Printed Pages-2 **Paper Code: NCS-303**
Paper ID: 1035

B. TECH
(SEM. III) THEORY EXAMINATION 2017-18
COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

Time : 3 Hours ***Total Marks: 100***

SECTION-A

1. Attempt **all** parts of this section: **(10×2=20)**

(a) Find the number of trustworthy figure in $(0.491)^3$ assuming that the number 0.491 is correct to last figure.

(b) Explain underflow and overflow conditions of error in floating point addition and subtraction.

(c) State intermediate value property for existence of root in the interval [a, b].

(d) Prove that $\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$, where Δ *and* ∇ are forward and backward difference operators respectively.

(e) Write Simpson's three –eighth and Boole's rules of integration.

(f) Define Chebyshev polynomials. Find the value of $T_2(x)$.

(g) Using least square approximations, write the normal equations for the curve $y = ax + bx^2$.

(h) Evaluate $\Delta\, tan^{-1}x$.

(i) Define type -I and type- II error in statistical hypothesis.

(j) Differentiate between ill conditioned and well conditioned methods.

SECTION-B

2. Attempt any **three** parts of this section: **(10×3=30).**

(a) Find a quadratic factor of the polynomial $x^4 + 5x^3 + 3x^2 - 5x - 9 = 0$ starting with $p_0 = 3, q_0 = -5$ by using Bairstow's method.

(b) Using Gram – Schmidth orthogonalization process, compute the first three orthogonal polynomials $P_0(x)$, $P_1(x)$, $P_2(x)$ which are orthogonal on interval [0, 1] w. r. t. weight function w (x) = 1. Using these polynomials obtain least square approximation of first degree for $f(x) = \sqrt{x}$ on interval [0, 1].

(c) Find the value of integral, using Gauss – Legendre three point integration rule –
$I = \int_2^3 \frac{cos2x}{1+sinx}\, dx.$

(d) The speed v meters per second of a car, t seconds after its start, is given in the following table –

t	0	12	24	36	48	60	72	84	96	108	120
v	0	3.6	10.08	18.9	21.6	18.54	10.26	5.40	4.50	5.40	9.00

Using Simpson's one – third rule find the distance travelled by the car in 2 minutes.

(e) Using Runge – Kutta method of fourth order find $y(0.1)$ *and* $y(0.2)$ correct to four decimal places for

the differential equation
$\frac{dy}{dx} = y - x$, *with initial condition* $y(0) = 2$.

SECTION-C

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

(a) Prove that Newton – Raphson method is quadratic convergent.

(b) Perform two iteration of linear iteration method followed by one iteration of the Aitken's Δ^2 method to find the root of the equation $x = \frac{1}{2} + sinx, \quad take\ x_0 = 1$.

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

(a) Obtain the cubic spline for the following data -

x	0	1	2	3
$f(x)$	2	- 6	- 8	2

under the conditions $M_0 = 0 = M_3$.

(b) Write down the computer algorithms of least square curve fitting.

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

(a) Estimate the integral $I = \int_0^1 e^{-x^2}\, dx$ by using Trapezoidal rule with 10 subintervals. Also, find an error bound.

(b) Obtain the approximate value of $I = \int_{-1}^{1} e^{-x^2} cosx\ dx$ using Labatto integration method for n =2, 3.

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

(a) Solve the following equations by relaxation method –

$9x - y + 2z = 9, \qquad x + 10y - 2z = 15,$
$2x - 2y - 13z = -17.$

(b) For $x = 0.4845\ and\ y = 0.4800$, calculate the value of $\frac{x^2-y^2}{x+y}$ using normalized floating point arithmetic. Compare the value of $(x - y)$. Indicate the error in the former.

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

(a) Given $\frac{dy}{dx} = \frac{1}{2}(1 + x^2)y^2\ \ and\ y(0) = 1$,
$y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21$.
Evaluate by Milne's predictor-corrector method $y(0.4)$.

(b) The theory predicts the proportion of beans in the four groups A, B, C , D should be in the ratio 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?