IAS
PREVIOUS YEARS QUESTIONS (2019-1989)
SEGMENT-WISE

NUMERICAL ANALYSIS

2019

- Apply Newton-Raphson method, to find a real root of transcendental equation $x \log_{10} x = 1.2$, correct to three decimal places. **[10]**
- Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2$. Use four decimal places for calculation and step length 0.2. **[10]**
- Draw the flow chart and write a basic algorithm (in FORTRAN/C/C^{++}) for evaluating $y = \int_0^6 \frac{dx}{1+x^2}$ using Trapezoidal rule. **[10]**
- Apply Gauss-Seidel iteration method to solve the following system of equations :

  $2x + y - 2z = 17$
  $3x + 20y - z = -18$
  $2x - 3y + 20z = 25$
  Correct to three decimal places. **[15]**

2018

- Using Newton's forward difference formula find the lowest degree polynomial u_x when it is given that $u_1 = 1$, $u_2 = 9$, $u_3 = 25$, $u_4 = 55$ and $u_5 = 105$. **(10)**
-

Time (Minutes)	2	4	6	8	10	12	14	16	18	20
Speed (km/h)	10	18	25	29	32	20	11	5	2	8.5

  Starting from rest in the beginning, the speed (in Km/h) of a train at different times (in minutes) is given by the above table:
  Using Simpson's $\frac{1}{3}$rd rule, find the approximate distance travelled (in Km) in 20 minutes from the beginning. **(10)**
- Find the values of the constants a,b,c such that the quadrature formula

  $$\int_0^h f(x)dx = h\left[af(o) + bf\left(\frac{h}{3}\right) + cf(h)\right]$$

  is exact for polynomials of as high degree as possible, and hence find the order of the truncation error. **(15)**

2017

- Explain the main steps of the Gauss-Jordan method and apply this method to find the inverse of the matrix

  $$\begin{bmatrix} 2 & 6 & 6 \\ 2 & 8 & 6 \\ 2 & 6 & 8 \end{bmatrix}.$$ **(10)**
- For given equidistant values u_{-1}, u_0, u_1 and u_2, a value is interpolated by Lagrange's formula. Show that it may be written in the form

  $$u_x = yu_0 + xu_1 + \frac{y(y^2-1)}{3!}\Delta^2 u_{-1} + \frac{x(x^2-1)}{3!}\Delta^2 u_0,$$

  where $x + y = 1$. **(10)**
- Derive the formula

  $$\int_a^b ydx = \frac{3h}{8}\left[(y_0+y_n)+3(y_1 + y_2 + y_4 + y_5 + \dots + y_{n-1}) + 2(y_3+y_6+ \dots + y_{n-3})\right].$$

  Is there any restriction on n ? State that condition. What is the error bound in the case of Simpson's $\frac{3}{8}$ rule ? **(20)**

2016

- Let $f(x) = e^{2x} \cos 3x$, for $x \in [0,1]$. Estimate the value of $f(0.5)$ using lagrange interpolating polynomial of degree 3 over the nodes $x = 0$, $x = 0.3$, $x = 0.6$ and $x = 1$. Also, compute the error bound over the interval [0, 1] and the actual error $E(0.5)$. **(20)**
- For an integral $\int_{-1}^{1} f(x)dx$, show that the two-point Gauss quadrature rule is given by

$\int_{-1}^{1} f(x)dx = f\left(\frac{1}{\sqrt{3}}\right) + f\left(-\frac{1}{\sqrt{3}}\right)$. Using this rule,

estimate $\int_{2}^{4} 2xe^{x}\,dx$. **(15)**

2015

❖ Find the Lagrange interpolating polynomial that fits the following data:

x	:	-1	2	3	4
$f(x)$	:	-1	11	31	69

Find f(1.5). **(20)**

❖ Solve the initial value problem

$\frac{dy}{dx} = x(y-x), y(2) = 3$ in the interval [2,2·4] using the Runge-Kutta fourth-order method with step size h=0.2. **(15)**

❖ Find the solution of the system

$10x_1 - 2x_2 - x_3 - x_4 = 3$
$-2x_1 + 10x_2 - x_3 - x_4 = 15$
$-x_1 - x_2 + 10x_3 - 2x_4 = 27$
$-x_1 - x_2 - 2x_3 + 10x_4 = -9$

using Gauss-Seidel method (make four iterations). **(15)**

2014

❖ Apply Newton-Raphson method to determine a root of the equation $\cos x - xe^{x} = 0$ correct up to four decimal places. **(10)**

❖ Use five subintervals to integrate $\int_0^1 \frac{dx}{1+x^2}$ using trapezoidal rule. **(10)**

❖ Solve the system of equations

$2x_1 - x_2 = 7$
$-x_1 + 2x_2 - x_3 = 1$
$-x_2 + 2x_3 = 1$

Using Gauss - Seidel iteration method (perform three iterations) **(15)**

❖ Use Runge-Kutta formula of fourth order to find the value of y at x=0.8,

where $\frac{dy}{dx} = \sqrt{x+y}, y(0.4) = 0.41.$

Take the step length $h = 0.2$. **(20)**

2013

❖ In an examination, the number of students who obtained marks between certain limits were given in the following table:

Marks	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of Students	31	42	51	35	31

Using Newton forward interpolation formula , find the number of students whose marks lie between 45 and 50. **(10)**

❖ Use Euler's method with step size h=0.15 to compute the approximate value of y(0.6), correct up to five decimal places from the initial value problem

$y' = x(y+x) - 2$

$y(0) = 2$ **(15)**

❖ The velocity of a train which starts from rest is given in the following table. The time is in minutes and velocity is in km/hour.

t	2	4	6	8	10	12	14	16	18	20
v	16	28.8	40	46.4	51.2	32.0	17.6	8	3.2	0

Estimate approximately the total distance run in 30 minutes by using composite Simpson's $\frac{1}{3}$ rule. **(15)**

2012

❖ Use Newton-Raphson method to find the real root of the equation $3x = \cos x + 1$ correct to four decimal places. **(12)**

❖ Provide a computer algorithm to solve an ordinary differential equation $\frac{dy}{dx} = f(x, y)$ in the intervl [a, b] for n number of discrete points, where the initial value is $y(a) = \alpha$, using Euler's method. **(12)**

❖ Solve the following system of simultaneous equations, using Gauss-Seidel iterative method:

