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

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

B.Tech.

THIRD SEMESTER EXAMINATION, 2006 - 07

COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

Time : 3 Hours *Total Marks : 100*

Note : *(i) Answer ALL questions.*

(ii) All questions carry equal marks.

(iii) In case of numerical problems assume data wherever not provided.

(iv) Be precise in your answer.

1. Attempt *any four* parts of the following : (5x4=20)

(a) Find the relative error, absolute error and percentage error, if $\frac{2}{3}$ is approximated to 0.6667.

(b) The function $f(x) = \tan^{-1} x$ can be expanded as

$$\tan^{-1} x = x - \frac{x^3}{3} + \frac{x^5}{5} - \ldots\ldots + (-1)^{n-1} \frac{x^{2n-1}}{2n-1} + \ldots$$

find n such that the series determine $\tan^{-1} x$ correct to eight significant digits.

(c) Using Regula-Falsi method, compute the smallest positive root of the equation $xe^x - 2 = 0$, correct upto four decimal places.

(d) Use Newton's Raphson method to find the smallest positive root of the equation $\tan x = x$.

(e) Compute the rate of convergence of Newton-Raphson method.

(f) Find the number of real and complex roots of the polynomial equation $x^4 - 4x^3 + 3x^2 + 4x - 4 = 0$ using Sturm sequence.

2. Attempt *any four* parts of the following : (5x4=20)

(a) Compute $f(27)$ from the following data using Lagrange's interpolation formula.

x :	14	17	31	35
$f(x)$:	68.7	64.0	44.0	39.1

(b) Find the polynomial of degree four which takes the following values :

x :	2	4	6	8	10
y :	0	0	1	0	0

(c) Obtain the Newton's divided difference interpolating polynomial and hence find $f(6)$.

x :	3	7	9	10
$f(x)$:	168	120	72	63

(d) Find the value of $\int_0^{\pi/2} \sqrt{1 - 0.162 \sin^2 x}\, dx$ using Simpson's one-third rule taking 6 sub-intervals.

(e) The velocity 'v' of a particle at distance 's' from a point on its linear path is given in the following table :

s (m) :	0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
v (m/sec) :	16	19	21	22	20	17	13	11	9

Estimate the time taken by the particle to traverse the distance of 20 meters, using Boole's rule.

(f) Compute $\int_0^{\pi/2} \sin x \, dx$, using Simpon's thr

eighth rule of integration, taking $h = \frac{\pi}{18}$.

3. Attempt *any two* parts of the following : (10x.

(a) Using Bessel's formula, compute the valu $f(1.95)$ from the following data :

x :	1.7	1.8	1.9	2.0	2.1	2.2	[illegible]
$f(x)$:	2.979	3.144	3.283	3.391	3.463	3.997	4.

(b) If $y(10) = 35.3$, $y(15) = 32.4$, $y(20) = 2$ $y(25) = 26.1$, $y(30) = 23.2$ and $y(35) = 20.5$, fi y(12) using Newton's forward as well backward interpolation formula. Also expl why the difference (if any) in the result occur.

(c) Find the values of $f''(5)$ and $f''(0.5)$ from t following table :

x :	0	1	2	3	4	5
$f(x)$:	4930	5026	5122	5217	5312	5407

4. Attempt *any two* parts of the following : (10x2

(a) Find the value of $y(1.1)$, using Runge-Ku method of fourth order, given that

$$\frac{dy}{dx} = y^2 + xy, y(1) = 1.0, \text{take } h = 0.05$$

(b) Given that $\frac{dy}{dx} = 1 + y^2$; $y(0.6) = 0.684$ $y(0.4) = 0.4228$, $y(0.2) = 0.2027$, $y(0) = 0$. Fi $y(-0.2)$, using Milne's predictor-correct method.

(c) Find $y(0.1)$, using improved Euler's method and then $y(0.2)$ by using modified Euler's method, given that

$$\frac{dy}{dx} = \log(x+y),\ y(0) = 1.0$$

5. Attempt *any two* parts of the following : (10x2=20)

(a) Obtain cubic spline for every subinterval, given in the tabular form :

x :	0	1	2	3
$f(x)$:	1	2	33	244

with the end conditions $M_0 = 0 = M_3$.

(b) Two variables x and y have zero means, the same variance σ^2 and zero correlation, show that :

$u = (x \cos \alpha + y \sin \alpha)$ and

$v = (x \cos \alpha - y \sin \alpha)$

have the same variance σ^2 and zero correlation.

(c) The data below given the number of defective bearing in samples of size 150. Construct np-chart for these data. If any points lie outside the control limits, assume that assignable cause can be found and determine the revised control limits :

Sample no. :	1	2	3	4	5	6	7	8	9	10
No. of defectives :	12	7	5	4	1	5	9	0	15	6

Sample no. :	11	12	13	14	15	16	17	18	19	20
No. of defectives :	7	4	1	3	6	8	10	5	2	7

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