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CT/LT/TT/APM/EVEN/SEM-4/M(CS)-401/2015-16



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : M(CS)-401

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 : $10 \times 1 = 10$
- i) The number 3.4506531 when rounded off to 4 places of decimal will give
- a) 3.4506 b) 3.4507
c) 3.451 d) none of these.
- ii) Lagrange's Interpolation formula is used for
- a) Equally spaced arguments
b) Unequally spaced arguments
c) Both equally and unequally spaced arguments
d) none of these.

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TT/APM/EVEN/SEM-4/M(CS)-401/2015-16

- iii) In the Newton's Forward Interpolation formula, the value of $u = \frac{x - x_0}{h}$ lies between
- a) 0 & 1 b) - 1 & 0
c) - 1 & 1 d) 5 & 0.
- iv) $\Delta^3(y_0)$ may be expressed as which of the following terms ?
- 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.
- v) Trapezoidal rule can be applied if the number of equal subintervals of the interval of integration is
- a) odd b) even
c) both d) none.
- vi) Regula Falsi Method is
- a) conditionally convergent
b) divergent
c) linearly convergent
d) none to these.
- vii) The n -th order divided difference of a polynomial of degree n is
- a) 0 b) constant
c) 1 d) -1.

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/TT/APM/EVEN/SEM-4/M(CS)-401/2015-16

viii) Runge-Kutta formula has a truncation error which is of order

- a) h^2 b) h^3
c) h^4 d) h^5 .

ix) Let $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 1 & 3 \\ 2 & 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & 3 \\ 2 & 2 & 4 \\ 9 & 8 & 7 \end{bmatrix}$

Consider the following two statements :

S1 : LU decomposition for the matrix A is possible

S2 : LU decomposition for the matrix B is not possible

- a) Both S1 and S2 are true
b) only S1 is true
c) only S2 is true
d) neither S1 nor S2 is true.

x) Newton-Raphson method for solution of the equation $f(x) = 0$ fails when

- a) $f'(x) = 1$ b) $f'(x) = 0$
c) $f'(x) = -1$ d) none of these.

xi) Which of the following does not always guarantee convergence ?

- a) Bijection method
b) Newton-Raphson method
c) Regula-falsi method
d) none of these.

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xii) Choose the correct alternative :

- a) $E = 1 + \Delta$ b) $E = 1 - \Delta$
c) $E = 1/\Delta$ d) None of these.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. Find $f(5)$ using Newton's Divide difference formula, for the following data :

X	0	2	3	4	7	8
f(x)	4	26	58	112	466	668

3. Solve by Gauss Elimination method :

$$x - 2y + 9z = 8$$

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

$$2x - 8y + z = -5$$

4. Calculate by Simpson's one third rule the value of the integral $\int_0^1 \frac{x dx}{1+x}$ corrected up to three significant figures.

5. Find a real root of the equation $xe^x - 2 = 0$ correct to three decimal places using Newton-Raphson method.

6. Evaluate $y(0.02)$ given $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$ by modified Euler's method.

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/TT/APM/EVEN/SEM-4/M(CS)-401/2015-16

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

- a) Find the value of $\int_1^5 \log_{10} x \, dx$ taking eight equal sub-intervals correct up to 4-decimal places by (i) Simpson 1/3 rule (ii) Trapezoidal rule and then compare the result. $3 + 3 + 1$

- b) Solve by Gauss-Seidel iterative method :

$$3y - 2z = 3$$

$$2x - y + 4z = 27$$

$$4x - y - 3z = 3$$

correct up to four significant figure. 8

- a) Solve the system of linear equations by LU factorization method :

$$2x - 6y + 8z = 24; \quad 5x + 4y - 3z = 2;$$

$$3x + y + 2z = 16.$$

- b) Find the polynomial $f(x)$ and hence find the $f(5.5)$ from the given data :

x	0	2	3	5	7
$f(x)$	1	47	97	251	477

$8 + 7$

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9. a) Compute $f(0.23)$ and $f(0.29)$ using suitable formula from the table below :

$$x: 0.20 \quad 0.22 \quad 0.24 \quad 0.26 \quad 0.28 \quad 0.30$$

$$f(x): 1.6596 \quad 1.6698 \quad 1.6804 \quad 1.6912 \quad 1.7024 \quad 1.7139$$

- b) Solve the equation $\frac{dy}{dx} = \frac{1}{x+y}$, $y(0) = 1$, for $y(0.1)$ and $y(0.2)$, using Runge-Kutta method of the fourth order.

- c) Show that $(1 + \Delta)(1 - \nabla) = 1$. $6 + 5 + 4$

10. a) Find by the method of Regula-Falsi, a positive root of $x^2 + 2x - 2 = 0$ correct up to three decimal places.

- b) Apply Finite difference method to solve the equation $\frac{d^2y}{dx^2} = 3x + 4y$, subject to the conditions $y(0) = 0$, $y(1) = 1$ by taking the mesh length $h = \frac{1}{4}$.

$7 + 8$

11. a) Use Lagrange's inverse interpolation formula to find the value of x when $y = 0.143$ from the following data :

x	1	2	4	5	8
y	1.000	0.500	0.250	0.200	0.125

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- b) Find the positive real root of $x + \ln x = 2$ by Newton-Raphson method, correct to six significant figures.
- c) Using Bisection method obtain a root between 1 and 2 of the equation $e^x - 3x = 0$. 5 + 5 + 5
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