$3x + 20y - z = -18$

$20x + y - 2z = 17$

$2x - 3y + 20z = 25.$ **(20)**

❖ Find $\frac{dy}{dx}$ at $x = 0.1$ from the following data:

x :	0.1	0.2	0.3	0.4
y :	0.9975	0.9900	0.9776	0.9604

(20)

2011

- Calculate $\int_{2}^{10}\frac{dx}{1+x}$ (upto 3 places of decimal) by dividing the range into 8 equal parts by Simpson's $\frac{1}{3}rd$ Rule. **(12)**
- A solid of revolution is formed by rotating about the x-axis, the area between the x-axis, the line x=0 and x=1 and curve through the points with the following co-ordinates:

x	.00	.25	.50	.75	1
y	1	.9896	.9589	.9089	.8415

Find the volume of the solid. **(20)**

2010

- Find the positive root of the equation $10xe^{-x^2}-1=0$ correct up to 6 decimal places by using Newton – Raphson method. Carry out computations only for three iterations. **(12)**
- Given the system of equations
  2x+3y=1
  2x+4y+z=2
  2y+6z+Aw=4
  4z+Bw=C
  State the solvability and uniqueness conditions for the system. Give the solution when it exists. **(20)**
- Find the value of the integral $\int_{1}^{5}\log_{10} x\,dx$ by using Simpson's $\frac{1}{3}$ - rule correct up to 4 decimal places. Take 8 subintervals in your computation. **(20)**

2009

- The equation $x^2+ax+b=0$ has two real roots α and β. Show that the iterative method given by: $x_{k+1}=-(a\,x_k+b)/x_k$, $k=0,1,2....$ is convergent near $x=\alpha$, if $|\alpha|>|\beta|$. **(6)**
- Using Lagrange interpolation formula , calculate the value of f(3) from the following table of values of x and f(x) :

X	0	1	2	4	5	6
F(x)	1	14	15	5	6	19

(15)

- Find the value of y(1.2) using Runge- kutta fourth order method with step size h=0.2 from the initial value problem:
  $y'=xy$
  $y(1)=2$ **(15)**

2008

- Find the smallest positive root of equation $Xe^{x}-\cos x=0$ using Regula Falsi method. Do three iterations. **(12)**
- The following values of the function f(x)=sin x+cos x are given :

X	10°	20°	30°
f (x)	1.1585	1.2817	1.3360

Construct the quadratic interpolating polynomial that fits the data. Hence calculate .compare with exact value. **(15)**

- Apply Gauss – Seidel method to calculate x,y,z from the system :
  -x-y+6z=42
  6x-y-z=11.33
  -x+6y-z=32
  with initial values (4.67, 7.62, 9.05).
  Carry out computations for two iterations. **(15)**

2007

- Use the method of false position to find a real root of $x^3-5x-7=0$ lying between 2 and 3 and correct to 3 places of decimals. **(12)**
- Find from the following table , the area bounded by the *x*-axis and the curve $y=f(x)$ between x=5.34 and x=5.40 using the Trapezoidal rule. **(15)**

X	5.34	5.35	5.36	5.37	5.38	5.39	5.40
$f(x)$	1.82	1.85	1.86	1.90	1.95	1.97	2.00

- Apply the second order Runge – Kutta method to find an approximate value of y at x=0.2 taking h=0.1 , given that y satisfies the differential equation and the initial condition
  $y'=x+y$, $y(0)=1$ **(15)**

2006

- Evaluate $I=\int_0^1 e^{-x^2}dx$ by the Simpson's rule

$$\int_a^b f(x)dx \approx \frac{\Delta x}{3}\left[f(x_0)+4f(x_1)+2f(x_2)+4f(x_3)+\cdots\cdots+2f(x_{2n-2})+4f(x_{2n-1})+f(x_{2n})\right]$$

with $2n=10,\ \Delta x=0.1,\ X_0=0,\ X_1=0.1,......,X_{10}=1.0$ **(12)**

- If Q is a polynomial with simple roots and if P is a polynomial of degree <n , show that . Hence prove that there exists a unique polynomial of degree <n with given values at the point , k=1,2….n.**(30)**

2005

- Use appropriate quadrature formula out of the Trapezoidal and Simpson's rules to numerically integrate $\int_0^1 \frac{dx}{1+x^2}$ with h=0.2.Hence obtain an approximate value of π. Justify the use of a particular quadrature formula. **(12)**
- Find the unique polynomial P(x) of degree 2 or less such that P (1) =1 ,P(3)=27 , P(4)=64 . Using Lagrange interpolation formula and the Newton's divided difference formula , evaluate P(1.5). **(30)**

2004

- The velocity of a particle at distance S from a point on its path is given by the following table:

S (meters)	V (m/sec)
0	47
10	58
20	64
30	65
40	61
50	52
60	38

Estimate the time taken to travel the first 60 meters using Simpson's 1/3 rule. Compare the result with Simpson's 3/8 rule. **(12)**

- How many positive and negative roots of the equation $e^x - 5\sin x = 0$ exist? Find the smallest positive root correct to 3 decimals. Using Newton – Raphson method. **(15)**
- Using Gauss-Siedel iterative method, find the solution of the following system.
4x-y+8z=26, 5x+2y-z=6, x - 10y + 2z = -13 upto three iterations. **(15)**

2003

- Evaluate $\int_0^1 e^{-x^2}dx$; employing three point Gaussian quadrature formula , finding the required weights and residues. Use five decimal places for computation. **(12)**
- Find the positive root of the equation $2e^{-x}=\frac{1}{x+2}+\frac{1}{x+1}$ using Newton – Raphson method correct to four decimal places. Also show that the following scheme has error of second order $x_{n+1}=\frac{1}{2}x_n\left(1+\frac{a}{x_n^2}\right)$. **(30)**

2002

- Find the real root of the equation
$f(x)=x^3-2x-5=0$
by the method of false position. **(12)**
- Given $\frac{dy}{dx}=y-x$ where y (0)=2, using the Runge – Kutta fourth order method , find y (0,1) and y (0,2). Compare the approximate solution with its exact solution $(e^{0.1}=1.10517, e^{0.2}=1.2214)$ **(20)**

2001

- Show that the truncation error associated with linear interpolation of f(x), using ordinates at $x_0\ and\ x_1\ with\ x_0\ "\ x"\ x_1$ is not larger in magnitude than $\frac{1}{8}M_2(x_1-x_0)^2$
where $M_2=\max|f''(x)|$ in $x_0\ "\ x"\ x_1$. Hence show that if $f(x)=\frac{2}{\sqrt{\pi}}\int_0^x e^{-t^2}dt$ the truncation error corresponding to linear interpolation of $f(x)\ in\ x_0\ "\ x"\ x_1$ cannot exceed $\frac{(x_1-x_0)^2}{2\sqrt{2\pi e}}$. **(12)**

