, solve numerically the equation $y' = x + y,\ y(0) = 1$, for x = 0.0 (0.2) (1.0). Check your answer with the exact solution.

III-Modified Euler's Method

8. Apply the modified Euler's method to find y(0.2) and y(0.4), given that $\frac{dy}{dx} = x^2 + y^2$ y(0) = 1. Take h = 0.2.

9. Using modified Euler method, find $y(0.1)$ and $y(0.2)$ given $\frac{dy}{dx} = x^2 + y^2,\ y(0) = 1$ with $h = 0.1$

10. Solve $\frac{dy}{dx} = \log_{10}(x + y),\ y(0) = 2$ by Euler's modified method and find the values of y(0.2), y(0.4) and y(0.6), taking h = 0.2. (N/D 2016)

IV-Adams-Bash Forth Predictor Corrector Method

11. By using Adam's pc method find y when x = 0.4, given
$\frac{dy}{dx} = \frac{xy}{2},\ y(0) = 1,\ y(0.1) = 1.01,\ y(0.2)\ 1.022,\ y(0.3) = 1.023.$ (N/D 2015)

12. Solve $2y' - x - y = 0$ given $y(0) = 2,\ y(0.5) = 2.636,\ y(1) = 3.595,\ y(1.5) = 4.968$ to find $y(2)$ by Adam's method.

13. Obtain $y(0.6)$ given $\frac{dy}{dx} = x + y,\ y(0) = 1$ using $h = 0.2$ by Adam's method if
$y(-0.2) = 0.8373\ y(0.2) = 1.2427$ and $y(0.4) = 1.5834$. (N/D 2016)

[Second Half] (All are 8 marks)

V-Fourth Order Runge-Kutta Method

14. Apply R-K method to find approximate value of y for x = 0.2 in steps of 0.1 if $\frac{dy}{dx} = x + y^2$ given that y = 1 when x = 0. (N/D 2015)

15. 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.

16. Using R-K method of fourth order, find y(0.8) correct to 4 decimal places if $y' = y - x^2,\ y(0.6) = 1.7379$ with $h = 0.1$. (A/M 2015)

17. 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. (N/D 2016)

VI-Milne's Predictor Corrector Method

18. 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. (N/D 2015)

19. Given $\frac{dy}{dx} = \frac{1}{2}\left(1 + x^2\right)y^2$ and $y(0) = 1,\ y(0.1) = 1.06,\ y(0.2) = 1.12,\ y(0.3)1.21$, evaluate $y(0.4)$ by Milne's predictor-corrector method. (A/M 2015)

20. Given $\frac{dy}{dx} = xy + y^2$, y(0) = 1, y(0.1)=1.1169, y(0.2) = 1.2773, find y(0.3) by R-K method of order four and y(0.4) using Milne's predictor-corrector method.

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