DRONACHARYA GROUP OF INSTITUTIONS, GREATER NOIDA
MCA (SEM – II)
CBNST (CA-201)
QUESTION BANK

Q.1 Define 'Absolute error' and 'Relative error'. An approximate value of π is given by 3.1428571 and its true value is 3.1415926.Find absolute and relative errors.

Q.2 In normalized floating point mode, carry out the following mathematical operation:
(.4546 E 3) + (.5454 E 8)

Q.3Apply the procedure for the following multiplication:
$$(.5334 \times 10^{9}) \times (.1132 \times 10^{-25})$$
Indicate if the result is overflow or underflow.

Q.4 In performing numerical calculations, how many types of errors are encountered? Write each type of errors and discuss them by giving examples.

Q.5 Multiply the following floating point numbers:
(i) .1111 E 51 and .4444 E 50
(ii) .1234 E -49 and .1111 E -54

Q.6 Subtract the following floating-point numbers :
0.46132447×10^{8} **and** 0.46123568×10^{8}

Q.7 Find the sum of $.234 \times 10^{3}$ **and** $.478 \times 10^{2}$ **and write the result in three – digit mantissa.**

Q.8 Add the number 0.1125×10^{-3} **&** 0.4798×10^{-4} **using normalized floating point concept.**

Q.9Subtract 0.4688×10^{8} **from** 0.1544×10^{7} **using normalized floating point concept.**

Q.10Define absolute error and relative error.If true value = $\frac{10}{3}$ **and approximate value is 3.33 , then find absolute and relative errors.**

Q.11 Let x^{*} approximate x correct up to n significant digits if e^{x} is evaluated for$x$, $-8 \le x \le 9$, then what should be relative error?

Q.12 For $x = .4845$ **and** $y = .4800$ **, calculate the value of** $\left(\frac{x^2 - y^2}{x+y}\right)$ **by using normalized floating point arithmetic. Compare the result with the value of (x-y).Indicate the error in the former.**

Q.13 Find the relative error involved in rounding and truncating 4.9997 to 5.000.

Q.14 Prove that the absolute error in the common logarithm of a number is less than half the relative error of the given number.

Q.15Show with suitable examples that associative and the distributive laws of arithmetic are not always valid when floating point representation of numbers is used.

Q.16 Evaluate $\sqrt{2}$ corrected to four decimal places by Newton-Raphson method.

Q.17 Find a positive value of $(17)^{1/3}$ correct to four decimal places by Newton-Raphson method.

Q.18Find the real root of the equation $2x - log_{10}x - 7 = 0$ using iteration method.

Q.19Find a real root of $cos\, x = 3x + 1$, correct to four decimal places using iteration method

Q.20 Find the rate of convergence for Regula-Falsi method..

Q.21 Write a computer program in 'C' for the Regula-Falsi method.

Q.22 Find the root of the equation $xe^x = \cos x$ correct to four decimal places by using secant method.

Q.23Discuss the various steps of Newton-Raphson method to find root of equation. For what starting values will Newton's method converge if the function is $f(x) = \frac{x^2}{(1+x^2)}$.

Q.24Write an algorithm and a program in C for finding the summation of the following Series :

$$S = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots\ldots.. + \frac{(-1)^{n-1}x^{(2n-1)}}{(2n-1)!}.$$

Q.25 Prove that the order of convergence of Secant method for finding the roots of equation is 1.62.

Q.26 Write 'C'program for finding a real root of equation $f(x) = 0$ by Bisection method.

Q.27 Find the root of the following equation in the interval $[0, 1]$ by Regula-Falsi method:

$$2x(1 - x^2 + x)Ln\, x = x^2 - 1$$

Q.28 Explain ,what do you understand by rate of convergence of a method to find out the root of an equation. Show that the Newton-Raphson method is better than the Secant method in respect to rate of convergence.

Q.29 Find the real root of the equation $x^3 + x^2 - 1 = 0$ on the interval $[0, 1]$ with the accuracy of 10^{-4} by iteration method.

Q.30Find a root of the equation $\tan x + \tanh x = 0$ which lies in the interval (1.6,3.0) correct to four significant digits using method of false position.

Q.31Write the procedure of Secant method to find a root of a polynomial equation to implement it in 'C'.

Q.32 Prove that Bisection method always converges.

