Printed Pages : 4 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, 2007-08

COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

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

Note : *Attempt **all** questions. All questions carry **equal** marks.*

1 Attempt any four parts of the following : **5×4=20**

(a) State the most common and popular computer arithmetic systems. Discuss with examples that the distributive laws of floating point arithmetic is not always satisfied in numerical computing.

(b) Use the series

$$\log_e\left(\frac{1+x}{1-x}\right) = 2\left(x + \frac{x^3}{3} + \frac{x^5}{5} + \ldots..\right)$$

to compute the value of $\log_e(1.2)$ correct to seven decimal places and find the number of terms retained.

(c) In a triangle ABC, $a = 30\ cm$, $b = 80\ cm$, $\angle B = 90^\circ$. Write a program in 'C' to find the maximum possible error in the computed value of area of ΔABC, if possible errors in a and b are $\frac{1}{3}\%$ and $\frac{1}{4}\%$ respectively.

(d) Develop an iteration formula to find a real root of the equation :

$$10\int_0^x e^{-x^2}\,dx = 1.$$

Find a root of this equation in the interval **(0, 1)**.

(e) Find a real root of the following equation correct to 3 decimal places $\cos x - xe^x = 0$ by Bisection method.

(f) Find a positive value of $\sqrt{13}$ correct to 4 decimal places by Newton-Raphson method.

2 Attempt any four parts of the following :

(a) (1) Prove : $\Delta + \nabla = \Delta / \nabla - \nabla / \Delta$.

(2) Find the missing term in the table :

x :	2	3	4	5	6
$f(x)$:	45.0	49.2	54.1	?	67.4

(b) Find the polynomial interpolating the data :

x :	0	1	2
$f(x)$:	0	5	2

Hence estimate $\max|f(x)|$ in [0, 2] and the value of $\int_0^2 f(x)\,dx$.

(c) State rules to find the suitable formula for interpolating the data.

(d) Using the Newton's divided difference formula find a polynomial which takes the values 3, 12, 15, -21, when x has the values 3, 2, 1, -1, respectively.

(e) For the following data :

x	$f(x)$	$f'(x)$
0.5	4	–16
1	1	–2

find the Hermite interpolating polynomial, fitting the data.

(f) Calculate the value of $f(1.5)$ using Bessel's interpolation formula :

x :	0	1	2	3
$f(x)$:	3	6	12	15

3 Attempt any two parts of the following :

(a) When does the need of numerical differentiation arise ? Given the following data, find $y'(6)$

x :	0	2	3	4	7	8
y :	4	26	58	112	466	922

(b) State the need and scope of numerical integration. Use the trapezoidal rule to estimate the integral

$$\int_0^2 e^{x^2} dx$$

taking the number of intervals 10.

(c) Derive an expression for error estimation in Simpson's one-third rule. Use Boole's five-point formula to compute

$$\int_0^{\pi/2} \sqrt{\sin x}dx.$$

4 Attempt any two parts of the following :

(a) Given the initial value problem :

$$y' = 1 + y^2, \quad y(0) = 0.$$

find $y(0.6)$ by Runge-Kutta method taking $h = 0.2$.

(b) Write a program in 'C' to solve the initial value problem :

$$y' = (x^2 - 1)y^2, \quad y(0) = 2, \quad 0 \le x \le 1$$

by Milne's Predictor-Corrector method.

(c) (1) Discuss the stability of Euler's method applied to the initial-value problem

$$y' = \lambda y, \quad y(0) = 1$$

(2) Consider the initial value problem :

$$y' = 2x + 3y, \quad y(0) = 1$$

Determine the number of terms in the Taylor's series required to obtain results correct to 5×10^{-6} for $x \le 0.4$.

5 Attempt any two parts of the following :

(a) State some important curve-fitting procedures. Obtain the least squares fit of the form

$$f(t) = ae^{-3t} + be^{-2t} \text{ for the data :}$$

t	0.1	0.2	0.3	0.4
$f(t)$	0.76	0.58	0.44	0.35

(b) Discuss regression and its importance. Given the following data :

x :	1	5	3	2	1	1	7	3
y :	6	1	0	0	1	2	1	5

Find a regression line of x on y.

(c) Discuss how control charts can be used in quality control of industrial products. The average percentage of defectives in 27 samples of size 1500 each was found to be 13.7%. Construct a suitable control chart for this problem. Explain how the control chart can be used to control quality.