PSN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai)
Approved by AICTE and Recognized by UGC Under section 2 (f), 12 (B)

An ISO 9001:2015 Certified Institution
Accredited by NAAC with A+
Melathediyoor,Palayamkottai, Tirunelveli – 627 152

B.E (Common to All)

QUESTION BANK
B.E DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2023

B.E. COMMON TO ALL / III SEMESTER

IC630017 –NUMERICAL METHODS AND STATISTICS

Regulation–2022

Time: 3 Hour | Answer ALL Questions | Max. Marks 100

Course Outcomes (COs): At the end of the course, the student will be able to

CO1:	Compute the solutions of the variables using iterative methods.
CO2:	Understand and apply methods to find interpolating and approximating polynomials.
CO3:	Compute the solutions of the variables using iterative methods.
CO4:	Understand and apply methods to find interpolating and approximating polynomials.
CO5:	Solve the physical problems by small and large sampling theory

BL – *Bloom's Level (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)*; **CO** – *Course Outcome*;

UNIT - I			
PART – A (2 Marks)			
S.No	**Question**	**CO**	**BL**
1	Give the name of any two iteration method in Numerical methods.	CO1	1
2	Explain the Gauss Elimination method.	CO1	1
3	Find an iterative formula to find √N, where N is positive number.	CO1	1
4	Write Newton –Raphson iterative formula	CO1	1
5	Derive Newton –Raphson formula to find the cube root of a positive number K	CO1	1
6	Evaluate √12 applying Newton formula.	CO1	2
7	Write the formula of Bisection method of the iteration.	CO1	1
8	Write the condition for Convergence of Gauss – Jacobi method of iteration.	CO1	1
9	What type of Eigen value can be obtained using power method?	CO1	1
10	Write the first iteration values of x, y, z when the equations 27x +6y –z = 85 ; 6x + 15y +2z = 72 ; X+ y + 5z = 110 are solved by Gauss – jacobi method.	CO1	2
11	Distinguish between Direct and Iterative method for solving system of equation.	CO1	1
12	Write the order of convergence of the following (i) Iterative Method (ii) Newton Raphson Method	CO1	1
13	Compare Gauss – Elimination and Gauss –seidel method for solving linear system of the form Ax = B	CO1	1

14	Find the interval and value of ϕ(x) for $x^3 + x^2 - 1 = 0$, by iterative method.	CO1	2
15	What is the alternative name for regula falsi method and write its formula?	CO1	1
	PART – B (13 Marks)		
1	Find the real root of the equation 3x-cosx -1=0, using Newton's Raphson method.	CO1	3
2	Find the positive root of x^4-x-10 correct to three decimal places using Newton's Raphson method.	CO1	3
3	Solve the equation x^2-2x-3=0 for the positive root by iteration method.	CO1	3
4	Find the real root of the equation cosx = 3x-1, using iteration method.	CO1	3
5	Solve the system of equations 28x+4y-z = 32;x+3y+10z = 24;2x+17y+4z = 35 Using Gauss elimination method.	CO1	3
6	Solve by using Gauss elimination method $3x_1+x_2+x_3=4$, $x_1+4x_2-x_3=-5$ and $x_1+x_2-6x_3=-12$	CO1	3
7	Solve by Gauss Jacobi method x-2y=-3 and 2x+25y = 15	CO1	3
8	Solve the system of equations 4x+2y+z=14, x+5y-z=10, x+y+8z=20 using Gauss Jacobi method.	CO1	3
	PART – C (15 Marks)		
1	Using Gauss Jordan methods solve the following equations. 5x+4y = 15 ; 3x+7y = 12	CO1	3
2	Solve by using Gauss elimination method 3x+y-z=3,2x-8y+z=-5 and x-2y+9z=8.	CO1	3
	UNIT - II		
	PART – A (2 Marks)		
S.No	**Question**	**CO**	**BL**
1	Find the polynomial which takes the following values x: 0, 1, 2 y: 1, 2, 1	CO2	2
2	From the following data, find θ at x=43 x: 40, 50, 60, 70, 80, 90 θ: 184, 204, 226, 250, 276, 304	CO2	2
3	State Newton's forward interpolation formula.	CO2	1
4	State Newton's backward interpolation formula.	CO2	1
5	State Lagrange's formula for interpolation method	CO2	1
6	State Inverse Lagrange's formula for interpolation method	CO2	1
7	State Newton's divided difference formula	CO2	1
8	X: 0, 2, 3, 5, 6 f(x): 1, 19, 55, 241, 415 Construct a table of divided difference for the following data:	CO2	2
9	Obtain the Newton's forward difference table for the following data x: -1, 0, 2, 3 y: -8, 3, 1, 12	CO2	2
10	Form the Newton's backward table for the following data	CO2	2