Q.33 If the equation $x^6 - x^4 - x^3 - 1 = 0$ has one real root between 1.4 and 1.5, using Newton-Raphson method, find the root correct up to 4 decimal places.

Q.34Show that the initial approximation x_0 for finding $\frac{1}{N}$, where N is a positive integer, by the Newton-Raphson method satisfy $0 < x_0 < \frac{2}{N}$, for convergence.

Q.35 Use the series $\log_e\left(\frac{1+x}{1-x}\right) = 2\left(x + \frac{x^3}{3} + \frac{x^5}{3} + \cdots \ldots\right)$ to compute the value of $\log(1.2)$ correct to 7 decimal places and find the no. of retained.

Q.36 If $u = \frac{4x^2y^3}{z^4}$ and $\Delta x = \Delta y = \Delta z = .001$ .Compute the relative maximum error in 'u' when $x = y = z = 1$.

Q.37 Compute the rate of convergence of Newton-Raphson method.

Q.38Prove that the order of convergence of Newton – Raphson method is quadratic.

Q.39 How should the constant 'α' be chosen to ensure the fastest possible convergence with the iteration formula $x_{n+1} = \frac{\alpha x_n + x_n^{-2} + 1}{\alpha+1}$.

Q.40 Find a positive real root of the equation $x^3 - 4x - 9 = 0$ by Newton-Raphson method.

Q.41Apply False Position method to find the smallest positive root of the equation $x - e^{-x} = 0$, correct to three decimal places.

Q.42 Solve the following system of equations using Gauss-Elimination method:

$$x + y + 2z = 4\,;\, 2x - y + 3z = 9\,;\, 3x - y - z = 2$$

Q.43 Solve the following system of equations by Gauss Elimination method(three iteration):

$$x - y + z = 1\,;\; -3x + 2y - 3z = -6\,;\, 2x - 5y + 4z = 5$$

Q.44 Solve the following system of equations with pivoting by Gauss-Elimination method:

$$1.4\,x + 2.3\,y + 3.7\,z = 7.4$$
$$3.3\,x + 1.6\,y + 4.3\,z = 9.2$$
$$2.5\,x + 1.9y + 4.1\,z = 8.5$$

Q.45 Solve the following equations by Gauss elimination method:

$$3x_1 + 2x_2 - 5x_3 = 0\,;\, 2x_1 - 3x_2 + x_3 = 0\,;\; x_1 + 4x_2 - x_3 = 4$$

The answer should be correct to 3 significant digits.

Q.46 What do you understand by ill – conditioned equations ? Consider the following system of equations:

$$100x - 200y = 100\,;\; -200x + 401y = -100$$

Determine, whether given system is ill-conditioned or not.

Or

What do you understand by ill – conditioned system of equations? Illustrate your answer with the help of suitable examples.

Q.47 Write a computer program in 'C' for Gauss – Seidel iteration method for solving the algebraic equation.

Q.48 Solve the following system of equations using Gauss-Seidel method:

$$10x + y + z = 12\,;\, 2x + 10y + z = 13\,;\, 2x + 2y + 10z = 14$$

Q.49 Apply Gauss-Seidel iteration method to solve the following equations(three iterations only):

$$20\,x + y - 2z = 17\,;\, 3x + 20y - z = -18\,;\, 2x - 3y + 20z = 25$$

Q.50 Solve the following set of equation by Gauss-Seidel iterative method:

$$3x_1 + 2x_2 - x_3 = 7\,;\, 5x_1 - 3x_2 + 2x_3 = 4\,;\; -x_1 + x_2 - 3x_3 = -1$$

Q.51 Use Gauss-Seidel iterative method to solve the following system of simultaneous equations:

$$9x + 4y + z = -17\,;\; x - 2y - 6z = 14\,;\, x + 6y = 4$$

Q.52 Prove the following:

(i) $E = 1 + \Delta$ (ii) $\Delta = \nabla\,(1 - \nabla)^{-1}$

(iii) $\delta = E^{1/2} + E^{-1/2}$ (iv) $\nabla + \Delta = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$

(v) $E = e^{hD}$ (vi) $\nabla = 1 - E^{-1}$

Q.53 Given $log\,x$ for $x = 40, 45, 50, 55, 60$ and 65 according to the following table:

x	40	45	50	55	60	65
$log\,x$	1.60206	1.65321	1.69897	1.74036	1.77815	1.81291

Find the value of $log\,58.75$.

