MCKV Institute of Engineering

Paper Code: BS-M404

Numerical Methods

Time Allotted: 1 Hour | *Full Marks: 30*

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1.Choose the correct alternatives for any ***five*** of the following: 5×1

(i) The number of significant digits in 1.00234 is

(a) 4
(b) 6
(c) 3
(d) 5

(ii) The ratio of absolute error and the true value is called

(a) relative error
(b) truncation error
(c) percentage error
(d) inherent error

(iii) Which of the following relations is true?

(a) $E = 1 + \Delta$
(b) $E = 1 - \Delta$
(c) $E = \Delta - 1$
(d) $E = \Delta + 2$

(iv) If a be the actual value, e be its estimated value, the formula for relative error is

(a) $\frac{a}{e}$
(b) $\frac{|a-e|}{e}$
(c) $\frac{a-e}{a}$

(d) $\left|\frac{n-r}{n}\right|$

(v) The expression for $\Delta^3 y_0$, the symbol Δ has its usual meaning, is

(a) $y_3 - 3y_2 + 3y_1 - y_0$
(b) $y_2 - 2y_1 + y_0$
(c) $y_3 + 3y_2 + 3y_1 + y_0$
(d) None of these

(vi) First order forward difference of a constant is

(a) 0
(b) 1
(c) 2
(d) 3

Group – B

(Short Answer Type Questions)

Answer any *two* of the following 2×5

(2) The approximate values of the number 1/3 are given as 0.30,0.33,0.34. Which of these is the best approximation ?

(3) Find $y(32)$ when $y(10) = 35.3, y(15) = 32.4, y(20) = 29.2, y(25) = 26.1, y(30) = 23.2, y(35) = 20.5$?

(4) . Show that $\Delta log f(x) = \log\left[1 + \frac{\Delta f(x)}{f(x)}\right]$

Group – C

(Long Answer Type Questions)

Answer any *one* of the following 1×15

(5)

(a) Find by Lagrange's formula the interpolation polynomial from the following data **(7+8)**

X	-1	0	2	5
y	9	5	3	15

(b) Find $sin32°$ by using suitable interpolation formula from the following table:

X	30	35	40	45	50	55
sinx	0.5000	0.5736	0.6428	0.7071	0.7660	0.8192

(6) **(5+5+5)**

Prove that $f[x_0, x_1, x_2] = 1$ if $f(x) = x^2$, where x_0, x_1, x_2 are distinct.

(b) Show that $\Delta.\nabla = \Delta - \nabla$

(c) By using the Newton-Gregory formula find $y(6)$, *where* $y(0) = -1, y(1) = 3, y(2) = 8, y(3) = 13$

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Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *five* of the following: 5×1

(i) One root of the equation $x^2 + 2x - 2 = 0$ lies between

(a) 0 and 0.5
(b) 0.5 and 1
(c) 1 and 1.5
(d) 1.5 and 2

(ii) According to Newton-Raphson method, the algorithm for iterates $x_{n+1} (n = 0,1,2, \ldots)$ is

(a) $x_{n+1} = x_n + \frac{f(x_n)}{f'(x_n)}$
(b) $x_{n+1} = x_n + \frac{f'(x_n)}{f(x_n)}$
(c) $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$
(d) $x_{n+1} = x_n - \frac{f'(x_n)}{f(x_n)}$

(iii) Newton-Raphson method fails when

(a) $f'(x) = 1$
(b) $f'(x) = 0$
(c) $f'(x) = -1$
(d) $f''(x) = 0$

(iv) If $f(x)$ is continuous in the interval $[a, b]$ and if $f(a)$ and $f(b)$ are of opposite signs, then there is

(a) at least one real roots of $f(x) = 0$ between a and b
(b) at most one real root of $f(x) = 0$ between a and b
(c) there will be no real roots of $f(x) = 0$ between a and b
(d) None of these

(v) . If $\frac{dy}{dx} = x + y$ and $y(1) = 0$, then $y(1.1)$ according to Euler's method $[h = 0.1]$

(a) 0.1
(b) 0.3
(c) 0.5
(d) 0.9

(vi) If $\int_0^1 \frac{dx}{1+x^2} = 0.7854$ then the value of π, correct up to 3 significant figures, is