- Using Gauss Seidel iterative method and the starting solution $x_1 = x_2 = x_3 = 0$, determine the solution of the following system of equations in two iterations $10x_1 - x_2 - x_3 = 8$, $x_1 + 10x_2 + x_3 = 12$, $x_1 - x_2 + 10x_3 = 10$ compare the approximate solution with the exact solution. **(30)**

2000

- (i) Using Newton – Raphson's method, show that the iteration formula for finding the reciprocal of the p^{th} root of N is

  $$x_{i+1} = \frac{x_i(p+1-Nx_i^p)}{p}.$$

  (ii) Prove that Demorgans Theorem $(p+q)' = p'.q'$ by means of a truth table. **(12)**

- (i) Evaluate $\int_0^1 \frac{dx}{1+x^2}$, by subdividing the interval (0,1) into 6 equal parts and using Simpson's 1/3 rule. Hence find the value of π and actual error, correct to five places of decimals.

  (ii) Solve the following system of linear equations using Gauss elimination method

  $$x_1 + 6x_2 + 3x_3 = 6$$
  $$2x_1 + 3x_2 + 3x_3 = 117$$
  $$4x_1 + x_2 + 2x_3 = 283$$ **(30)**

1999

- Obtain the Simpson's rule for the integral $I = \int_a^b f(x)dx$ and show that this rule is exact for polynomials of degree $n \le 3$. In general show that the error of approximation for Simpson's rule is given by $R = -\frac{(b-a)^5}{2880} f^{iv}(\eta), \eta \in (0,2)$. Apply this rule to the integral $\int_0^1 \frac{dx}{1+x}$ and show that $|R|'' \ 0.008333$.

- Using fourth order classical Runge- Kutta method for the initial value problem. $\frac{du}{dt} = -2tu^2, u(0) = 1$ with h=0.2 on the interval [0, 1], calculate u (0.4) correct to six places of decimal.

1998

- Evaluate $\int_1^3 \frac{dx}{x}$ by Simpson's rule with 4 strips. Determine the error by direct integration.

- By the fourth order Runge–Kutta method tabulate the solution of the differential equation $\frac{dy}{dx} = \frac{xy+1}{10y^2+4}, y(0) = 0$ in [0, 0.4] with step length 0.1 correct to five places of decimals.

- Use Regula – Falsi method to show that the real root of $x\log_{10} x - 1.2 = 0$ lies between 3 & 2.740646.

1997

- Apply the fourth order Runge – Kutta method to find a value of y correct to four places of decimals at x =0.2 when

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

- Show that the iteration formula for finding the reciprocal of N is

  $X_{n+1} = X_n(2 - NX_n)$, $n = 0,1......$

1996

- Describe Newton – Raphson method for finding the solutions of the equation f (x) = 0 and show that the method has a quadratic convergence.

- The following are the measurements t made on a curve recorded by the oscillograph representing a change of current i due to a change in the conditions of an electric current.

t:	1.2	2.0	2.5	3.0
i:	1.36	0.58	0.34	0.20

  Applying appropriate formula interpolate for the value of i when t =1.6

- Solve the system of differential equations $\frac{dy}{dx} = xz + 1, \frac{dz}{dx} = -xy$ for x=0.3 given that y=0 and z = 1 when x=0, using Runge Kutta method of order four.

1995

- Find the positive root of $\log_e x = \cos x$ nearest to five places of decimal by Newton – Raphson method.

- Find the value of $\int_{1.6}^{3.4} f(x)dx$ from the following data using Simpson's 3/8th rule for the interval (1.6, 2.2) & 1/3rd rule for (2.2 , 3.4)

X:	1.6	1.8	2.0	2.2	2.4
F(x):	4.953	6.050	7.389	9.025	11.023
X:	2.6	2.8	3.0	3.2	3.4
F(x):	13.464	16.445	20.086	24.533	29.964

- For the differential equation $\frac{dy}{dx} = y - x^2, y(0) = 1$ starting values are given as; y (0.2) =1.2186, y (0.4) =1.4682 and y (0.6) =1.7379
Using Milne's predictor corrector method advance the solution to x=0.8 and compare it with the analytical solution. (Carry four decimals)

1994

- Find the positive root of the equation
$$e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} e^{0.3x}$$
correct to five decimal places. **(20)**
- Find the derivative of f (x) at x= 0.4 from the following table.

x	0.1	0.2	0.3	0.4
Y= $f(x)$	1.10517	1.22140	1.34986	1.49182

(20)

1993

- Find correct to 3 decimal places the two positive roots of $2e^x - 3x^2 = 2.5644$ **(20)**
- Evaluate approximately $\int_{-3}^{3} x^4 dx$ by Simpson's rule by taking seven equidistant ordinates. Compare it with the value obtained by using the trapezoidal rule and with exact value. **(20)**
- Solve $\frac{dy}{dx} = xy$ for x =1.4 by Runge – Kutta method, initially x = 1 , y = 2 (Take h = 0.2) **(20)**

1992

- Compute to 4 decimal places by using Newton – Raphson method , the real root of $x^2 + 4\sin x = 0$ **(20)**
- Solve by Runge – Kutta method $\frac{dy}{dx} = x + y$ with initial conditions $x_0 = 0, y_0 = 1$ correct to up to 4 decimal places by evaluating up to second increment of y. [Take h=0.1] **(20)**

1991

- Using Regula Falsi method, find the real root of the equation $x\log_{10} x - 1.2 = 0$ correct to 5 decimal places. **(20)**
- Apply Lagrange's formula to find a root of the equation f(x) =0 given that f (30) = -30, f (34) =-13, f(38) = 3 and f (42) =18. **(20)**

1990

- Using Runge -kutta method with third order accuracy, solve $\frac{dy}{dx} = y - x$ with initial condition y=2, x=0 **(20)**
- Solve $x^2 - 5x + 3 = 0$ in the interval [1, 2] by the secant method. ***(20)***

1989

- The polynomial $x^3 - x - 1$ has a root between 1 and 2. Using the secant method, find this root correct to three significant figures.
- The integral is defined by
$$K(k) = \int_0^{\frac{\pi}{2}} \frac{dx}{(1 - \sin^2 k \sin^2 x)^{\frac{1}{2}}} .$$
Given that K(1)=1.5709, K(4)=1.5727 and K(6)=1.5751 find K(3.5) using a second degree interpolating polynomial.
- Use Runge Kutta method to solve
$$10\frac{dy}{dx} = x^2 + y^2, y(0) = 1$$
for the interval $0 < x \le 0.4$ with h=0.1.