Q.54 The table gives the distance (y) in km, of the vision horizon for the given heights (x) in meter above the earth's surface:

x	100	150	200	250	300	350	400
y	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Use Newton-Gregory's forward interpolation formula to find the value of y when $x = 160$ m.

Q.55 The following table gives the population of a town during the last six censuses. Estimate the population in 1913 by Newton's forward difference formula:

Year	1911	1921	1931	1941	1951	1961
Population (in thousand)	12	15	20	27	39	52

Q.56 Derive the Newton's Gregory formula for forward interpolation.Hence obtain the value of $f(2.5)$ from the following data:

x	2	4	6	8	10
$f(x)$	15	10	5	7	13

Q.57 Find the polynomial of degree four which takes the following values:

x	2	4	6	8	10
y	0	0	1	0	0

Q.58 Find the order of the polynomial which might be suitable for the following function:

x	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7
$f(x)$	0.577	0.568	0.556	0.540	0.520	0.497	0.471	0.442

Also find the value of $f(2.15)$ using difference formulae.

Q.59 From the following table:

x	10°	20°	30°	40°	50°	60°	70°	80°
$\cos x$	.9848	.9397	.8660	.7660	.6428	.5000	.3420	.1737

Calculate $\cos 25°$ and $\cos 73°$ using Gregory Newton formula.

Q.60 What do you mean by interpolation? When a function is tabulated at equal intervals, obtain a more concise Lagrange's interpolation formula.

Q.61 Derive the Newton-divided difference formula,hence calculate $f(3)$ from the following data:

x	0	1	2	4	5	6
f	1	14	15	5	6	19

Q.62 Find the unique polynomial P(n) of degree two such that :
P(1) =1 , P(3) = 27 , P(4) = 64

Use Lagrange's method of interpolation.

Q.63Value of $f(x)$ for values of x are given as:

$$f(1) = 4, f(2) = 5 , f(7) = 5 , f(8) = 4$$

Find $f(6)$ and also the value of 'x' for which $f(x)$ is maximum or minimum using Lagrange's formula.

Q.64Use the Lagrange's and the Newton Divided difference formulas to calculate $f(3)$ from the following table:

x	0	1	2	4	5	6
f	1	14	15	5	6	19

Q.65 Using the following table,apply Gauss forward formula to get $f(3.75)$:

x	2.5	3.0	3.5	4.0	4.5	5.0
$f(x)$	24.145	22.043	20.225	18.644	17.262	16.047

Q.66Apply Gauss forward formula to find the value of $f(x)$ at $x = 3.75$ from the table:

x	2.5	3.0	3.5	4.0	4.5	5.0
$f(x)$	24.145	22.043	20.225	18.644	17.262	16.047

Q.67 Apply Bessel's formula to obtain value of 'y' for $x = 25$,from the following table:

x	20	24	28	32
y	2854	3162	3544	3992

Q.68 Apply Bessel's formula to find the value of f(27.5) from the table:

x	25	26	27	28	29	30
$f(x)$	4.000	3.846	3.704	3.571	3.448	3.333

Q.69 Find the suitable values of a_0, a_1, a_2, a_3, a_4 so that $a_r T_r(x)$ is a good Approximation $\frac{1}{(1+x)}$ for $0 \le x \le 1$.

Q.70Show that : $f\left(\frac{a+b}{2}\right) = \frac{f(a)+f(b)}{2} + \frac{(b-a)[f'(a)-f'(b)]}{8}$ by Hermite's interpolation.

Q.71 Prove that the nth differences of a polynomial of nth degree is constant and all higher order differences are zero.

Q.72 Find $y(1)$, if $y(x)$ is the solution of $\frac{dy}{dx} = x^2 + y^2$ by Runge-Kutta method, in two steps taking $h = 0.5$, given $y(0) = 0$.

Q.73 Prove that Taylor's series for a function of one variable.

Q.74 Explain two types of errors in Numerical Differentiation.

Q.75 Write Newton-Cote's quadrature formula.

Q.76 Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's one third rule.

Q.77 A train is moving at the speed of 30 m/sec.Suddenly brakes are applied. The speed Of the train per second after 't' seconds is given by :

Time (t)	0	5	10	15	20	25	30	35	40	45
Speed(v)	30	24	19	16	13	11	10	8	7	5

Apply Simpson's three-eight rule to determine the distance moved by the train in 45 seconds.

