RAMANASRI
IAS/IFoS Institute

Numerical Analysis & Computer Programming

Previous year Questions from 2017 to 1992

Ramanasri Institute

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2017

1. 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 Marks]**

2. Write the Boolean expression $z(y+z)(x+y+z)$ in the 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 Marks]**

3. For given equidistant values u_{-1}, u_0, u_1 and u_2 a values is interpolated by Lagrange's formula. Show that it may be written in the form $u_x = yu_0 + \frac{y(y^2-1)}{3!}\Delta^2 u_{-1} + \frac{x(x^2-1)}{3!}\Delta^2 u_0$, where $x+y=1$. **[15 Marks]**

4. Derive the formula $\int_a^b y\,dx = \frac{3h}{8}[(y_0+y_n)+3(y_1+y_2+y_4+y_5+...+y_{n-1})+2(y_3+y_6+y_{n-3})]$. Is there any restriction on n? State that condition. What is the error bounded in the case of Simpson's $\frac{3}{8}$ rule? **[20 Marks]**

5. Write an algorithm in the form of a flow chart for Newton-Raphson method. Describe the cases of failure of this method. **[15 Marks]**

2016

6. (i) 4096 (ii) 0.4375 (iii) 2048.0625
   Convert the following decimal numbers to univalent binary and hexadecimal numbers: **(10 marks)**

7. 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 marks)**

8. 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 marks)**

9. Let A, B, C be Boolean variable denote complement $A, A+B$ of is an expression for $A\ OR\ B$ and $B.A$ is an expression for $AANDB$ .Then simplify the following expression and draw a block diagram of the simplified expression using AND and OR gates.
   $A.(A+B,C).(\overline{A}+B+C).(A+\overline{B}+C).(A+B+\overline{C})$. **(15 marks)**

2015

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

11. 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 Marks)**

12. 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 Marks)**

13. 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 Marks)**

2014

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

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

16. Use only AND and OR logic gates to construct a logic circuit for the Boolean expression $z=xy+uv$ **(10 Marks)**

17. 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 Marks)**

18. 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 Marks)**

19. Draw a flowchart for Simpson's one-third rule. **(15 Marks)**

20. For any Boolean variables x and y, show that $x+xy=x$. **(15 Marks)**

2013

21. 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 Marks)**

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

23. 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. $y'=x(y+x)-1,\ y(0)=2$ **(15 Marks)**

24. 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 Marks)**

2012

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

26. Provide a computer algorithm to solve an ordinary differential equation $\frac{dy}{dx}=f(x,y)$ in the interval $[a,b]$ for n number of discrete points, where the initial value is $y(a)=\alpha,$ using Euler's method. **(15 Marks)**

27. 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 Marks)

28. 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 Marks)

29. In a certain examination, a candidate has to appear for one major & two major 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 anyone 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 Marks)**

2011

30. Calculate $\int_2^{10} \frac{dx}{1+x}$ (up to 3 places of decimal) by dividing the range into 8 equal parts by Simpson's $\frac{1}{3}^{rd}$ rule. **(12 Marks)**

31. (i) Compute $(3205)_{10}$ to the base 8.

(ii) 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 Marks)**

32. 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 a curve through the points with the following co-ordinates:

x	0.00	0.25	0.50	0.75	1
y	1	0.9896	0.9589	0.9089	0.8415

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

33. 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

(20 Marks)

34. Draw a flow chart for Lagrange's interpolation formula. **(20 Marks)**

2010

35. 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 Marks)**

36. (i) Suppose a computer spends 60 per cent of its time handling a particular type of computation when running a given program and its manufacturers 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 $x \oplus y \oplus z.$ **(6+6=12 Marks)**

37. 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 Marks)

38. Find the value of the integral $\int_1^5 \log_{10} x\, dx$ by using Simpson's $\frac{1}{3}^{rd}$ rule correct up to 4 decimal places. Take 8 subintervals in your computation. **(20 Marks)**

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

(ii) For the given set of data points $(x_1, f(x_1), (x_2, f(x_2), \ldots (x_n, f(x_n)$ 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) $a + a'b + a'b'c + a'b'c'd + \ldots$

(b) $x'y'z + yz + xz$ where x' represents the complement of x **(5+10+5=15 Marks)**

2009

40. (i) The equation $x^2 + ax + b = 0$ has two real roots α and β. Show that the iterative method given by : $x_{k+1} = -\frac{(ax_k + b)}{x_k}, k = 0,1,2\ldots$ is convergent near $x = \alpha$, if $|\alpha| > |\beta|$

(ii) 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 $\overline{x}$ represents the complement of x **(6+6=12 Marks)**

41. (i) Realize the following expressions by using NAND gates only :

$g = (\overline{a} + \overline{b} + c)\overline{d}(\overline{a} + e)f$ where $\overline{x}$ represents the complement of x

(ii) Find the decimal equivalent of $(357.32)_8$ **(6+6=12 Marks)**

42. 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 $\text{sign}(f(x_0)) \neq \text{sign}(f(x_1))$. Take n as the maximum number of iterations allowed and epsilon be the prescribed error. **(30 Marks)**

43. 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 Marks)

44. 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 Marks)**

2008

45. Find the smallest positive root of equation $xe^x - \cos x = 0$ using Regula-Falsi method. Do three iterations. **(12 Marks)**

46. State the principle of duality

(i) in Boolean algebra and give the dual of the Boolean expressions $(X+Y).(\overline{X}.\overline{Z}).(Y+Z)$ and $X\overline{X}=0$

(ii) Represent $(\overline{A}+\overline{B}+\overline{C})(A+\overline{B}+C)(A+B+\overline{C})$ in NOR to NOR logic network.

