Printed Pages : 7 **TAS-302**

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

PAPER ID : 9967 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. III) EXAMINATION, 2008-09

COMPUTER BASED NUMERICAL & STATISTICAL TECHNIQUES

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

Note : *(1) Attempt **all** questions.*

*(2) All questions carry **equal** marks.*

1 Attempt any **four** of the following : **5×4**

(a) Let $f(x) = x^{\frac{1}{10}}$ be computed for $0 \le x \le 10$.

If x^* approximate x correct to n significant decimal digits, then to how many significant digits $f(x^*)$ approximate $f(x)$.

(b) Expand $\log(1+x)$ in a Taylor expansion about $x_0 = 1$ through terms of degree 4. Obtain a bound on the truncation error when approximating $\log(1.2)$ using this expansion.

(c) Find the root of the equation $2x = \cos x + 3$ correct to three decimal places by the iteration method.

(d) Show that the equation

$$f(x) = \cos\left(\frac{\pi(x+1)}{8}\right) + 0.148x - 0.9062 = 0$$

has one root in the interval $(-1, 0)$ and one in $(0, 1)$. Calculate the negative root correct to 4 decimals by Newton-Raphson method.

(e) Show that the following sequence has convergence of the second order with same limit $\sqrt{a}$.

$$x_{n+1} = \frac{1}{2} x_n \left(1 + \frac{a}{x_n^2}\right)$$

(f) Find the root of the equation $x^3 - 2x - 5 = 0$ which lies between 2 and 3 by Muller's method.

2 Attempt any **four** of the following : 5×4

(a) Prove the following

$$\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$$

(b) Evaluate from following table $f(3.8)$ to three significant figures, using Gregery-Newton backward interpolation formula :

x :	0	1	2	3	4
$f(x)$:	1.00	1.50	2.20	3.10	4.60

(c) From the following table, find the value of $e^{1.22}$ using Gauss's backward formula :

x :	1.00	1.05	1.10	1.15	1.20	1.25	1.30
e^x :	2.7183	2.8577	3.0042	3.1582	3.3201	3.4903	3.6693

(d) Using Stirling's formula, find $f(1.42)$ from the following table :

x :	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
$f(x)$:	0.84	0.89	0.93	0.96	0.99	1.01	1.02	1.03	1.04

(e) For the following table find $f(x)$ as a polynomial in x using Newton's divided difference formula :

x :	−1	0	3	6	9
$f(x)$:	3	−6	39	822	1611

(f) Using Lagrange's interpolation formula, find $y(10)$ from the following table :

x :	5	6	9	11
y :	12	13	14	16

3 Attempt any **two** of the following : 10×2

(a) Derive the formula

$$y_0' = \left(y_{-2} - 8y_{-1} + 8y_1 - y_2\right)/12\,h$$

For numerical differentiation at mid-point of a table, and indicate the truncation error.

(b) Derive Simpson's 3/8th rule on integration.

Hence, evaluate $\int_0^6 \frac{1}{1+x}\,dx$.

(c) Evaluate the value of the integral

$$\int_{.2}^{1.4} \left(\sin x - \log_e x + e^x\right) dx$$ by

Weddle's rule.

4 Attempt any **two** of the following : 10×2

(a) If $\frac{dy}{dx} = x + y^2$, use Runge-Kutta method of fourth order to find an approximate value of y for $x = 0.2$, given that $y = 1$ when $x = 0$.

(b) Apply predictor-corrector method, find $y(2)$ if $y(x)$ is the solution of $\frac{dy}{dx} = \frac{1}{2}(x+y)$ given $y(0) = 2$, $y(.5) = 2.636$ $y(1) = 3.595$ and $y(1.5) = 4.968$.

(c) Applying Euler's method to the equation

$\frac{dy}{dx} = -y$, given $y(x_0) = y_o$, determine its stability zone ?

5 Attempt any **two** of the following : 10×2

(a) Fit a second degree parabola to the data, taking y as dependent variable :

x :	1929	1930	1931	1932	1933	1934	1935
y :	352	356	357	358	360	361	361

(b) Find the multiple linear regression of X_1 on X_2 and X_3 from the data relating to three variables :

X_1 :	7	12	17	20
X_2 :	4	7	9	12
X_3 :	1	2	5	8

(c) In a manufacturing process, the number of defectives items found in the inspection of 15 lots of 400 items each are given below :

Lot No.	*No. of defective*	*Lot No.*	*No. of defective*
1	2	9	18
2	5	10	8
3	0	11	6
4	14	12	0
5	3	13	3
6	0	14	0
7	1	15	6
8	0		

Determine the trial control limits for np chart and state whether the process is in control.