PSN COLLEGE OF ENGINEERING AND TECHNOLOGY

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Melathediyoor, Tirunelveli – 627 152

IC630017 - NUMERICAL METHODS AND STATISTICS – QUESTION BANK

PART- A (2MARKS)

UNIT – 1 – SOLUTION OF EQUATION AND EIGENVALUE PROBLEM

S.No	QUESTION	CO	BL
1	Find the negative root of the equation x^3-2x+5 , by using iteration method.	CO1	1
2	Give the name of any two iteration method in Numerical methods.	CO1	1
3	Explain the Gauss Elimination method.	CO1	2
4	Find an iterative formula to find √N , where N is positive number.	CO1	2
5	Write Newton –Raphson iterative formula	CO1	2
6	Derive Newton –Raphson formula to find the cube root of a positive number K	CO1	2
7	Evaluate √12 applying Newton formula.	CO1	2
8	Compare Gauss –Jacobi and Gauss –seidel method for solving linear system of the form Ax = B	CO1	2
9	Write is the condition for Convergence of Gauss – Jacobi method of iteration.	CO1	1
10	What type of Eigen value can be obtained using power method?	CO1	1
11	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 –seidel method.	CO1	1
12	Distinguish between Direct and Iterative method for solving system of equation.	CO1	1
13	Write the order of convergence of the following (i) Iterative Method (ii) Regula Falsi Method (iii) Newton Raphson Method	CO1	1
	UNIT II- INTERPOLATION AND APPROXIMATING POLYNOMIALS		
1.	Find the polynomial which takes the following values x: 0, 1, 2 y: 1, 2, 1	CO2	1
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	1
3.	State Newton's forward interpolation formula.	CO2	1
4.	State Newton's backward interpolation formula.	CO2	1

<table>
<tr><td>5.</td><td>State Lagrange's formula for interpolation method</td><td>CO2</td><td>1</td></tr>
<tr><td>6.</td><td>State Inverse Lagrange's formula for interpolation method</td><td>CO2</td><td>2</td></tr>
<tr><td>7.</td><td>State Newton's divided difference formula</td><td>CO2</td><td>2</td></tr>
<tr><td>8.</td><td><table><tr><td>X</td><td>0</td><td>2</td><td>3</td><td>5</td><td>6</td></tr><tr><td>f(x)</td><td>1</td><td>19</td><td>55</td><td>241</td><td>415</td></tr></table>Construct a table of divided difference for the following data:</td><td>CO2</td><td>1</td></tr>
<tr><td>9.</td><td>Obtain the Newton's forward difference table for the following data<table><tr><td>x</td><td>-1</td><td>0</td><td>2</td><td>3</td></tr><tr><td>y</td><td>-8</td><td>3</td><td>1</td><td>12</td></tr></table></td><td>CO2</td><td>2</td></tr>
<tr><td>10.</td><td>Form the Newton's backward table for the following data<table><tr><td>x</td><td>2</td><td>5</td><td>10</td></tr><tr><td>y</td><td>5</td><td>29</td><td>109</td></tr></table></td><td>CO2</td><td>1</td></tr>
<tr><td>11</td><td>Using Lagrange's formula, find f(6) given<table><tr><td>x</td><td>2</td><td>5</td><td>7</td><td>10</td><td>12</td></tr><tr><td>f(x)</td><td>18</td><td>180</td><td>448</td><td>1210</td><td>2028</td></tr></table></td><td>CO2</td><td>2</td></tr>
<tr><td>12</td><td>State Stirling's Central difference formula.</td><td>CO2</td><td>2</td></tr>
<tr><td>13</td><td>Write Central difference table.</td><td>CO2</td><td>4</td></tr>
<tr><td></td><td>UNIT III – NUMERICAL DIFFERENTIATION AND INTEGRATION</td><td></td><td></td></tr>
<tr><td>1.</td><td>Write down the expression for first and second derivative by Newton's forward difference formula.</td><td>CO3</td><td>3</td></tr>
<tr><td>2.</td><td>Write down the expression for first and second derivative by Newton's backward difference formula.</td><td>CO3</td><td>3</td></tr>
<tr><td>3.</td><td>State Simpson's 1/3 rule.</td><td>CO3</td><td>1</td></tr>
<tr><td>4.</td><td>State Simpson's 3/8 rule.</td><td>CO3</td><td>1</td></tr>
<tr><td>5.</td><td>State Trapezoidal rule of Numerical integration</td><td>CO3</td><td>1</td></tr>
<tr><td>6.</td><td>Find $\int_{-2}^{2} x^4 dx$ by Simpson's rule taking h = 1</td><td>CO3</td><td>1</td></tr>
<tr><td>7.</td><td>Evaluate $\int_{0}^{1} \frac{1}{1+x} dx$ with h = 0.5 using Trapezoidal rule.</td><td>CO3</td><td>1</td></tr>
<tr><td>8.</td><td>First and second derivative of Stirling's formula</td><td>CO3</td><td>1</td></tr>
</table>