❖❖❖

IAS
PREVIOUS YEARS QUESTIONS (2019-2001)
SEGMENT-WISE

COMPUTER PROGRAMMING

2019

- Find the equivalent numbers given in a specified number to the system mentioned against them :
  - (i) Integer 524 in binary system.
  - (ii) 101 010110101 • 101 1010 11 to octal system.
  - (iii) Decimal number 5280 to hexadecimal system.
  - (iv) Find the unknown number $(1101.101)_8 \to (?)_{10}$ **[15]**
- Given the Boolean expression

  $X = AB + ABC + A\bar{B}\bar{C} + A\bar{C}$
  - (i) Draw the logical diagram for the expression.
  - (ii) Minimize the expression
  - (iii) Draw the logical diagram for the reduced expression. **[15]**

2018

- Write down the basic algorithm for solving the equation: $xe^x-1=0$ by bisection method, correct to 4 decimal places. **(10)**
- Find the equivalent of numbers given in a specified number system to the system mentioned against them.
  - (i) $(111011\cdot101)_2$ to decimal system
  - (ii) $(1000111110000\cdot00101100)_2$ to hexadecimal system
  - (iii) $(C4F2)_{16}$ to decimal system
  - (iv) $(418)_{10}$ to binary system **(15)**
- Simplify the boolean expression:

  $(a+b)\cdot(\bar{b}+c)+b\cdot(\bar{a}+\bar{c})$ by using the laws of boolean algebra. From its truth table write it in minterm normal form. **(15)**

2017

- Write the Boolean expression z(y+z) (x+y+z) in its simplest form using Boolean postulate rules. Mention the rules used during simplification. Verify your result by constructing the truth table for the given expression and for its simplest form. **(10)**
- Write an algorithm in the form of a flow chart for Newton-Raphson method. Describe the cases of failure of this method. **(15)**

2016

- Convert the following decimal numbers to equivalent binary and hexadecimal numbers :
  - (i) 4096
  - (ii) 0.4375
  - (iii) 2048.0625 **(10)**
- Let A, B, C be Boolean variables, $\bar{A}$ denote complement of A, A + B is an expression for A OR B and A . B is an expression for A AND B. Then simplify the following expression and draw a block diagram of the simplified expression, using AND and OR gates.

  $A.(A+B+C).(\bar{A}+B+C).$

  $(A+\bar{B}+C).(A+B+\bar{C}).$ **(15)**

2015

- Find the Principal (or canonical)disjunctive normal form in three variables p,q,r for the Boolean expression $((p\wedge q)\to r)\vee((p\wedge q)\to -r)$. Is the Boolean expression a contradiction or a tautology? **(10)**

2014

- Use only AND and OR logic gates to construct a logic circuit for the Boolean expression $z = xy + uv$. **(10)**
- Draw a flowchart for Simpson's one-third rule. **(15)**
- For any Boolean variables x and y, show that $x + xy = x$. **(15)**

2013

- Develop an algorithm for Newton – Rephson method to solve $f(x)=0$ starting with initial iterate x_0, n be the number of iterations allowed, eps be the prescribed relative error and delta be the prescribed lower bound for $f'(x)$. **(20)**

2012

❖ In a certain examination, a candidate has to appear for one major and two minor subjects. The rules for declaration of results are: marks for major are denoted by M_1 and for minors by M_2 and M_3. If the candidate obtains 75% and above marks in each of the three subjects, the candidate is declared to have passed the examination in first class with distinction. If the candidate obtains 60% and above marks in each of the three subjects, the candidate is declared to have passed the examination in first class. If the candidate obtains 50% or above in major, 40% or above in each of the two minors and an average of 50% or above in all the three subjects put together, the candidate is declared to have passed the examination in second class. All those candidates, who have obtained 50% and above in major and 40% or above in minor, are declared to have passed the examination. If the candidate obtains less than 50% in major or less than 40% in any one of the two minors, the candidate is declared to have failed in the examinations. Draw a flow chart to declare the results for the above. **(20)**

2011

❖ Compute $(3205)_{10}$ to base 8.

Let A be an arbitrary but fixed Boolean algebra with operations $\wedge, \vee$ *and* $'$ and the zero and the unit element denoted by 0 and 1 respectively. Let x,y,z,....... be elements of A.

If $x, y \in A$ be such that $x \wedge y = 0$ *and* $x \vee y = 1$ then prove that $y = x'$. **(12)**

❖ Find the logic circuit that represents the following Boolean function.Find also an equivalent simpler circuit:

x	*y*	*z*	*f(x,y,z)*
1	1	1	1
1	1	0	0
1	0	1	0
1	0	0	0
0	1	1	1
0	1	0	0
0	0	1	0
0	0	0	0

Draw a flow chart for Lagarange's interpolation formula. **(20)**

2010

❖ (i) Suppose a computer spend 60 per cent of its time handling a particular type of computation when running a given program and its manufactures make a change that improves its performance on that type of computation by a factor of 10. If the program takes 100 sec to execute, What will its execution time be after the change?

(ii) If $A \oplus B = AB' + A'B$, Find the value of $x \oplus y \oplus z$. **(12)**

❖ (i) Find the hexadecimal equivalent of the decimal number $(587632)_{10}$.

(ii) For the given set of data points $(x_1, f(x_1)), (x_2, f(x_2)), \ldots\ldots\ldots (x_n, f(x_n))$ write an algorithm to find the value of f(x) by using Lagrange's interpolation formula.

(iii) Using Boolean algebra, simplify the following expressions

$a + a'b + a'b'c + a'b'c'd + \ldots\ldots$

$x'y'z + yz + xz$

Where x' represents the complement of x. **(20)**

2009

❖ Find the values of two valued Boolean variables A,B,C,D by solving the following simultaneous equations:

$\overline{A} + AB = 0$,

AB=AC,

$AB + A\overline{C} + CD = \overline{C}D$

Where $\overline{x}$ denotes the complement of x. **(6)**

❖ (i) Realize the following expression by using NAND gates only:

$g = (\overline{a} + \overline{b} + c)d(\overline{a} + e)f$

where $\overline{x}$ denotes the complement of x.