(a) 3.14
(b) 3.15
(c) 3.141
(d) 3.142

Group – B

(Short Answer Type Questions)

Answer any ***two*** of the following 2×5

(2) Solve by using Euler's method the differential equation for $x = 1, \frac{dy}{dx} = xy, y = 1$when $x = 0$

(3) Calculate the value of $\int_{1.2}^{1.6} \left(x + \frac{1}{x}\right) dx$ *correct upto* 3 *significant* figures, What by the Trapezoidal rule, taking 4 intervals

(4) Evaluate $\sqrt{12}$ correct up to 3 decimal places,using Newton-raphson method

Group – C

(Long Answer Type Questions)

Answer any ***one*** of the following 1×15

(5) (a) Evaluate $\int_0^1 xe^x dx$ *by* using Trapezoidal rule taking n=6 (7+8)

(b) Find the positive root of the equation $x^3 - 3x + 1.06 = 0$, by the bisection method, correct up to 3 decimel figures

(6) (a) Using Newton-Raphson method to find the cube root of 17. (6+9)

(b) Using Euler's method $\frac{dy}{dx} = \frac{y-x}{y+x}$ with initial condition $y = 1$ *at* $x = 0$ find y *for* $x = 0.1$, correct upto 4 decimal places taking step length $h = 0.02$

1·2
1·6 4n 0·1 h.

0·761
0·468
0·187.

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Paper Code : BS-M404

Paper Name : Numerical Methods

Time Allotted: 1 Hour ***Full Marks: 30***

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Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***five*** of the following: 5×1=5

(i) Newton-Raphson method fails when

(a) $f'(x) = 1$
(b) $f'(x) = 0$
(c) $f'(x) = -1$
(d) $f''(x) = 0$

(ii) The number of significant figures in 0.002501 is

(a) 3
(b) 4
(c) 6
(d) 7

(iii) The expression for $\Delta^3 y_0$, the symbol Δ has its usual meaning, is

(a) $y_3 - 3y_2 + 3y_1 - y_0$
(b) $y_2 - 2y_1 + y_0$
(c) $y_3 + 3y_2 + 3y_1 + y_0$
(d) None of these

(iv) Lagrange's interpolation formula deals with

(a) equi-spaced arguments only
(b) unequi-spaced arguments only
(c) both (a) and (b)
(d) None of these

(v) In bisection method, x_{n+1} is the

(a) arithmetic mean of a_n and b_n
(b) geometric mean of a_n and b_n
(c) harmonic mean of a_n and b_n
(d) None of these

(vi) Newton-Raphson method is

(a) analytical method
(b) graphical method
(c) iterative method
(d) None of these

Group – B

(Short Answer Type Questions)

Answer any ***two*** of the following 2×5=10

(2) Evaluate $\sqrt{12}$ correct up to 3 decimal places,using Newton-Raphson method. (CO3, Apply, HOCQ)

(3) If $y_0 = 3, y_1 = 12, y_2 = 81, y_3 = 2000, y_4 = 100$ then find $\Delta^4 y_0$ (CO3, Apply, HOCQ)

(4) Find the value of $\frac{\Delta^2}{E} x^3$ when $h = 1$ (CO1, Apply, HOCQ)

Group – C

(Long Answer Type Questions)

Answer any ***one*** of the following 1×15=15

(5)

(a) Find the absolute error, relative error, percentage error if 5/3 is approximated to 1.6667 (CO1,Apply,HOCQ)

(b) Apply Lagrange's interpolation formula to find $f(x)$ at $x = 5$,if $f(1) = 2, f(2) = 4, f(3) = 3, f(4) = 16, f(7) = 128$ (CO3,Apply,HOCQ)

5+10

(6)

(a) Find the root of the equation $x^3 - 3x + 1.06 = 0$,by the bisection method. (CO3, Apply, HOCQ)

(b) Apply suitable Interpolation formula to find $f(1.02)$, when $f(x)$ takes the following data:

x	1.00	1.10	1.20	1.30
f(x)	0.8415	0.8912	0.9320	0.9636

(CO3, Apply, HOCQ)