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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**	1
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**	1
13.	Find $\int_{-2}^{2} x^4 dx$ by Simpson's rule taking h = 1.	**CO3**	1
	UNIT IV - THEORY OF ESTIMATION		
1.	Define a point estimate of a parameter Q.	**CO4**	1
2.	Define Point estimator of Q.	**CO4**	2
3.	Find the estimate $(\overline{X})$ for the three observations $x_1 = 5.6, x_2 = 4.5$ and $x_3 = 6.1$	**CO4**	3
4.	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 $\overline{X}_{tr(10)}$	**CO4**	1
5.	Find the standard deviation for the following data 1, 2, 3, 4, 5.	**CO4**	3
6.	Define 95% confidence interval for μ	**CO4**	1
7.	Define 98% confidence interval for μ	**CO4**	1
8.	Define 99% confidence interval for μ	**CO4**	1
9.	What is the confidence level for the interval $\overline{X} \pm 2.81\frac{\sigma}{\sqrt{n}}$	**CO4**	1
10.	What is the confidence level for the interval $\overline{X} \pm 1.44\frac{\sigma}{\sqrt{n}}$	**CO4**	2
11.	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 $\sigma = 3.0$ a) Compute a 95% CI for μ when $n = 25$ and $\overline{x} = 58.3$	**CO4**	3
12.	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 $\sigma = 3.0$ b) Compute a 95% CI for μ when $n = 100$ and $\overline{x} = 58.3$	**CO4**	1

<table>
<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 $\sigma = 3.0$
c) Compute a 82% CI for μ when $n = 100$ and $\bar{x} = 58.3$</td><td>CO4</td><td>3</td></tr>
<tr><td></td><td colspan="2">UNIT V – TESTING OF HYPOTHESIS</td><td></td></tr>
<tr><td>1.</td><td>Find the calculated value of ψ^2 for the following dada,
<table><tr><td>Days</td><td>Mon</td><td>Tue</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr><tr><td>Frequency</td><td>14</td><td>18</td><td>12</td><td>11</td><td>15</td><td>14</td></tr></table></td><td>CO5</td><td>1</td></tr>
<tr><td>2.</td><td>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]</td><td>CO5</td><td>3</td></tr>
<tr><td>3.</td><td>Define Null hypothesis</td><td>CO5</td><td>1</td></tr>
<tr><td>4.</td><td>Define‘t’ test.</td><td>CO5</td><td>1</td></tr>
<tr><td>5.</td><td>Define ‘F’ test.</td><td>CO5</td><td>1</td></tr>
<tr><td>6.</td><td>Write the application of F- test and ψ^2-test.</td><td>CO5</td><td>1</td></tr>
<tr><td>7.</td><td>Define Test of significance of single mean.</td><td>CO5</td><td>1</td></tr>
<tr><td>8.</td><td>Define ψ^2-test</td><td>CO5</td><td>1</td></tr>
<tr><td>9.</td><td>The number of automobile accidents per week in a certain community are as follows: 12, 8, 20, 2, 14, 10, 15,6,9,4. What is the expected frequency?</td><td>CO5</td><td>1</td></tr>
<tr><td>10.</td><td>Observed frequencies are 1026, 1107, 997, 966, 1075,933, 1107, 972, 964, 853. What is the expected frequency?</td><td>CO5</td><td>1</td></tr>
<tr><td>11</td><td>IF Observed frequency are 14,18,12,11,15,14 and expected frequency is 14 . Find chi-square value</td><td>CO5</td><td>1</td></tr>
<tr><td>12</td><td>A coin is tossed 144 times and a person gets 80 heads. Can we say that the coin is unbiased one?</td><td>CO5</td><td>1</td></tr>
<tr><td>13</td><td>Observed frequencies are 14, 18, 12, 11, 15, 14. what is the expected frequency?</td><td>CO5</td><td>1</td></tr>
<tr><td></td><td colspan="2">PART B (13 MARKS)</td><td></td></tr>
<tr><td></td><td colspan="2">UNIT I – SOLUTION OF EQUATION AND EIGENVALUE PROBLEM</td><td></td></tr>
</table>