(ii) Find the decimal equivalent of $(357.32)_8$ **(12)**

❖ Develop an algorithm for Regula – Falsi method to find a root of f(x) = 0 starting with two initial iterates x_0 and x_1 to the root such that sign $(f(x_0)) \neq sign\,(f(x_1))$. Take n as the maximum number of iterations allowed and eps be prescribed error. **(30)**

2008

- State the principle of duality.
  In Boolean algebra and give the dual of the Boolean expressions $(X+Y).(\overline{X}.\overline{Z}).(Y+Z)$ and $X.\overline{X}=0$.

  Represent $(\overline{A}+\overline{B}+\overline{C})(A+\overline{B}+C)\,(A+B+\overline{C})$ in NOR to NOR logic network. **(12)**
- Draw a flow chart for solving equation F(x)=0 correct to five decimal places by the Newton – Raphson method. **(30)**

2007

- Convert: 46655 given to be in the decimal system into one in base 6.
  $(11110.01)_2$ into a number in the decimal system. **(12)**

2006

- Given the number 59.625 in decimal system. write its binary system.
- Given the number 3898 in decimal system. Writes its equivalent in system base 8.

2005

- Find the hexadecimal equivalent of $(41819)_{10}$ and decimal equivalent of $(111011.10)_2$. **(12)**

2004

- (i) If a 4 - bit representation, what is the value of 1111 in signed integer form, unsigned integer form, signed 1's complement form and signed 2's complement form ?
  (ii) If $(AB,CD)_{16}=(x)_2=(y)_8=(z)_{10}$ then find x, y and z. **(12)**

2003

- (i) Convert the following binary number into octal and hexa decimal system 101110010.10010
- (ii) Find the multiplication of the following binary numbers 11001.1 and 101.1 **(12)**

2002

- (i) Convert $(100.85)_{10}$ into its binary equivalent.
  (ii) Multiply the binary numbers $(1111.01)_2$ *and* $(1101.11)_2$ and check the with its decimal equivalent. **(12)**
- Draw a flow chart to examine whether a given number is a prime. **(10)**

2001

- Given $A.B'+A'.B=C$ show that $A.C'+A'.C=B$

  Express the area of Δ^{le} having sides of lengths $6\sqrt{2}, 12, 6\sqrt{2}$ units in binary number system. **(12)**
- Find the values of the two valued variables A,B,C & D by solving set of the Simultaneous equations $A'+A.B=0$, $A.B=A.C$, $A.B+A.C'+C.D=C'.D$ **(15)**

❖❖❖

IFoS
PREVIOUS YEARS QUESTIONS (2019-2000)
SEGMENT-WISE

NUMERICAL ANALYSIS
(ACCORDING TO THE NEW SYLLABUS PATTERN) PAPER - II

2019

❖ The following table gives the values of $y = f(x)$ for certain equidistant values of x. Find the value of f(x) when $x = 0.612$ using Newton's forward difference interpolation formula.

x :	0.61	0.62	0.63	0.64	0.65
y = f(x) :	1.840431	1.858928	1.877610	1.896481	1.915541

(08)

❖ Following values of x_i and the corresponding values of y_i are given. Find $\int_0^3 y\,dx$ using Simpson's one-third rule. **(08)**

x_i :	0.0	0.5	1.0	1.5	2.0	2.5	3.0
y_i :	0.0	0.75	1.0	0.75	0.0	−1.25	−3.0

❖ Solve the following system of equations by Gauss-Jordan elimination method :

$$x_1 + x_2 + x_3 = 3$$
$$2x_1 + 3x_2 + x_3 = 6$$
$$x_1 - x_2 - x_3 = -3$$ **(10)**

❖ Given $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$. Find y(0.1) and y(0.2) by fourth order Runge-Kutta method. **(15)**

❖ Use Gauss quadrature formula of point six to evaluate $\int_0^1 \frac{dx}{1+x^2}$ given

$x_1 = -0.23861919,\quad w_1 = 0.46791393$
$x_2 = -0.66120939,\quad w_2 = 0.36076157$
$x_3 = -0.93246951,\quad w_3 = 0.17132449$
$x_4 = -x_1, x_5 = -x_2, x_6 = -x_3,$
$w_4 = w_1, w_5 = w_2$ and $w_6 = w_3,$ **(15)**

2018

❖ A solid of revolution is formed by rotating about the x–axis, the area between the x–axis, the line $x = 0$ and a curve through the points with the following coordinates

x	0.0	0.25	0.50	0.75	1.00	1.25	1.50
y	1.0	0.9896	0.9589	0.9089	0.8415	0.8029	0.7635

Estimate the volume of the solid formed using Weddle's rule. **(10)**

❖ Apply fourth-order Runge-Kutta method to compute y at $x = 0.1$ and $x = 0.2$, given that $\frac{dy}{dx} = x + y^2, y = 1$ at $x = 0$. **(12)**

❖ The velocity v (km/min) of a moped is given at fixed interval of time (min) as below:

t	0.1	0.2	0.3	0.4	0.5	0.6
v	1.00	1.104987	1.219779	1.34385	1.476122	1.615146

t	0.7	0.8	0.9	1.0	1.1
v	1.758819	1.904497	2.049009	2.18874	2.31977

Estimate the distance covered during the time (use Simpson's one-third rule). **(10)**

❖ The equation $x^6 - x^4 - x^3 - 1 = 0$ has one real root between 1.4 and 1.5. Find the root to four places of decimal by Regula-Falsi method. **(10)**

2017

❖ Evaluate $\int_0^1 e^{-x^2} dx$ using the composite trapezoidal rule with four decimal precision, i.e., with the absolute value of the error not exceeding 5×10^{-5}. **(10)**

❖ Find the real root of the equation $x^3 + x^2 + 3x + 4 = 0$ correct up to five places of decimal using Newton-raphson method. **(10)**

❖ A river is 80 metre wide, the depth y, in metre, of the river at a distance x from one bank is given by the following table :

x	0	10	20	30	40	50	60	70	80
y	0	4	7	9	12	15	14	8	3

Find the area of cross-section of the river using Simpson's $\frac{1}{3}$rd rule. **(10)**

❖ Find y for x = 0.2 taking h = 0.1 by modified Euler's method and compute the error, given that :