	x	2	5	10
	y	5	29	109

11	Apply Lagrange's formula to find f(x) from the following data. x: 4, 5 f(x): 24, 39	CO2	2
12	Find the equation y = f(x) of least degree and passing through the points (-1,21), (1,15), (2,12) using Newton's divided difference formula	CO2	2
13	State Cubic Spline interpolation formula.	CO2	2
14	State Striling's formula	CO2	2
15	Apply Lagrange's formula to find f(x) from the following data. x: 0, 1 f(x): 4, 3	CO2	2
	PART – B (13 Marks)		
1	Using Newton's forward interpolation formula, find the polynomial f(x) satisfying the following data. Hence find f(2). x: 0, 5, 10, 15 y: 14, 379, 1444, 3584	CO2	3
2	Using Newton's forward interpolation formula, find the polynomial f(x) satisfying the following data. Hence find f(5). x: 4, 6, 8, 10 y: 1, 3, 8, 10	CO2	3
3	x: 3, 4, 5, 6 y: 6, 24, 60, 120 Apply Newton's backward formula to find a polynomial of degree 3 which includes the following x,y pairs.	CO2	3
4	Using Newton's backward interpolation formula, find the polynomial f(x) satisfying the following data. Hence find f(9). x: 0, 2, 4, 6, 8, 10 y: 4, 6, 16, 34, 60, 94	CO2	3
5	x: 0, 2, 3, 4, 7, 8 f(x): 4, 26, 58, 112, 466, 668 Using Newton's divided difference formula, find the values of f(1), f(5) and f(9) from the following table:	CO2	3
6	Find the equation y = f(x) of least degree and passing through the points (-1,-21), (1,15), (2,12), (3,3) . Find also y at x = 0	CO2	3
7	Apply Lagrange's formula to find f(x) from the following data. x: 0, 1, 4, 5	CO2	3

	f(x) 4 | 3 | 24 | 39		
8	Find the parabola passing through the points (0, 1), (1, 3) and (3, 55) using Lagrange's interpolation formula	CO2	3
	PART – C (15 Marks)		
1	Find the Lagrange polynomial of x and hence find f(3) from the following table: x: 0, 1, 2 f(x): 2, 3, 12	CO2	3
2	Using Newton's forward interpolation formula, find the polynomial f(x) satisfying the following data. Hence find f (2.5). x: 0, 1, 2, 3, 4 y: 7, 10, 13, 22, 43	CO2	3
	UNIT - III		
	PART – A (2 Marks)		
1	Write down the expression for first derivative by Newton's forward difference formula.	CO3	1
2	Write down the expression for first derivative by Newton's backward difference formula.	CO3	1
3	State Simpson's 1/3 rule.	CO3	1
4	State Simpson's 3/8 rule.	CO3	1
5	State Trapezoidal rule of Numerical integration	CO3	1
6	Find $\int_{-2}^{2} x^4 dx$ by Simpson's rule taking h = 1	CO3	2
7	Evaluate $\int_{0}^{1} \frac{1}{1+x} dx$ with h = 0.5 using Trapezoidal rule.	CO3	2
8	State Romberg's method of Numerical integration.	CO3	1
9	Write the formula for evaluating double integrals using trapezoidal method.	CO3	1
10	Write the formula for evaluating double integrals using Simpson's method.	CO3	1
11	Given f(0) = - 1, f(1) = 1 and f(2) = 4, find $\int_{0}^{2} f(x)dx$ by Trapezoidal rule.	CO3	2
12	Using Simpson's rule find $\int_{0}^{4} e^x dx$ $e^0 = 1$, $e^1 = 2.72$, $e^2 = 7.39$, $e^3 = 20.09$ and $e^4 = 54.6$.	CO3	2
13	Write down the expression for first derivative by Newton's forward difference formula.	CO3	1
14	State Romberg's Formula.	CO3	1
15	Write down the expression for second derivative by Newton's forward difference formula.	CO3	1
	PART – B (13 Marks)		
1	.	CO3	3

