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

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

B.Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2010-11

COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

Time : 3 Hours *Total Marks : 100*

Note : Attempt **ALL** questions.

1. Attempt any **four** parts of the following :— **(5×4=20)**

(a) Find the absolute, relative and percentage errors if x is rounded-off to three decimal digits where x = 0·005998.

(b) Determine the number of terms of the exponential series

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots + \frac{x^n}{n!} + \ldots$$

such that their sum gives the value of e^x correct to six decimal places for $0 \le x \le 1$.

(c) Use Bisection method to obtain the smallest positive root of the equation $x^3 - 5x + 1 = 0$. Perform five iterations.

(d) Find the real root of the equation $2x - \log_{10} x = 7$ correct to four decimal places, using Newton-Raphson method.

(e) Find a real root of the equation $x^3 + x - 1 = 0$ using iteration 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 :— (5×4=20)

(a) Find the missing terms of the following data :

x	1·0	1·5	2·0	2·5	3·0	3·5	4·0
f(x)	6	—	10	20	—	15	5

(b) Use Newton-Gregory formula to compute y at x = 24 from the following data :

x	21	25	29	33	37
y	18·4	17·8	17·1	16·3	15·5

(c) Prove that

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

where symbols have their usual meaning for finite difference.

(d) Use Stirling formula to find y_{35}, given

$y_{20} = 512$, $y_{30} = 439$, $y_{40} = 346$ and $y_{50} = 243$.

(e) Use Lagrange's interpolation formula to compute f(5·5) from the following data :

x	0	1	4	5	6
f(x)	1	14	15	6	3

(f) The function $y = f(x)$ is given at the points (7, 3), (8, 1), (9, 1) and (10, 9). Find the value of y for $x = 9{\cdot}5$ using Newton's divided difference formula.

3. Attempt any **two** parts of the following :— **(10×2=20)**

(a) A rod is rotating in a plane. The following table gives the angle θ (radians) through which the rod has turned for various values of the time 't' (seconds) :

t	0	0·2	0·4	0·6	0·8	1·0	1·2
θ	0	0·12	0·49	1·12	2·02	3·20	4·67

Calculate the angular velocity and acceleration of the rod when $t = 0{\cdot}6$ sec.

(b) Derive the formula for Simpson's $\frac{1}{3}$ rule. The velocity v of a particle at distance s from a point on its path is given by the table below :

s (meter)	0	10	20	30	40	50	60
v (m/sec)	47	58	64	65	61	52	38

Estimate the time taken to travel 60 meters.

(c) Evaluate $\int_4^{5{\cdot}2} \ell nx\, dx$ by Simpson's $\frac{3}{8}$ rule and Weddle's rule.

4. Attempt any **two** parts of the the following :— **(10×2=20)**

(a) (i) Solve

$$\frac{dy}{dx} = x + y^2, \quad y(0) = 0$$

to get $y(0{\cdot}2)$ by Taylor's series method.

(ii) If $\frac{dy}{dx} = 1 + y^2$, $y(0) = 1$, find $y(0{\cdot}4)$ by using Euler's method. Take $h = 0{\cdot}2$.

(b) Use Runge-Kutta method of fourth order to solve the following differential equation in the interval [0, 0, 4] :

$$\frac{dy}{dx} = \frac{y + x}{y - x}, \quad y(0) = 1.$$

Take $h = 0{\cdot}2$.

(c) Given that $\frac{dy}{dx} = 1 + y^2$; and

$y(0{\cdot}6) = 0{\cdot}6841$, $y(0{\cdot}4) = 0{\cdot}4228$;

$y(0{\cdot}2) = 0{\cdot}2027$, $y(0) = 0$.

Find $y(-0{\cdot}2)$ using Milne's predictor-corrector method.

5. Attempt any **two** parts of the following :— **(10×2=20)**

(a) Find the two regression lines from the following data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

Also, estimate the value of y when $x = 6{\cdot}5$.

(b) In a trivariate distribution, the following data have been obtained :

X_1	1	2	3	4
X_2	0	1	2	3
X_3	12	18	24	30

Find :

(i) The regression equation of X_3 on X_1 and X_2.

(ii) Estimate X_3 when $X_1 = 3{\cdot}5$ and $X_2 = 1{\cdot}5$.

(c) In a blade manufacturing factory 1000 blades are examined daily. Following information shows number of defective blades obtained there. Draw the np-chart and give your findings :

Date	No. of defective blades
1	9
2	10
3	12
4	8
5	7
6	15
7	10
8	12
9	10
10	8
11	7
12	13
13	14
14	15
15	16