$\frac{dy}{dx} = x + y, y(0) = 1.$ **(10)**

2016

❖ Develop an algorithm for Newton-Raphsom method to solve $\phi(x) = 0$ starting with initial iterate x_0, n be the number of iterations allowed, eps be the prescribed relative error and delta be the prescribed lower bound for $\phi'(x)$. **(8)**

❖ Apply Lagrange's interpolation formula to find f(5) and f(6) given that f(1) = 2, f(2) = 4, f(3) = 8, f(7) = 128. **(8)**

❖ Evaluate $\int_0^{0.6} \frac{dx}{\sqrt{1-x^2}}$ by Simpson's $\frac{1}{3}$rd rule, by taking 12 equal sub-intervals. **(15)**

❖ Find the cube root of 10 up to 5 significant figures by newton-Raphson method. **(10)**

❖ Use the Classical Fourth-order Runge-Kutta method with h = 0.2 to calculate a solution at x = 0.4 for the initial value problem $\frac{dy}{dx} = x + y^2$ with initial condition y = 1 when x = 0. **(15)**

2015

❖ Show that $\sum_{k=1}^{n} l_k(x) = 1,$ where $l_k(x), k = 1$ to n, are Lagrange's fundamental polynomials. **(10)**

❖ Solve the following system of linear equations correct to two places by Gauss-Seidel method: $x + 4y + z = -1, 3x - y + z = 6, x + y + 2z = 4.$ **(16)**

❖ Use the classical fourth order Runge-Kutta method to find solutions at x=0.1 and x=0.2 of the differential equation $\frac{dy}{dx} = x + y, y(0) = 1$ with step size h=0.1. **(14)**

2014

❖ Use Lagrange's formula to find the form of $f(x)$ from the following table.

x	0	2	3	6
$f(x)$	648	704	729	792

(8)

❖ The values of $f(x)$ for different values of x are given as $f(1)$=4, $f(2)$=5, $f(7)$=5 and $f(8)$=4. Using Lagrange's interpolation formula, find the value of $f(6)$. Also find the value of x for which $f(x)$ is optimum. **(10)**

❖ Solve the following system of equations **(15)**

$$2x_1 + x_2 + x_3 - 2x_4 = -10$$

$$4x_1 + 2x_3 + x_4 = 8$$

$$3x_1 + 2x_2 + 2x_3 = 7$$

$$x_1 + 3x_2 + 2x_3 - x_4 = -5$$

❖ Using Runge-kutta 4^{th} order method, find y from $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$. **(10)**

2013

❖ Use Newton - Raphson method and derive the iteration scheme $X_{n+1} = \frac{1}{2}\left(X_n + \frac{N}{X_n}\right)$ to calculate an approximate value of the square root of a number N. Show that the formula $\sqrt{N} \approx \frac{A+B}{4} + \frac{N}{A+B}$ where AB=N, can easily be obtained if the above scheme is applied two times. Assume A=1 as an initial guess value and use the formula twice to calculate the value of $\sqrt{2}$ [For 2^{nd} iteration, one may take A= result of the 1^{st} iteration]. **(14)**

❖ Use the Classical fourth-order Runge-Kutta method with h=0.2 to calculate a solution at x=0.4 for the initial value problem $\frac{du}{dx} = 4 - x^2 + u, u(0) = 0$ on the interval [0, 0.4]. **(12)**

2012

❖ Using Lagrange's interpolation formula,show that 32f(1) = –3f(–4) + 10f(–2) + 30f(2) – 5f(4). **(10)**

❖ A river is 80 meters wide. The depth d (in meters) of the river at a distance x from one bank of the river is given by the following table:

x	0	10	20	30	40	50	60	70	80
d	0	4	7	9	12	15	14	8	3

Find approximately the area of cross-section of the river. **(14)**

❖ Show that

$$u = \frac{A(x^2 - y^2)}{(x^2 + y^2)^2},\ \ v = \frac{2Axy}{(x^2 + y^2)^2}, w = 0$$

are components of a possible velocity vector for inviscid incompressible fluid flow. Determine the pressure associated with this velocity field. **(13)**

❖ Using Euler's Modified Method, obtain the solution of

$$\frac{dy}{dx} = x + \left|\sqrt{y}\right|, y(0) = 1$$

for the range $0 \text{"} x \text{"} 0.6$ and step size 0.2. **(14)**

2011

❖ Solve by Gauss-Jacobi method of iteration the equations

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 110.$$

(Correct to two decimal places) **(10)**

❖ Find the smallest positive root of the equation $x^3 - 6x + 4 = 0$ correct to four decimal places using Newton-Raphson method. From this root, determine the positive square root of 3 correct to four decimal places. **(12)**

2010

❖ Solve $x\log_{10} x = 1.2$ by regula falsi method. **(10)**

❖ Using Lagrange interpolation, obtain an approximate value of sin(0.15) and a bound on the truncation error for the given data:

$\sin(0.1) = 0.09983$, $\sin(0.2) = 0.19867$ **(12)**

❖ Find the interpolating polynomial for $(0,2),(1,3),(2,12)$ *and* $(5,147)$. **(14)**

2009

❖ Obtain the iterative scheme for finding p*th* root of a function of single variable using Newton-Raphson method. Hence, find $\sqrt[7]{277234}$ correct to four decimal places. **(10)**

❖ Using Runge-Kutta method, solve $y'' = xy'^2 - y^2$ for $x = 0.2$. Initial conditions are at $x = 0$, $y = 1$ and $y' = 0$. Use four decimal places for computations. **(13)**

❖ From the following data

x:	1	8	27	64
y:	1	2	3	4

Calculate $y(20)$, using Lagrangian interpolation technique. Use four decimal points for computations. **(13)**

❖ Derive composite $\frac{1}{3}rd$ Simpson's rule. Hence, evaluate $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. Tabulate the integrand for these ordinates to four decimal places. **(13)**

2008

❖ Apply Newton-Raphson method to find the root of $x^4 - x - 10 = 0$ which is near to $x = 2$ (correct to 3 decimal places). **(10)**

❖ Solve the following system of equations by Gauss-Seidel iteration method (iterate upto 2 iterations only):

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 110.$$

2007

❖ Find the smallest +ve root of equation $3x + \sin x - e^x = 0$, correct to five decimal places, using Regula-falsi method. **(10)**

❖ Derive three-point Gaussian quadrature formula & hence evaluate $\int_{0.2}^{1.5} e^{-x^2} dx$, calculating weights and residues. Give the result to three decimal places. **(13)**