<table>
<tr><td></td><td><table><tr><td>x</td><td>02</td><td>0.4</td><td>0.6</td><td>0.8</td><td>1.0</td></tr><tr><td>y</td><td>0.979</td><td>0.917</td><td>0.808</td><td>0.638</td><td>0.348</td></tr></table>
Consider the following table of data: Find $f'(0.25)$ using Newton's forward difference and $f'(0.95)$ using Newton's backward difference</td><td></td><td></td></tr>
<tr><td>2</td><td>Using Trapezoidal rule, Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by dividing the interval into 10 equal parts. Hence obtain an approximate value of π .</td><td>CO3</td><td>3</td></tr>
<tr><td>3</td><td>Using Simpson's 1/3 and 3/8 rule, Evaluate $\int_0^1 \frac{x^2dx}{1+x^3}$,
also find loge 21/3</td><td>CO3</td><td>3</td></tr>
<tr><td>4</td><td>Compute $\int_0^1 \frac{dx}{1+x^2}$ Using Trapezoidal rule, taking h= 0.5 and h=0.25. Hence find the value of the above integration by Romberg's Method.</td><td>CO3</td><td>3</td></tr>
<tr><td>5</td><td>Evaluate $\int_0^1 \frac{dx}{1+x}$
Correct to three deciamal places, using Romberg's Method.</td><td>CO3</td><td>3</td></tr>
<tr><td>6</td><td>Using 2-point Gaussian Quadrature formula, evaluate $\int_1^2 \frac{1}{1+x^3}dx$ and $\int_{-1}^1 (3x^2+5x^4)dx$</td><td>CO3</td><td>3</td></tr>
<tr><td>7</td><td>Evaluate the integral $\int_1^2\int_1^2 \frac{dxdy}{x+y}$ using the trapezoidal rule with h = k = 0.5 and h=k=0.25.</td><td>CO3</td><td>3</td></tr>
<tr><td>8</td><td>$\int_0^1\int_0^1 \frac{1}{1+x+y}dydx$
Using Trapezoidal and Simpson's rules, evaluate with h=k=0.5.</td><td>CO3</td><td>3</td></tr>
<tr><td colspan="4">PART – C (15 Marks)</td></tr>
<tr><td>1</td><td>Using Trapezoidal rule and Simpson's rule, evaluate $\int_{1.4}^{2}\int_{1}^{1.5} \ln(x+2y)dydx,$
choosing $\Delta x = 0.15$ and $\Delta y = 0.25$.</td><td>CO3</td><td>3</td></tr>
<tr><td>2</td><td><table><tr><td>x</td><td>02</td><td>0.4</td><td>0.6</td><td>0.8</td><td>1.0</td></tr><tr><td>y</td><td>0.979</td><td>0.917</td><td>0.808</td><td>0.638</td><td>0.348</td></tr></table>
Consider the above table of data: Find $f'(0.25)$ using Newton's forward difference and $f'(0.95)$ using Newton's backward difference.</td><td>CO3</td><td>3</td></tr>
<tr><td colspan="4">UNIT - IV</td></tr>
</table>