Q.78 A rod is rotating in a plane.The following table gives the angle θ (in radians) through which the rod has turned for various values of time t (seconds). Calculate the angular velocity of the rod at t = 0.6 seconds.

t	0	0.2	0.4	0.6	0.8	1.0
θ	0	0.12	0.49	1.12	2.02	3.20

Q.79 Write a computer program in 'C' for the trapezoidal rule of integration.

Q.80 Describe Simpson's $\frac{1}{3}$ rule of integration. Also write a function in C to find the integration using Simpson's $\frac{1}{3}$ rule.

Q.81 Write 'C' program for the evaluation of integration by Simpson's $\frac{3}{8}$ rule. Find $\int_0^6 \frac{e^x}{1+x} dx$ approximately using Simpson's $\frac{3}{8}$ rule.

Q.82 Write the algorithm and the flow-chart for Milne's Predictor-Corrector method.

Q.83 Use Euler-Maclaurin's formula to prove that $\sum_1^n \chi^2 = \frac{n(n+1)(2n+1)}{6}$.

Q.84Apply Euler-Maclaurin's formula to evaluate

$$\frac{1}{51^2} + \frac{1}{53^2} + \frac{1}{55^2} + \cdots \ldots\ldots\ldots\ldots\ldots\ldots . + \frac{1}{99^2}$$

Q.85Find an approximate value of $\int_1^2 x^{-1} dx$ using composite Simpson's rule (Simpson's $\frac{1}{3}$ rule) with h=0.25 .Give a bound on the error.

Q.86 Compute $\int_0^{\pi/2} \sin x \, dx$ using Simpson's three – eighth rule of integration, taking h=$\frac{\pi}{18}$.

Q.87 Describe Euler's method for solving the differential equations.

Q.88 Find $y(2)$, if $y(x)$ is the solution of $\frac{dy}{dx} = \frac{1}{2}(x+y)$ using Runge-Kutta method, in two steps taking $h = 1.0$. Given $y(0) = 2.0$.

Q.89 Given that : $\frac{dy}{dx} = 1 + y^2$

and $y(0.6) = 0.6841$, $y(0.4) = 0.4228$, $y(0.2) = 0.2027$, $y(0) = 0$.

Find $y(-0.2)$ using Milne's Predictor – Corrector method.

Q.90Using Runge-Kutta method of fourth order,solve for y(0.1), y(0.2) and y(0.3) Given that $y' = xy + y^2$, $y(0) = 1$.

Q.91 Given $\frac{dy}{dx} = y - x$, $y(0) = 2$ .Find y(0.1) and y(0.2) correct to four decimal places by using fourth order Runge-Kutta Method.

Q.92 Evaluate $\int_0^6 \frac{1}{1+x^3} dx$ by Weddle's rule.

Q.93 Compute the value of 'y' at $x = 1.4$. $\frac{dy}{dx} = xy + x^2 - 1$; $h = 0.1$ using Predictor-Corrector method.

Q.94 Write an algorithm for solving differential equation using 4th order Runge-Kutta method.

Q.95 Find an approximate value of $\int_1^2 x^{-1} dx$ using composite Simpson's Rule with

$h = 0.25$ .Give a bound on the error.

Q.96 Describe the Euler's method for solving the differential equations.

Q.97 Write down the principle of least squares method for curve fitting.

Q.98Explain the method of least squares to fit a curve.Hence obtain a second degree parabola from the following data:

x	0	5	10	15	20	25
y	1.5	6.2	15.3	20.0	23.7	28.6

Q.99What straight line best fits the following data:

x	1	2	3	4
y	0	1	1	2

in the least square sense.

Q.100 The velocity V of a liquid is known to vary with temperature T,according to a quadratic law $V = a + bT + cT^2$.Find the best values of a,b and c for the following table :

T	1	2	3	4	5	6	7
V	2.31	2.01	1.80	1.66	1.55	1.47	1.41

Q.101 Fit a second degree curve of regression of 'y' on 'x' to the following data:

x	1.0	2.0	3.0	4.0
y	6.0	11.0	18.0	27.0

Q.102Fit the curve $pv^n = K$ to the following data:

$p(Kg/cm^3)$	0.5	1.0	1.5	2.0	2.5	3.0
$v\ (litres)$	1620	1000	750	620	520	460

Q.103 Using the method of least square fit the non-linear curve of the form $y = ae^{bx}$ to the following data:

x	0	2	4
y	5.012	10	31.62

Q.104State some important curve-fitting procedures. Obtain the least squares fit of the form $f(t) = ae^{-3t} + be^{-2t}$ for the data :

t	0.1	0.2	0.3	0.4
$f(t)$	0.76	0.58	0.44	0.35

Q.105Give the application of Cubic-Spline.Determine the natural cubic spline that interpolates the functions $f(x) = x^6$ over the interval [0,2] using nodes 0,1 and 2.