❖ Compute y(10) using Lagrange's interpolation formula from the following data:

x	3	7	11	17
y	10	15	17	20

(13)

❖ Solve the system

$$1.2x_1 + 21.2x_2 + 1.5x_3 + 2.5x_4 = 27.46$$

$$0.9x_1 + 2.5x_2 + 1.3x_3 + 32.1x_4 = 49.72$$

$$2.1x_1 + 1.5x_2 + 19.8x_3 + 1.3x_4 = 28.76$$

$$20.9x_1 + 1.2x_2 + 2.1x_3 + 0.9x_4 = 21.70$$

using Gauss-seidel iterative scheme correct to 3 decimal places starting with initial value $(1.04 \quad 1.30 \quad 1.45 \quad 1.55)^T$ **(13)**

2005

❖ Perform four iterations of the Bisection method to obtain a +ve root of the equation $f(x) = x^3 - 5x + 1 = 0$ **(10,2006)**

❖ Evaluate $\int_0^1 \sqrt{1+2x}\, dx$ by applying Gaussian quadrature formula, namely $\int_{-1}^{1} f(t)\, dt = \sum_{i=1}^{n} A_i f(t_i)$

Where the coefficients A_i & the roots t_i are given below for $n = 4$ as

$t_1 = -0.8611 \qquad A_1 = A_4 = 0.3478$

$t_1 = -0.3399 \qquad A_2 = A_3 = 0.6521$

$t_1 = 0.3399$

$t_1 = 0.8611$ **(10)**

❖ Apply Gauss-Seidel iterative method for five iterations to slove the equations. **(13)**

$$\begin{bmatrix} 10 & -2 & -1 & -1 \\ -2 & 10 & -1 & -1 \\ -1 & -1 & 10 & -2 \\ -1 & -1 & -2 & 10 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 3 \\ 15 \\ 27 \\ -9 \end{bmatrix}$$

(14,2006)

❖ Apply Runge-kutta method of fourth order to find an approximate value of y When $x = 0.2$, given that $\frac{dy}{dx} = x + y^2$, $y = 1$ When $x = 0$. **(14,2006)**

❖ Using Newton-Raphson method obtain a root near $x = 0$ and correct to three decimal places of the equation $x + \sin x = 1$. **(10)**

❖ Solve the initial value problem $\frac{dy}{dx} = \frac{1}{x+y}, y(0) = 1$ using Runge-Kutta method of fourth order to evaluate y(0.5) in a single step. **(13)**

❖ Using Gauss-seidel iteration method find the solution, correct to three decimal places, of the linear system

$7x + 52y + 13z = 104$; $3x + 8y + 29z = 71$; $83x + 11y - 4z = 95$

with $(x^0, y^0, z^0) = (1.145 , 1.846 , 1.821)$. Only two iterations may be supplied. **(13)**

2003

❖ Find the cube root of 10 using Newton-Raphson method, correct to 4 decimal places. **(10)**

❖ Apply modified Euler's method to determine $y(0.1)$, given that $\frac{dy}{dx} = x^2 + y$ when $y(0) = 1$.

(10)

❖ The velocities of a car running on a straight road at intervals of 2 minutes are given below:

Time (in min) :	0	2	4	6	8	10	12
Velocity (in km/hr):	0	22	30	27	18	7	0

Apply simphson's $1/3$ rule to find the distance covered by the car. **(13)**

❖ Apply Runge-kutta method of order 4 to find on approximate value of y when $x = 0.2$ given that $\frac{dy}{dx} = x + y$, $y = 1$ *when* $x = 0$. **(14)**

2002

❖ From the data given below

x	0	1	2	4	5	6
$f(x)$	1	14	15	5	6	19

using Lagrange's interpolation formula calculate $f(3)$.

❖ Solve the following system of equations by Gauss's elimination method

$10x-7y+3z+5w=6$; $-6x+8y-z-4w=5$.

$3x+y+4z+11w=2$; $5x-9y-2z+4w=7$.

(14)

❖ Given the differential equation : $\frac{dy}{dx}=xy; y=2,$

When x=1, use Runge-Kutta Fourth order rule to find y at $x = 1.2$ taking the step length $h = 0.2$.

(13)

2001

❖ Find Lagrange's interpolation polynomial $P_2(x)$ Which

$f(0)=P_2(0)=1$

$f(-1)=P_2(-1)=2$

$f(1)=P_2(1)=3,$

Find $f(0.5)$ **(10)**

❖ By applying the Newton-Raphson method to $f(x)=x^2-a$ Where a > 0, Prove that

$x_{n+1}=\frac{1}{2}\left(x_n+\frac{a}{x_n}\right)$ **(13)**

❖ Applying simphson's one-third rule compute the value of the definite integral $\int_4^{5.2} \log x \; dx$ *with* $h=0.2$ and estimate the error.

(13)

2000

❖ By Applying Newton-Raphson Method to

$f(x)=1-\frac{a}{x^n},$

Prove that $x_{k+1}=\frac{1}{n}\left[(n+1)x_k-\frac{x_k^{n+1}}{a}\right]$

❖ Define interpolation.Find the polynomial $P_2(x)$ which satisfies

$f(-1)=P_2(-1)=2$

$f(1)=P_2(1)=1$

$f(2)=P_2(2)=1$

Find $f(1.5)$

❖ Discuss simpson's one-third rule of integration. Use it to find the value of $\int_1^2 x \; dx$.

❖❖❖

IFoS
PREVIOUS YEARS QUESTIONS (2019-2000)
SEGMENT-WISE

COMPUTER PROGRAMMING
(ACCORDING TO THE NEW SYLLABUS PATTERN) PAPER - II

2019

- State the Newton-Raphson iteration formula to compute a root of an equation f(x) = 0 and hence write a program in BASIC to compute a root of the equation $\cos x - xe^x = 0$
lying between 0 and 1. Use DEF function to define f(x) and f′(x). **(10)**

2018

- Write a programme in BASIC to multiply two matrices (checking for consistency for multiplication is required). **(10)**
- Write a program in BASIC to implement trapezoidal rule to compute $\int_0^{10} e^{-x^2}dx$ with 10 subdivisions. **(08)**
- Assuming a 16-bit computer representation of signed integers, represent –44 in 2's complement representation. **(10)**

2017

- Write a BASIC program to compute the multiplicative inverse of a non-singular square matrix. **(12)**
- Assuming a 32 bit computer representation of signed integers using 2's complement representation, add the two numbers –1 and –1024 and give the answer in 2's complement representation. **(12)**