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<table>
<tr><td>1.</td><td>Find the real root of the equation 3x-cosx -1=0, using Newton's Raphson method.</td><td>CO1</td><td>1</td></tr>
<tr><td>2.</td><td>Find the positive root of x^4-x-10 correct to three decimal places using Newton's Raphson method.</td><td>CO1</td><td>1</td></tr>
<tr><td>3.</td><td>Solve the equation x^2-2x-3=0 for the positive root by iteration method.</td><td>CO1</td><td>1</td></tr>
<tr><td>4.</td><td>Find the real root of the equation cosx = 3x-1, using iteration method.</td><td>CO1</td><td>1</td></tr>
<tr><td>5.</td><td>Solve the system of equations 28x+4y-z = 32;x+3y+10z = 24;2x+17y+4z = 35 Using Gauss elimination method.</td><td>CO1</td><td>1</td></tr>
<tr><td>6.</td><td>Solve by using Gauss elimination method 3x+y-z=3,2x-8y+z=-5 and x-2y+9z=8</td><td>CO1</td><td>1</td></tr>
<tr><td>7.</td><td>Solve by Guass Seidal method x-2y=-3 and 2x+25y = 15</td><td>CO1</td><td>1</td></tr>
<tr><td>8.</td><td>Solve the system of equations 4x+2y+z=14, x+5y-z=10, x+y+8z=20 using Gauss Seidel method.</td><td>CO1</td><td>1</td></tr>
<tr><td></td><td>UNIT II -INTERPOLATION AND APPROXIMATING POLYNOMIALS</td><td></td><td></td></tr>
<tr><td>1.</td><td>Using Newton's forward interpolation formula, find the polynomial f(x) satisfying the following data. Hence find f(2).
<table>
<tr><td>x</td><td>0</td><td>5</td><td>10</td><td>15</td></tr>
<tr><td>y</td><td>1
4</td><td>379</td><td>14
44</td><td>3584</td></tr>
</table></td><td>CO2</td><td>1</td></tr>
<tr><td>2.</td><td>Using Newton's forward interpolation formula, find the polynomial f(x) satisfying the following data. Hence find f(5).
<table>
<tr><td>x</td><td>4</td><td>6</td><td>8</td><td>10</td></tr>
<tr><td>y</td><td>1</td><td>3</td><td>8</td><td>10</td></tr>
</table></td><td>CO2</td><td>1</td></tr>
<tr><td>3.</td><td>
<table>
<tr><td>x</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>y</td><td>6</td><td>24</td><td>60</td><td>120</td></tr>
</table>
Apply Newton's backward formula to find a polynomial of degree 3 which includes the following x,y pairs.</td><td>CO2</td><td>3</td></tr>
<tr><td>4.</td><td>Using Newton's backward interpolation formula, find the polynomial f(x) satisfying the following data. Hence find f(9).
<table>
<tr><td>x</td><td>0</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr>
<tr><td>y</td><td>4</td><td>6</td><td>16</td><td>34</td><td>60</td><td>94</td></tr>
</table></td><td>CO2</td><td>3</td></tr>
<tr><td>5.</td><td></td><td>CO2</td><td>3</td></tr>
</table>

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:

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.	**CO2**	3

x	0	1	4	5
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
	UNIT III – NUMERICAL DIFFERENTIATION AND INTEGRATION		
1.	.	**CO3**	3

x	02	0.4	0.6	0.8	1.0
y	0.979	0.917	0.808	0.638	0.348

Consider the following table of data: Find $f'(0.25)$ using Newton's forward difference and $f'(0.95)$ using Newton's backward difference