<table>
<tr><th colspan="4">PART – A (2 Marks)</th></tr>
<tr><td>1</td><td>Define a point estimate of a parameter Q.</td><td>CO4</td><td>1</td></tr>
<tr><td>2</td><td>Define Point estimator of Q.</td><td>CO4</td><td>1</td></tr>
<tr><td>3</td><td>Find the estimate $(\overline{X})$ for the three observations $x_1 = 5.6, x_2 = 4.5$ and $x_3 = 6.1$</td><td>CO4</td><td>1</td></tr>
<tr><td>4</td><td>The 20 observations data are as follows
24.46,25.61,26.25,26.42,26.66,27.15,27.31,27.54,27.74,27.94,27.98,28.04,28.28,28.49,28.50,28.87,29.11,29.13,29.50,30.88.Find the estimator $\overline{X}_{tr(10)}$</td><td>CO4</td><td>2</td></tr>
<tr><td>5</td><td>Find the standard deviation for the following data $1, 2, 3, 4, 5.$</td><td>CO4</td><td>2</td></tr>
<tr><td>6</td><td>Define 95% confidence interval for μ</td><td>CO4</td><td>1</td></tr>
<tr><td>7</td><td>Define 98% confidence interval for μ</td><td>CO4</td><td>1</td></tr>
<tr><td>8</td><td>Define 99% confidence interval for μ</td><td>CO4</td><td>1</td></tr>
<tr><td>9</td><td>What is the confidence level for the interval $\overline{X} \pm 2.81\frac{\sigma}{\sqrt{n}}$</td><td>CO4</td><td>1</td></tr>
<tr><td>10</td><td>What is the confidence level for the interval $\overline{X} \pm 1.44\frac{\sigma}{\sqrt{n}}$</td><td>CO4</td><td>1</td></tr>
<tr><td>11</td><td>A CI is desired for the true average stray-load loss μ (watts) for a certain type of induction motor when the line current is held at 10amps for a speed of 1500rpm. Assume that stray-load loss is normally distributed with $\sigma = 3.0$
Compute a 95% CI for μ when $n = 25$ and $\overline{x} = 58.3$</td><td>CO4</td><td>2</td></tr>
<tr><td>12</td><td>A CI is desired for the true average stray-load loss μ (watts) for a certain type of induction motor when the line current is held at 10amps for a speed of 1500rpm. Assume that stray-load loss is normally distributed with $\sigma = 3.0$
Compute a 95% CI for μ when $n = 100$ and $\overline{x} = 58.3$</td><td>CO4</td><td>2</td></tr>
<tr><td>13</td><td>A CI is desired for the true average stray-load loss μ (watts) for a certain type of induction motor when the line current is held at 10amps for a speed of 1500rpm. Assume that stray-load loss is normally distributed with $\sigma = 3.0$
Compute a 82% CI for μ when $n = 100$ and $\overline{x} = 58.3$</td><td>CO4</td><td>2</td></tr>
<tr><td>14</td><td>Explain 95% CI for μ</td><td>CO4</td><td>1</td></tr>
<tr><td>15</td><td>Explain 99% CI for μ</td><td>CO4</td><td>1</td></tr>
<tr><th colspan="4">PART – B (13 Marks)</th></tr>
<tr><td>1</td><td>The data on flexural strength for concrete beams of certain type are as follows:
5.9, 7.2, 7.3, 6.3, 8.1, 6.8, 7.0, 7.6, 6.8, 6.5, 7.0, 6.3, 7.9, 9.0, 8.2, 8.7, 7.8, 9.7, 7.4, 7.7, 9.7, 7.8, 7.7, 11.6, 11.3, 11.8, 10.7
Calculate a point estimate of the mean value of strength for the conceptual population of all beams manufactured in this fashion (Hint: $\sum x_i = 219.8$)</td><td>CO4</td><td>3</td></tr>
<tr><td>2</td><td>A sample of 20 students who had recently taken elementary statistics yielded the following information on the brand of calculator owned (T=Texas Instruments, H-Hewlett Packard, C- Casio, S-sharp)
<table>
<tr><td>T</td><td>T</td><td>H</td><td>T</td><td>C</td><td>T</td><td>T</td><td>S</td><td>C</td><td>H</td></tr>
<tr><td>S</td><td>S</td><td>T</td><td>H</td><td>C</td><td>T</td><td>T</td><td>T</td><td>H</td><td>T</td></tr>
</table>
Estimate the true proportion of all such students who own a Teras Instruments calculation.</td><td>CO4</td><td>3</td></tr>
<tr><td>3</td><td>Consider the following sample of observation on coating thickness for low-viscosity paint
<table>
<tr><td>0.83</td><td>0.88</td><td>0.88</td><td>1.04</td><td>1.09</td><td>1.12</td><td>1.29</td><td>1.31</td></tr>
</table></td><td>CO4</td><td>3</td></tr>
</table>

	1.48 1.49 1.59 1.62 1.65 1.71 1.76 1.83 Assume that the distribution of coating thickness is normal. Calculate a point estimate of the mean value of coating thickness and state which estimate is used.			
4	A random sample of 10 houses in a particular area, each of which is heated with natural gas used during the month of January is determined for each house. The resulting observations are $103, 156, 118, 89, 125, 147, 122, 109, 139, 99$. Let μ denote the average gas usage during January by all houses in this area. Compute a point estimate of μ.	CO4	3
5	Each of 150 newly manufactured items is examined and the number of scratches per item is recorded(the items are supposed to be free of scratches) yielding the following data: No of scratches per item: 0 1 2 3 4 5 6 7 Observed: 18 37 42 30 13 7 2 1 Let X be the number of scratches on a randomly chosen item and assume that X has a Poisson distribution with parameter μ.Find an estimater of μ and compute the estimate for the data.	CO4	3
6	A Sample of $n = 31$ trained typists was selected and the preferred keyboard height was determined for each typist. The resulting sample average preferred height was$\bar{x} = 80cm$. Assuming that the preferred height is normally distributed with$\sigma = 2.0cm$. Obtain a CI for μ at 95% confidence level.	CO4	3
7	Extensive monitoring of a computer time-sharing system has suggested that response time to a particular editing command is normally distributed with standard deviation 25 $millisec$ A new operating system has been installed and we wish to estimate the true average response times are still normally distributed with $\sigma = 25$, what sample size is necessary to ensure that the resulting 95% CI has a width of atmost 10?	CO4	3
8	Obtain the class interval with 95% confidence level for the following data 12 14 11 16 13 17 12 16 17 14 14 15 10 11 12 19 18 16 13 12	CO4	3
	PART – C (15 Marks)		
1	Obtain the class interval with 98% confidence level for the following data: No of absentess: 0 1 2 3 4 5 6 7 8 9 10 Frequency: 1 4 8 10 8 7 5 3 2 1 1	CO4	3
2	Obtain the class interval with 95% confidence level for the following data. 12 14 11 16 13 17 12 16 17 14 14 15 10 11 12 19 18 16 13 12	CO4	3
	UNIT - V		
	PART – A (2 Marks)		
1	Define Null hypothesis	CO5	1
2	Define Alternative hypothesis.	CO5	1
3	Write the condition for two tailed test.	CO5	1
4	Write the condition for right tailed test.	CO5	1
5	Write the condition for left tailed test.	CO5	1