2016

- Develop an algorithm for Newtom-Raphsom method to solve $\phi(x) = 0$ starting with initial iterate x_0, n be the number of iterations allowed, eps be the prescribed relative error and delta be the prescribed lower bound for $\phi'(x)$. **(8)**

2015

- Store the value of –1 in hexadecimal in a 32-bit computer. **(10)**
- Write a BASIC Program to compute the product of two matrices. **(12)**

2014

- Write a BASIC program to sum the series $S = 1 + x + x^2 + ... + x^n$, for n=30, 60 and 90 for the values of x=0.1 (0.1) 0.3. **(10)**
- Write a program in BASIC to integrate $\int_0^1 e^{-2x}\sin x\,dx$ by Simpson's $\frac{1}{3}$rd rule with 20 subintervals. **(8)**

2013

- Convert $(0.231)_5$, $(104.231)_5$ and $(247)_7$ to base 10. **(12)**
- Write an algorithm to find the inverse of a given non singular diagonally dominant square matrix using Gauss - Jordan method. **(13)**
- Draw a flow chart for testing whether a given real number is a prime or not. **(12)**

2012

- Wrie a computer program to implement trapezoidal rule to evaluate
$$\int_0^{10}\left(1-e^{-\frac{x}{2}}\right)dx.$$ **(10)**
- Draw a flow chart for interpolation using Newton's forward difference formula. **(14)**

2011

- Draw a flow chart to declare the results for the following examination system: 60 candidates take the examination. Each candidate writes one major and two minor papers.
A candidate is declared to have passed in the examination if he/she gets a minimum of 40 in all the three papers separately and an average of 50 in all the three papers put together.
Remaining candidates fail in the examination with an exemption in major if they obtain 60 and above and exemption in each minor if they obtain 50 and more in that minor. **(12)**

- Draw a flow chart to solve a quadratic equation with non-zero coefficients. The roots be classified as real distinct, real repeated and complex. **(12)**

2010

- Convert the following: **(10)**
  (i) $(736.4)_8$ to decimal number
  (ii) $(41.6875)_{10}$ to binary number
  (iii) $(101101)_2$ to decimal number
  (iv) $(AF63)_{16}$ to decimal number
  (v) $(101111011111)_2$ to hexadecimal number
- Draw a flow chart for finding the roots of the quadratic equation $ax^2 + bx + c = 0$. **(12)**

2009

- Convert the following binary numbers to the base indicated:
  (i) $(10111011001.101110)_2$ to octal
  (ii) $(10111011001.10111000)_2$ to hexadecimal
  (iii) $(0.101)_2$ to decimal **(10)**
- Convert the following to the base indicated against each: **(7)**
  (i) $(266.375)_{10}$ to base 8
  (ii) $(341.24)_5$ to base 10
  (iii) $(43.3125)_{10}$ to base 2
- Draw the circuit diagram for
  $\overline{F} = A\overline{B}C + \overline{C}B$
  using NAND to NAND logic long. **(6)**

2008

- Show that
  $(A+B).(\overline{A}+C) = (A+B+C).\ (A+B+\overline{C}).$
  $(\overline{A}+B+C).(\overline{A}+\overline{B}+C)$ **(10)**
  Represent right-hand side using NOR gates only.
- (i) Add binary number 110100.01 and 101111.11
  (ii) Subtract $\frac{1}{2}$ from 10000_2.
  (iii) Multiply 1100110.01_2 with 1000.1_2.
  (iv) Divide 11101_2 by 1100_2.
  (v) Convert 72905_{10} to hexadecimal. **(14)**
- Draw a flow chart and write a program to solve the non-linear equation $e^x = 4\sin x$ near the root $x = x_0$. Calculate the root correct to five decimal places. **(14)**

2007

- (i) Multiply 1.01_2 with 10.1_2
  (ii) Draw a diagram of digital circuit for the function. $F(X,Y,Z) = YZ + XZ$ using NAND gates only. **(10)**
- Write a computer program using BASIC to solve the following problem.
  $\int_{\pi/4}^{\pi/2} \frac{\sin x}{x} dx$ by Trapezoidal rule. **(14)**

2006

- Convert 239870 decimal to
  (i) Octal number
  (ii) Hexadecimal number

2005

- Evaluate the following expressions: **(10)**
  (i) 78 OR 87
  (ii) 78 XOR 87
  (iii) 78 AND 87
  (iv) Shift 87 left by 2
  (v) Rotate 78 right by 2
- Write a BASIC program to solve the equation $x^3 - 4x^2 + x + 6 = 0$ by Newton - Raphson method by taking the initial approximation as $x_0 = 5$. Indicate which lines are to be changed for a different equation. **(13)**
- Write a BASIC program to evaluate a definite integral $\int_0^1 (x^3 + \sin x)\,dx$ by Simpson's $\frac{1}{3}$ rule. Indicate the lines which are to be modified for a different problem. **(13)**

2004

- Convert **(10)**
  (i) The decimal number 412 to octal, to binary & finally to hexadecimal number
  (ii) The hexadecimal number F9A. BC3 to a decimal number.
- Write a BASIC program to evaluate $\int_2^5 \frac{dx}{1+x^2}$ using Simpson's $\frac{1}{3}$ rule with 20 subintervals **(13)**

2003

- (i) Convert ABCD hex and 76543 octal to decimal.
  (ii) Convert 39870 decimal to octal and hexadecimal. **(10)**

- Write a programme in BASIC to integrate $\int_0^{10}(1-e^{-\frac{x}{2}})\,dx$ by trapezoidal rule for 20 equal sub-divisions of the interval (0, 10). Indicate which lines are to be changed for different integral. **(13)**
- Draw a flow chart and write a program in BASIC for an algorithm to determine the greatest common divisor of two given +ve integers. **(13)**

2002

- Convert $(135.34)_8$ to decimal number and then convert the resulting decimal number to binary number. **(10)**
- Write a BASIC Program to find **(14)**
  (i) the sum of first N natural numbers
  (ii) the factorial of a given number

2001

- Convert the decimal number $(1479.25)_{10}$ to the binary and the hexadecimal numbers. **(10)**
- Write an algorithm for generating even integers ≤ 100. Also draw the flow chart which executes this algorithm. **(13)**

2000

- Draw a flow chart for finding the roots of the equation $ax^2+bx+c=0$

❖❖❖