

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

PAPER ID : 9967

Roll No.

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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

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

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

(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

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

(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 $x = 9.5$ 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 $t = 0.6$ 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 $\int_4^{5.2} \ln x \, dx$ 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 $y(0.2)$ by Taylor's series method.

- (ii) If $\frac{dy}{dx} = 1 + y^2$, $y(0) = 1$, find $y(0.4)$ by using Euler's method. Take $h = 0.2$.

- (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 $h = 0.2$.

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

$$y(0.6) = 0.6841, \quad y(0.4) = 0.4228,$$

$$y(0.2) = 0.2027, \quad y(0) = 0.$$

Find $y(-0.2)$ 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 $x = 6.5$.

- (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 $X_1 = 3.5$ and $X_2 = 1.5$.
- (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