6	Write the application of F- test and ψ^2-test.	CO5	1
7	Define Test of significance of single mean.	CO5	1
8	Define χ^2-test	CO5	1
9	Observed frequencies are 14, 18, 12, 11, 15, and 14. What is the expected frequency?	CO5	2
10	Write the formula for‘t’ test.	CO5	1
11	If Observed frequency are 14, 18, 12, 11, 15, 14 and expected frequency is 14. Find chi-square value.	CO5	2
12	A coin is tossed 144 times and a person gets 80 heads. Can we say that the coin is unbiased one?	CO5	2
13	Observed frequencies are 14, 18, 12, 11, 15, and 14. What is the expected frequency?	CO5	2
14	Define Students‘t’ test.	CO5	1
15	Define ‘F’ test for Goodness for fit.	CO5	1
	PART – B (13 Marks)		
1	Find the calculated value of ψ^2 for the following dada, Days: Mon 14, Tue 18, Wed 12, Thu 11, Fri 15, Sat 14 (Frequency)	CO5	3
2	A machinist is making engine parts with axle diameters of 0.700 inch. A random sample of 10 parts shows a mean diameter of 0.742 inch with a S.D. of 0.040 inch. Compute the statistic you would use to test whether the work is meeting the specification. (5% significance level assuming that for 9 degrees of freedom P(t >2.26)= 0.05	CO5	3
3	A sample of size 13 gave an estimated population variance of 3.0, while another sample of size 15 gave an estimate of 2.5 could both sample be from populations with the same variance. [Given tabulated value of ‘F’ for (12, 14) d.f is 2.53]	CO5	3
4	A sample of 900 members has a mean 3.4cm and S.D 2.61 cms. Is the sample from a large population of mean 3.25 cms and S.D 2.61 cms (test whether 5% level of significance? $z_\alpha = 1.96$)	CO5	3
5	To verify whether a course in accounting improved performance, a similar test was given to 12 participants both before and after the course. The marks are Before: 44 40 61 52 32 44 70 41 67 72 53 72 After :53 38 69 57 46 39 73 48 73 74 60 78 What the course useful? [22 d.f , $t_{0.05}$= 1.717].	CO5	3
6	A group of 5 patients treated with medicine A weigh 42, 39, 48, 60 and 41 kgs. Second group of 7 patients form the same hospital treated with medicine B weigh 38, 42, 56, 64, 68, 69 and 62 kgs. Do you agree with the claim that medicine B increases the weight significantly? [10 d.f, $t_{0.05}$= 1.81].	CO5	3
7	In one sample of 8 observations the sum of the squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this difference is significant at 5% level. (D.F (7,9) $F_{0.05}$=3.29)	CO5	3
8	Two random sample gave the following results.	CO5	3

	<table><tr><th>Sample</th><th>Size</th><th>Sample mean</th><th>Sum of squares of the deviation for the mean</th></tr><tr><td>1</td><td>10</td><td>15</td><td>90</td></tr><tr><td>2</td><td>12</td><td>14</td><td>108</td></tr></table> Test whether the sample come from the same normal population. ($F_{0.05}(9,11)= 2.90$, $t_{0.05}= 2.086$)		
PART – C (15 Marks)			
1	The number of automobile accidents per week in a certain community are as follows: 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. [Given $\psi_{0.05} = 16.9$ for 9 d.f]	CO5	3
2	The heights of 10 males of a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66, inches. Is it reasonable to believe that the average height is greater than 64 inches? Test at 5% significance level assuming that for 9 degrees of freedom P (t >1.83) = 0.05.	CO5	3