Q.106 Obtain the cubic spline for the following data:

x	0	1	2	3
y	2	-6	-8	2

Q.107 What is Regression analysis? Describe the method of least square to obtain the Regression lines.

Q.108 In 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 the regression equation of X_3 on X_1 and X_2.

Q.109 Obtain a regression plane by using multiple linear regression to fit the data given below:

x	1	2	3	4
y	0	1	2	3
z	2	3	4	5

Q.110For 10 observations on price 'x' and supply 'y' ,the following data were obtained:

$\sum x = 130 , \sum y = 220 , \sum x^2 = 228 , \sum y^2 = 5506 , \sum xy = 3467$.

Obtain the line of regression of 'y' on 'x' and estimate the supply when the price is 16 units.

Q.111Find the two lines of regression and coefficient of correlation for the data given below:

$n = 18 , \sum x = 12 , \sum y = 18 , \sum x^2 = 60 , \sum y^2 = 96 , \sum x\,y = 48$

Q.112 Prove that the regression coefficients are independent of the origin but not to scale.

Q.113 Assuming 5-yearly moving averages calculate trend values from the data given below and draw approximately on answer sheet:

Years	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Production (000 tons)	105	107	109	112	114	116	118	121	123	124	125	127	129

Q.114 Discuss how statistical data can be used in quality control of industrial products.

Q.115 Explain the following terms clearly:
(i) Null Hypothesis
(ii) Level of significance

Q.116Prove the formula for fitting a straight line.

Q.117 What do you know about Histograms?

Q.118 A manufacturer claims that only 4% of his products supplied by him are defective. A random sample of 600 products contained 36 defectives. Test the claim of the

manufacturer.

Q.119 Explain the following control charts:
(i) P – chart (ii) np – chart

Q.120Write the t-test for difference of means of two small samples.

Q.121Explain the types of test of significance.

Q.122 Write any four advantages of Statistical quality control.

Q.123 Explain CHI-SQUARE test and write the Yates's correction for test of independence.

Q.124 Records taken of the number of male and female births in 800 families having four children are as follows:

No. of male births	0	1	2	3	4
No. of female births	4	3	2	1	0
No. of families	32	178	260	236	94

Q.125 A survey of 320 families with 5 children shows the following distribution:-

Number of Boys & Girls	5 boys 0 girls	4 boys 1 girls	3 boys 2girls	2 boys 3 girls	1 boys 4 girls	0 boys 5 girls	Total
Number of Families	18	56	110	88	40	8	320

Given that χ^2 for 5 degree of freedom are 11.1 and 15.1 at 0.05 and 0.01 significance level respectively, test the hypothesis that male and female births are equally probable.

Q.126A die is thrown 90 times and the number of faces shown are as indicated below:

Faces	1	2	3	4	5	6
Frequency	18	14	13	15	14	16

Test whether the die is fair. (Given $\chi_5 = (.05) = 11.07$)

Q.127 Given the following information about two samples drawn from two normal population:
$n_1 = 8$, $\sum(x-\bar{x})^2 = 94.5$, $n_2 = 10$ & $\sum(y-\bar{y})^2 = 101.7$.
Test the equality of two popular variances .(Given $F_{7,9}(.05) = 3.29$.

Q.128 What is time series analysis? Explain the objectives of analysis of a time series. Why is time-series analysis important in Technology?

Q.129 Distinguish between p-chart , np – chart and c-chart of statistical quality control.

Q.130 Discuss advantages and disadvantages of moving average method used for estimation of trend values.

Q.131 Write short notes on the following:

a) Fourth order Runge-Kutta method for solving O.D.E.
b) Moving Averages
c) Multiple Regressions
d) Representation of floating point numbers
e) Frequency charts of statistical documentation
f) Statistical quality control charts
g) Hermite's interpolation
h) Forecasting models and methods
i) F-test and t-test
j) Chi – square test
k) ANOVA
l) Statistical quality control method