2.	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 .	**CO3**	3
3.	Using Simpson's 1/3 and 3/8 rule, Evaluate $\int_0^1 \frac{x^2 dx}{1+x^3}$, also find $\log_e 2^{1/3}$	**CO3**	3
4.	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.	**CO3**	3
5.	Evaluate $\int_0^1 \frac{dx}{1+x}$ Correct to three deciamal places, using Romberg's Method.	**CO3**	1

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6.	Using 2-point Gaussian Quadrature formula, evaluate $\int_1^2 \frac{1}{1+x^3}dx$ and $\int_{-1}^{1}(3x^2+5x^4)dx$	**CO3**	1
7.	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.	**CO3**	3
8.	$\int_0^1\int_0^1 \frac{1}{1+x+y}dydx$ Using Trapezoidal and Simpson's rules, evaluate with h=k=0.5.	**CO3**	1
	UNIT IV - THEORY OF ESTIMATION		
1.	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: $\sum x_i = 219.8$)	**CO4**	3
2.	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) T T H T C T T S C H S S T H C T T T H T a) Estimate the true proportion of all such students who own a Teras Instruments calculation.	**CO4**	**1**
3.	Consider the following sample of observation on coating thickness for low-viscosity paint 0.83 0.88 0.88 1.04 1.09 1.12 1.29 1.31 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.	**CO4**	**3**

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<table>
<tr><td>4.</td><td>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.</td><td>CO4</td><td>1</td></tr>
<tr><td>5.</td><td>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:
<table>
<tr><td>No of scratches per item</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Observed</td><td>18</td><td>37</td><td>42</td><td>30</td><td>13</td><td>7</td><td>2</td><td>1</td></tr>
</table>
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.</td><td>CO4</td><td>2</td></tr>
<tr><td>6.</td><td>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.</td><td>CO4</td><td>1</td></tr>
<tr><td>7.</td><td>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?</td><td>CO4</td><td>2</td></tr>
<tr><td>8.</td><td>Obtain the class interval with 95% confidence level for the following data
<table>
<tr><td>12</td><td>14</td><td>11</td><td>16</td><td>13</td><td>17</td><td>12</td><td>16</td><td>17</td><td>14</td></tr>
<tr><td>14</td><td>15</td><td>10</td><td>11</td><td>12</td><td>19</td><td>18</td><td>16</td><td>13</td><td>12</td></tr>
</table></td><td>CO4</td><td>2</td></tr>
<tr><td></td><td colspan="3">UNIT V – TESTING OF HYPOTHESIS</td></tr>
<tr><td>1.</td><td>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.</td><td>CO5</td><td>1</td></tr>
<tr><td>2.</td><td>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? $z_\alpha = 1.96$)</td><td>CO5</td><td>1</td></tr>
</table>

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3.	The heights of 10 males of a given locality are found to be 70, 67,62,68,70,64,64,66 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**	1
4.	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
5.	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
6	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
7	Two random sample gave the following results. Sample | Size | Sample mean | Sum of squares of the deviation for the mean 1 | 10 | 15 | 90 2 | 12 | 14 | 108 Test whether the sample come from the same normal population. ($F_{0.05}$(9,11)= 2.90, $t_{0.05}$= 2.086)	**CO5**	1
8	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
	PART C (15 Mark)		
1.	Using Gauss Jordan methods solve the following equations. 5x+4y = 15 ; 3x+7y = 12	**CO1**	3
2.	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

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<table>
<tr><td>3.</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>4.</td><td>Obtain the class interval with 98% confidence level for the following data:
<table>
<tr><td>No of absentess</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>Frequency</td><td>1</td><td>4</td><td>8</td><td>10</td><td>8</td><td>7</td><td>5</td><td>3</td><td>2</td><td>1</td><td>1</td></tr>
</table></td><td>CO4</td><td>3</td></tr>
<tr><td>5.</td><td>A die is thrown 264 times with the following results. Show that the die is biased. [Given $\psi_{0.05} = 11.07$ for 5 d.f]
<table>
<tr><td>No. appeared on the die</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Frequency</td><td>40</td><td>32</td><td>28</td><td>58</td><td>54</td><td>52</td></tr>
</table></td><td>CO5</td><td>3</td></tr>
</table>