9+6

Rough

SUBHAM

MCKV Institute of Engineering

Paper Code :BS-M404

Paper Name:Numerical Methods

Time Allotted: 1* Hour** ***Full Marks: 30

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Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***five*** of the following: 5×1=5

(i) If $\frac{dy}{dx} = x + y$ and $y(1) = 0$, then $y(1.1)$ according to Euler's method $[h = 0.1]$
(a) 0.1
(b) 0.3
(c) 0.5
(d) 0.9

(ii) If $\int_0^1 \frac{dx}{1+x^2} = 0.7854$ then the value of π, correct up to 3 significant figures, is
(a) 3.14
(b) 3.15
(c) 3.141
(d) 3.142

(iii) An $n \times n$ matrix A is said to be diagonally dominant if
(a) $|a_{ii}| \leq \sum_{\substack{i,j=1 \\ i \neq j}}^{n} |a_{ij}|$
(b) $|a_{ii}| < \sum_{\substack{i,j=1 \\ i \neq j}}^{n} |a_{ij}|$
(c) $|a_{ii}| > \sum_{\substack{i,j=1 \\ i \neq j}}^{n} |a_{ij}|$
(d) *none of these*

(iv) The iterative method to solve a system of equations is
(a) Gauss-elimination
(b) Gauss-Jordon
(c) Gauss-Seidel
(d) None of these

(v) A boundary value problem is solved by
(a) Newton-Raphson method
(b) Finite difference method
(c) Predictor-corrector method
(d) Secant method

(vi) The error involved in Euler's method is of
(a) $O(h)$
(b) $O(h^2)$
(c) $O(h^3)$
(d) $O(h^4)$

Group - B

(Short Answer Type Questions)

Answer any ***two*** of the following 2×5=10

(2.) Find $y(1.1)$ using Runge-Kutta method of 4th order ,given that $\frac{dy}{dx} = y^2 + xy, y(1) = 1$

(C0-3/APPLY/IOCQ/5)

(3) Fit a curve of the form$y = ae^{bx}$ to the following data, considering x as an independent variable :

X	2	4	6	8	10
Y	4	11	30	82	223

(C0-4/APPLY/HOCQ/6)

(4) Solve by Gauss-Seidel method up to 2nd iteration of the following equations:

$$x + y + 54z = 110, 27x + 6y - z = 85, 6x + 15y + 2z = 72$$

(C0-3/APPLY/HOCQ/5)

Group – C

(Long Answer Type Questions)

Answer any ***one*** of the following 1×15=15

(5.) (a) Compute $y(0.4)$ by Milne's Predictor-Corrector Method from the equation

$\frac{dy}{dx} = 4yy(0) = 1, y(0.1) = 1.492, y(0.2) = 2.226, y(0.3) = 3.320$ **(C0-3/APPLY/HOCQ/6)**

(b) Fit a curve of the form$y = ax + bx^2$ to the following data, considering x as an independent variable

x	1	2	3	4	5
y	3	5	6	7	9

(C0-4/APPLY/IOCQ/5)

(c) Evaluate $\int_0^1 x(1+x)dx$ by taking 6 equal sub-intervals. **(C0-3/APPLY/IOCQ/4)**

(6) (a) Solve the following system by matrix inversion method:

$$2x + 5y + 3z = 9, 3x + y + 2z = 3, x + 2y - z = 6$$

(C0-3/APPLY/IOCQ/7)

(b) Using the finite difference method solve the boundary value problem: $\frac{d^2y}{dx^2} = y$ with $y(0) = 0, y(2) = 3.63$ taking h=0.5

(C0-3/APPLY/HOCQ/8)

MCKV Institute of Engineering

Paper Code: BS-M404

Numerical Methods

Time Allotted: **3 Hours** *Full Marks:* **70**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***ten*** of the following: 10×1=10

(i) The number of significant digits in 0.10378 is

(a) 4 (b) 5 (c) 6 (d) 3

(ii) First order forward difference of a constant is

(a) 0 (b) 1 (c) 2 (d) 3

(iii) In interpolation, the value of x lies

(a) between smallest and larger value of x (b) outside the range of max. and min. values of x

