

Printed Pages: 7

NCS - 303

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

Paper ID : 2289953

Roll No.

--	--	--	--	--	--	--	--	--	--

**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**

1. 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.

303/12/2016/15680

(1)

[P.T.O.]

**NCS - 303**

- 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

303/12/2016/15680 (2)

**NCS - 303**

- $x^4 - 3x^3 + 3x^2 - 3x + 2 = 0$ . 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.

303/12/2016/15680 (3)

[P.T.O.]

NCS - 303

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  $\Delta^2$  method. Find a real root of the equation  $2x - \log_{10} x = 7$ , correct to three decimal places using Aitken's  $\Delta^2$  method and iteration method. Also show how the rate of convergence of Aitken's  $\Delta^2$  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  $5 \times 10^{-8}$

303/12/2016/15680

(4)

NCS - 303

- 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

$$\int_0^1 \frac{f(x) dx}{\sqrt{x(1-x)}} = a_1 f(0) + a_2 f\left(\frac{1}{2}\right) + a_3 f(1) \text{ which is}$$

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.

303/12/2016/15680

(5)

NCS - 303

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.

$$\begin{aligned} 10x - 2y - 2z &= 6 \\ -x + 10y - 2z &= 7 \\ -x - y + 10z &= 8 \end{aligned}$$

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.

303/12/2016/15680

(6)

NCS - 303

- ii) Find a uniform polynomial approximation of degree four or less to  $e^x$  on  $[-1, 1]$  using

Lanczos economization with a tolerance of  $\epsilon = 0.02$

303/12/2016/15680

(7)