B) Numerical Analysis (821104)

me : Two Hours **Max. Marks : 60**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory.
5. Figures to the right indicate full marks.
6. Use of scientific calculator is allowed.

1. a) Attempt **any six** of the following. **6**

i) The root of the equation $x^2+2x-1=0$ lies between.

a) 0 and 1 b) 1 and 2

c) 2 and 3 d) 3 and 4

ii) If y is exact value and y_1 is approximate value then relative error is

a) $|y-y_1|$ b) $\frac{|y-y_1|}{y}$

c) $\frac{|y-y_1|}{y_1}$ d) $\frac{|y-y_1|}{y}\times 100$

iii) With usual notations $E-1=$

a) Δ b) ∇

c) δ d) μ

iv) If $y_1=10, y_2=13$ and $y_3=20$ then $\nabla y_2=----$

a) 10 b) 7

c) 3 d) 2

v) In least square method one of the normal equation to fit a parabola $y=a+bx+cx^2$ is $\sum_{i=1}^{n} x_i y_i=----$

a) $na+b\sum_{i=1}^{n} x_i$ b) $na+b\sum_{i=1}^{n} x_i+c\sum_{i=1}^{n} x_i^2$

c) $a\sum_{i=1}^{n} x_i+b\sum_{i=1}^{n} x_i^2+c\sum_{i=1}^{n} x_i^3$ d) $a\sum_{i=1}^{n} x_i^2+b\sum_{i=1}^{n} x_i^3+c\sum_{i=1}^{n} x_i^4$

vi) From the following table.

x	0	1	3	6
y	3	5	9	15

$\sum_{i=1}^{n} x_i y_i = ----$

a) 10

b) 29

c) 46

d) 122

vii) Euler's formula to solve the differential equation $\frac{dy}{dx} = f(x, y)$ with $y(x_0) = y_0$ is $y_{n+1} = ---$

a) $y_n - hf(x_n\ y_n)$

b) $y_n - hf^1(x_n\ y_n)$

c) $y_0 - hf(x_n y_n)$

d) $y_0 - hf^1(x_n y_n)$

viii) In Runge Kutta second order formula, $k_2 = ---$

a) $hf(x_0 + h,\ y_0 + k)$

b) $hf(x_0 + h,\ y_0 + k_1)$

c) $hf(x_0 + h_1\ y_0 + k_1)$

d) $-hf(x_0 + h\ \ y_0 + k_1)$

b) Attempt **any six** of the following. 6

i) Round of the no. 7.835465 to three decimal places.

ii) If approximate value of $\sqrt{2}$ is 1.4140 and it's true value 1.4142 then find absolute error.

iii) Write any one transcendental equation.

iv) Define the mean operator μ.

v) State Gauss's Backward central difference formula.

vi) Write any one normal equation to fit the straight line $y = a + bx$ using least square method.

vii) Write the Taylor's series expansion of y(x) in the neighbor hood of $(x_0\ y_0)$.

viii) If $\frac{dy}{dx} = y - x^2$ with $y(0) = 1$ then with usual notation find value of k_1.

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2. Attempt **any six** of the following.

i) Find sum of the numbers 14.075, 2.81, 3.141 where each of all digits are correct & Estimate the absolute error in the sum.

ii) Find absolute and relative error in counting the no. 12.02.

iii) To solve the equation $\cos x - 2x + 3 = 0$ check whether iteration method is applicable or not

iv) Compute $\Delta^2 e^x$

v) Show that

a) $\Delta = \nabla E$ b) $\delta E^{-\frac{1}{2}} = \nabla$

vi) For given data construct the forward difference table.

x	1	2	3	4
y	15	12	5	3

vii) Find the normal equations of the line $y = a + bx$ from the following data.

x	0	1	3	6
y	3	5	9	15

viii) In Runge Kutta method of fourth order write the values of k_1, k_2 k_3 and k_4

ix) Write the formula for Euler's modified method.

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3. Attempt **any four** of the following.

i) Explain the bisection method to find the root of the equation $f(x) = 0$

ii) Find real root of the equation $\cos x = 3x - 1$ by iteration method.

iii) Find root of the equation $x^3 - 2x - 5 = 0$ by using method of false position.

iv) Obtain the Newton Rapson formula for square root of N.

v) Find y(5) by Lagranges interpolation formula given that y(2) = -1 y(4) = 3 y(7) = 20 and y(10) = 106

vi) Fit the curve $y = a + bx + cx^2$ to the following data.

x	0	1	2	3
y	2	5	8	11

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4. Attempt **any three** of the following. 12

i) Explain the method of least squares for fitting the straight line $y = a + bx$

ii) Using Euler's method compute y(0.4) for the differential equation $\frac{dy}{dx} = y^2 - x^2$ with y(0) = 1 take h = 0.1

iii) Fit the curve of the type $y = ae^{bx}$ from the following data.

x	1	2	3	4	5
y	20	40	60	80	100

iv) Obtain the Taylors series for y(x) given that $\frac{dy}{dx} = 1 + y^2$ in the neighborhood of origin (0 0) and compute y(0.2) correct upto three decimal places.

5. Attempt **any two** of the following. 12

i) From the following table find value of f(0.274) by Gauss forward formula.

x	0.25	0.26	0.27	0.28	0.29	0.30
f(x)	4.000	3.846	3.704	3.571	3.448	3.333

ii) Using Euler's modified method compute y(0.2) given that $\frac{dy}{dx} = \log_{10}(x + y)$ with y(0) = 1 take h = 0.2.

iii) Applying Runge Kutta fourth order method obtain y(0.1) where $\frac{dy}{dx} = xy^{1/3}$ with y(1) = 1 take h = 0.1

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