(c) may be anything (d) half of the smallest and largest value of x

(iv) Lagrange's interpolation formula deals with

(a) equi-spaced arguments only (b) unequi-spaced arguments only

(c) both (a) and (b) (d) None of these

(v) Evaluating $\int_a^b f(x)\,dx$, the error in Trapezoidal rule In is of order

(a) h^2 (b) h^3 (c) h^4 (d) h

(vi) In Trapezoidal rule, if the interval of the integration $\int_2^9 f(x)\,dx$ is divided into equal subintervals taking 8 ordinates, the length of each subinterval is

(a) 0.5 (b) 1 (c) 1.5 (d) 2

(vii) A first order ordinary differential equation is solved by

(a) Runge-Kutta method (b) Gauss elimination method

(c) Regula-Falsi method (d) Trapezoidal rule

(viii) The order of convergence of bisection method is

(a) 1 (b) 1.62 (c) 2 (d) 3

(ix) Regula-Falsi method is

(a) conditionally convergent (b) always convergent

(c) non-convergent (d) None of these

(x) Newton-Raphson method fails when

(a) $f'(x) = 1$ (b) $f'(x) = 0$ (c) $f'(x) = -1$ (d) $f''(x) = 0$

(xi) A matrix A can be factorized into lower and upper triangular matrices if all the principal minors of A are

(a) non-singular (b) singular (c) null (d) None of these

(xii) Iterative method is convergent for $x = \phi(x)$ if

(a) $|\phi'(x)| = 1$ (b) $|\phi'(x)| > 1$ (c) $|\phi'(x)| < 1$ (d) None of these

Group – B

(Short Answer Type Questions)

Answer any ***three*** of the following **3×5=15**

2. Calculate the value of $\int_{1.2}^{1.6} \left(x + \frac{1}{x}\right) dx$ correct upto 3 significant figures, by the Trapezoidal rule, taking 4 intervals

3. Compute y(0.4) from the equation $\frac{dy}{dx} = x - y$, y(0) = 1 , taking h = 0.2 , by Euler's Method (correct to 3 decimal places).

4. Find the mean and the standard deviation of the first n natural numbers.

5. Solve the system of liner equation by using Gauss-Seidel method upto 2nd iteration correct upto 4 decimal places: $5x - 2y + z = -4, x + 6y - 2z = -1, 3x + y + 5z = 13$

6. Fit a straight line to the following table, considering x as an independent variable:

x	0	2	4	6	8
y	10	12	14	16	18

Group – C

(Long Answer Type Questions)

Answer any ***three*** of the following **3×15=45**

7.(a) Solve the following system of equations by the LU factorization method:

$$2x - 6y + 8z = 24, 5x + 4y - 3z = 2, 3x + y + 2z = 1$$

(b) Solve the following system by the matrix inversion method:

$$2x + 5y + 3z = 9, 3x + y + 2z = 3, x + 2y - z = 6$$ 8+7

8. (a)The arithmetic mean calculated from the following frequency distribution is known to be 67.42 inches. Find the value of unknown frequency f_3

Height(in inches)	60 – 62	63 – 65	66 – 68	69 – 71	72 – 74
Frequency	15	54	f_3	81	24

(b) Calculate the median and mode of the following frequency distribution:

Height(in inches)	56 – 60	61 – 65	66 – 70	71 – 75	76 – 80
no of persons	7	25	43	28	7

9. (a) Using Newton-Raphson method find the cube root of 17

(b) Find the root of the equation $3x - cosx - 1 = 0$ that lies between 0 and 1 correct up to 3 decimal places using bisection method. 6+9=15

10.a) Find the missing term in the following table:

X	0	1	2	3	4	5
y	0	?	8	15	?	35

b) Find the positive root of the equation $x^3 - 3x + 1.06 = 0$, by Regula-Falsi method, up to 4^{th} iteration correct up to 3 decimal places.

8+7=15

11.a) Find the polynomial by using Newton's divided difference formula $f(-1) = 21, f(1) = 15, f(2) = 12, f(3) = 3$

b) Using Taylor's method to solve $\frac{dy}{dx} = -2y$ with y (0) = 1.

c) Use Lagrange's interpolation formula to compute f(3) from the following data :

x :	1	2	4	5	6
f(x) :	2	4	8	16	128

5+5+5=15