(6+6=12 Marks)

47. (i) The following values of the function $f(x)=\sin x+\cos x$ are given:

x	10^0	20^0	30^0
$f(x)$	1.1585	1.2817	1.3360

Construct the quadratic interpolating polynomial that fits the data. Hence calculate $f\left(\frac{\pi}{12}\right)$.

Compare with exact value.

(ii) 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+15=30 Marks)

48. Draw a flow chart for solving equation $F(x)=0$ correct to five decimal places by Newton-Raphson method **(30 Marks)**

2007

49. 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 Marks)**

50. Convert:

(i) 46655 given to be in the decimal system into one in base 6.

(ii) $(11110.01)_2$ into a number in the decimal system. **(6+6=12 Marks)**

51. (i) 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:

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

(15 Marks)

(ii) 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 Marks)**

2006

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

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

$2n=10, \Delta x=0.1, x_0=0, x_1=0.1,..., x_{10}=1.0$ **(12 Marks)**

53. (i) Given the number 59.625 in decimal system. Write its binary equivalent.

(ii) Given the number 3898 in decimal system. Write its equivalent in system base 8.

(6+6=12 Marks)

54. If Q is a polynomial with simple roots $\alpha_1, \alpha_2, ...\alpha_n$ and if P is a polynomial of degree $< n,$ show that $\frac{P(x)}{Q(x)} = \sum_{k=1}^{n} \frac{P(\alpha_k)}{Q'(\alpha_k)(x-\alpha_k)}$. Hence prove that there exists a unique polynomial of degree with given values c_k at the point $\alpha_k,\ k = 1,2,...n.$. **(30 Marks)**

55. Draw a flowchart and algorithm for solving the following system of 3 linear equations in 3 unknowns $x_1, x_2 \,\&\, x_3$: $C * X = D$ with $C = \left(c_{ij}\right)_{i,j=1}^{3}, X = \left(x_j\right)_{j=1}^{3}, D = \left(d_i\right)_{i=1}^{3}$ **(30 Marks)**

2005

56. Use appropriate quadrature formulae 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 particular quadrature formula. **(12 Marks)**

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

58. Find the unique polynomial $P(x)$ of degree 2 or less such that $P(1) = 1, P(3) = 27, P(4) = 64$. Using the Lagrange's interpolation formula and the Newton's divided difference formula, evaluate $P(1.5)$ **(30 Marks)**

59. Draw a flow chart and also write algorithm to find one real root of the non linear equation $x = \phi(x)$ by the fixed point iteration method. Illustrate it to find one real root, correct up to four places of decimals, of $x^3 - 2x - 5 = 0$. **(30 Marks)**

2004

60. The velocity of a particle at distance from a pint on it s path is given by the following table:

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

Estimate the time taken to travel the first 60 meters using Simpson's $\frac{1}{3}$ rd rule. Compare the result with Simpson's $\frac{3}{8}$ th rule. **(12 Marks)**

61. (i) If $(AB,CD)_{16} = (x)_2 = (y)_8 = (z)_{10}$ then find $x, y \,\&\, z$

(ii) In 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? **(6+6=12 Marks)**

62. 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. **(10 Marks)**

63. Using Gauss-Siedel iterative method, find the solution of the following system:

$$4x - y + 8z = 26$$
$$5x + 2y - z = 6$$
$$x - 10y + 2z = -13$$

up to three iterations. **(15 Marks)**

2003

64. Evaluate $\int_0^1 e^{-x^2} dx$ by employing three points Gaussian quadrature formula, finding the required weights and residues. Use five decimal places for computation. **(12 Marks)**

65. (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 **(6+6=12 Marks)**

66. 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 Marks)**

67. Draw a flow chart and algorithm for Simpson's $\frac{1}{3}$ rd rule for integration $\int_a^b \frac{1}{1+x^2} dx$ correct to 10^{-6}

(30 Marks)

2002

68. Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$ by the method of false position. **(12 Marks)**

69. (i) Convert $(100.85)_{10}$ into its binary equivalent.

(ii) Multiply the binary numbers $(1111.01)_2$ and $(1101.11)_2$ and check with its decimal equivalent **(4+8=12 Marks)**

70. (i) Find the cubic polynomial which takes the following values: $y(0) = 1,\ y(1) = 0,\ y(2) = 1\ \&\ y(3) = 10$. Hence , or otherwise, obtain $y(4)$

(ii) 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. $\left(e^{0.1} = 1.10517, e^{0.2} = 1.2214\right)$.

