

Printed Pages: 7

NCS - 303

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2280953

Roll No.

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B.TECH

Regular Theory Examination (Odd Sem-III) 2016-17

**COMPUTER BASED NUMERICAL AND
STATISTICAL TECHNIQUES**

Time : 3 Hours

Max. Marks : 100

Note: Attempt all Sections. If require any missing data; then choose suitably.

Section - A

- I. Attempt all questions in brief. (10×2=20)
- a) Discuss the significant digits with suitable example.
 - b) The error in the measurement of the area of a circle is not allowed to exceed 0.1%. How accurately should the diameter be measured?
 - c) Define testing of Statistical hypothesis.

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[P.T.O.]

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- d) Express $1 + x - x^2 + x^3$ as sum of Chebyshev polynomial.
- e) What is the condition of natural spline.
- f) Write the normal equation for a $y = a + bx + cx^2$
- g) Write a short note on floating point arithmetic.
- h) Prove that $\mu\delta = \frac{1}{2}(\Delta + \nabla) = \frac{\Delta E^{-1}}{2} + \frac{\Delta}{2}$
- i) Determine the condition number of the matrix

$$\begin{bmatrix} 2 & -1 & 1 \\ 1 & 0 & 1 \\ 3 & -1 & 4 \end{bmatrix}$$
 using the maximum absolute row sum norm.
- j) Differentiate between ill conditioned and well conditioned methods.

Section - B

2. Attempt three questions from this section
(3×10=30)
 - a) Use synthetic division and perform two iterations for the Birge-Vieta method to find the smallest positive root of the equation

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- $x^4 - 3x^3 + 3x^2 - 3x + 2 = 0$. Use the initial approximation $P_0 = 0.5$.
- b) Write down the computer algorithms of least square curve fitting.
- c) Derive the formula for error analysis of trapezoidal rule. If $I = \int_0^1 e^{-x^2} dx$, then estimate I using the Trapezoidal rule with the 10 subintervals. Find an error bound also.
- d) Use Gauss-Elimination method to solve the following system of equations:

$$\begin{aligned} 2x + y + z &= 10 \\ 3x + 2y + 3z &= 18 \\ x + 4y + 9z &= 16 \end{aligned}$$
- e) Use secant method to determine the root of the equation $\cos x - xe^x = 0$. Choose suitable initial approximation.

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Section - C
3. Attempt any one part of the following: (1×10=10)

- a) Find the condition for convergence of fixed point iteration method. Find by fixed point iteration method, the real root of the equation $\sin x = 10(x-1)$.

- b) Define Aitken's Δ^2 method. Find a real root of the equation $2x - \log_{10} x = 7$, correct to three decimal places using Aitken's Δ^2 method and iteration method. Also show how the rate of convergence of Aitken's Δ^2 method is rapid than iteration method.

4. Attempt any one part of the following: (1×10=10)

- a) Write the algorithm for Lagrange's interpolation formula. Determine the step size that can be used in the tabulation of $f(x) = \sin x$ in the interval $[0, \pi/4]$ at equally spaced nodal points so that the truncation error of the quadratic interpolation is less than 5×10^{-3}

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- b) Obtain an approximation in the sense of the principle of least squares in the form of a polynomial of the degree 2 to the function $1/(1+x^2)$ in the range $-1 \leq x \leq 1$.

5. Attempt any one part of the following: (1×10=10)

- a) Calculate $y'(0.398)$ as accurately as possible using the table below and with the aid of the approximation $S(h)$. Give the error estimate (the values in the table are correctly rounded.)

x	0.398	0.399	0.400	0.401	0.402
$f(x)$	0.408591	0.409671	0.410752	0.411834	0.412915

- b) Find a quadrature formula

$$\int_0^1 \frac{f(x) dx}{\sqrt{x(1-x)}} = a_0 f(0) + a_1 f\left(\frac{1}{2}\right) + a_2 f(1) \text{ which is exact for polynomials of highest possible degree.}$$

Then use the formula on $\int_0^1 \frac{dx}{\sqrt{x-x^3}}$ and compare with the exact value.

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6. Attempt any one part of the following: (1×10=10)

a) Apply Runge-Kutta method to find an approximate

value of y for $x = 0.2$ and $x = 0.4$ if $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$

b) Solve by successive over relaxation method, the equations,

$$10x - 2y - 2z = 6$$

$$-x + 10y - 2z = 7$$

$$-x - y + 10z = 8$$

7. Attempt any one part of the following: (1×10=10)

a) Evaluate

$$I = \int_0^1 \frac{dx}{2x^2 + 2x + 1}, \text{ using the Lobatto 3 point and}$$

Radau 3-point formula. Compare with the exact solution.

b) i) A random sample of 900 members has a mean 3.4 cms. Can it be reasonably regarded as a sample from a large population of mean 3.2 cms and S.D. 2.3 cms.

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ii)

Find a uniform polynomial approximation of degree four or less to e^x on $[-1, 1]$ using Lanczos economization with a tolerance of $\epsilon = 0.02$

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