(10+20=30 Marks)

71. Draw a flow chart to examine whether a given number is a prime. **(10 Marks)**

2001

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

73. (i) Given $A.B'+A'.B=C$ show that $A.C'+A'.C=B$

(ii) Express the area of the triangle having sides of lengths $6\sqrt{2},\ 12,\ 6\sqrt{2}$ units in binary number system. **(6+6=12 Marks)**

74. 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 Marks)**

75. Find the values of the two-valued variables $A,B,C\,\&\,D$ by solving the set of simultaneous equations

$$A'+A.B=0$$
$$A.B=A.C$$
$$A.B+A.C'+C.D=C'.D$$

(15 Marks)

2000

76. (i) Using Newton-Raphson method, show that the iteration formula for finding the reciprocal of the p^{th} root of N is $x_{i+1}=\dfrac{x_i\left(p+1-Nx_i\right)}{p}$

(ii) Prove De Morgan's Theorem $(p+q)'=p'.q'$ **(6+6=12 Marks)**

77. (i) Evaluate $\int_0^1 \dfrac{dx}{1+x^2},$ by subdividing the interval $(0,\ 1)$ into 6 equal parts and using Simpson's one-third 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:

$$x_1+6x_2+3x_3=6$$
$$2x_1+3x_2+3x_3=117$$
$$4x_1+x_2+2x_3=283$$

(15+15=30 Marks)

1999

78. 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

$$R=-\frac{(b-a)^5}{2880}f^{iv}(\eta),\ \eta\in\left(0,2\right).$$

Apply this rule to the integral $\int_0^1 \dfrac{dx}{1+x}$ and show that $\left|R\right|\le 0.008333.$ **(20 Marks)**

79. Using fourth order classical Runge-Kutta method for the initial value problem $\dfrac{du}{dt}=-2tu^2,u(0)=1,$ with $h=0.2$ on the interval $[0,\ 1],$ calculate $u(0.4)$ correct to six places of decimal. **(20 Marks)**

1998

80. Evaluate $\int_1^3 \frac{dx}{x}$ by Simpson's rule with 4 strips. Determine the error by direct integration. **(20 Marks)**

81. 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 **(20 Marks)**

82. Use Regula-Falsi method to show that the real root of $x\log_{10}x-1.2=0$ lies between 3 and 2.740646 **(20 Marks)**

1997

83. Apply that fourth order Runge-Kutta method to find a value of y correct to four places of decimals at $x=0.2,$ when $y'=\frac{dy}{dx}=x+y,\ y(0)=1$ **(20 Marks)**

84. Show that the iteration formula for finding the reciprocal of N is $x_{n+1}=x_n\left(2-N_{xn}\right),\ n=0,\ 1...$ **(20 Marks)**

85. Obtain the cubic spline approximation for the function given in the tabular form below:

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

and $M_0=0, M_3=0$ **(20 Marks)**

1996

86. Describe Newton-Raphson method for finding the solutions of the equation $f(x)=0$ and show that the method has a quadratic convergence. **(20 Marks)**

87. 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 an appropriate formula interpolate for the value of i when $t=1.6$ **(20 Marks)**

88. 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 **(20 Marks)**

1995

89. Find the positive root of $\log_e x=\cos x$ nearest to five places of decimal by Newton-Raphson method. **(20 Marks)**

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

(20 Marks)

1994

91. 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 Marks)

92. Fit the following four points by the cubic splines.

i	0	1	2	3
x_i	1	2	3	4
y_i	1	5	11	8

Use the end conditions Use the end conditions $y''_0 = y''_3 = 0$

Hence compute (i) $y(1.5)$

(ii) $y'(2)$

(20 Marks)

93. 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 Marks)

1993

94. Find correct to 3 decimal places the two positive roots of $2e^x - 3x^2 = 2.5644$ **(20 Marks)**

95. Evaluate approximately $\int_{-3}^{3} x^4 \, dx$ Simpson's rule by taking seven equidistant ordinates. Compare it with the value obtained by using the trapezoidal rule and with exact value. **(20 Marks)**

96. Solve $\frac{dy}{dx} = xy$ for $x = 1.4$ by Runge-Kutta method, initially $x = 1, y = 2$ (Take $h = 0.2$) **(20 Marks)**

1992

97. Compute to 4 decimal placed by using Newton-Raphson method, the real root of $x^2 + 4\sin x = 0$.

(20 Marks)

98. Solve by Runge-Kutta method $\frac{dy}{dx} = x + y$ with the initial conditions $x_0 = 0, y_0 = 1$ correct up to 4 decimal places, by evaluating up to second increment of y (Take $h = 0.1$) **(20 Marks)**

99. Fit the natural cubic spline for the data.

$x:$	0	1	2	3	4
$y:$	0	0	1	0	0

(20 Marks)