# বিদ্যাসাগর বিশ্ববিদ্যালয়
# VIDYASAGAR UNIVERSITY

## Question Paper

## B.Sc. Honours Examinations 2020
**(Under CBCS Pattern)**
## Semester - III
## Subject: MATHEAMATICS
**Paper: C7T**

**Full Marks : 60**
**Time : 3 Hours**

*Candiates are required to give their answer in their own words as far as practicable.*
*The figures in the margin indicate full marks.*

**THEORY [Marks 40]**

Answer any ***two*** from the following questions : 2×20

1. (a) Explain Newton-Raphson method to solve the equation $g(x)=0$. 6

   (b) Find the rate of convergence of Newton-Raphson method. 7

   (c) Find a real root of the equation $f(x)\equiv x^3-2x-5=0$ lies between 2 and 3 by Resula-Falsi method. 7

2. (a) Discuss Gauss-elimination method to slove the system of linear equation. 8

(b) Solve the folloiwng equation by Gauss-elimination method. 8

$2x_1 + x_2 + x_3 = 4$

$x_1 - x_2 + 2x_3 = 2$

$2x_1 + 2x_2 - x_3 = 3$

(c) State the differences between direct and iterative methods. 4

3. (a) Find an LU- decomposition of the matrix $A = \begin{bmatrix} 2 & 7 & 5 \\ 6 & 20 & 10 \\ 4 & 3 & 0 \end{bmatrix}$ and use it to solve the system $Ax = \begin{bmatrix} -3 \\ -12 \\ 6 \end{bmatrix}$ where $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$. 10

(b) Deduce Lagrange interpolation method. 10

4. (a) Describe Euler's method and modified Enler's method to solve the following differential equation

$$\frac{dy}{dx} = f(x, y), \quad y(x_0) = y_0$$ 10

(b) Given $\frac{dy}{dx} = x^2 + y^2$, and when $x = 0, y = 1$. Find the values of $y(0.1)$ by fourth order Runge-Kutta method. 10

**PRACTICAL [Marks 20]**

**Group - A**

Answer any ***one*** from the following questions : 1×10

Each question carries 10 marks.

1. Write a program to evaluate $\int_{12}^{3}(x\log 2x+\sin 2x)dx$ by trapezoidal rule taking 140 subintervals.

2. Write a program to find the value of $y(0.1)$ from the differential equation

   $\frac{dy}{dx}=x^2+y,\ y(0.1)=1.$

3. Write a program to find the sum of the following series $1+\frac{1}{2}+\frac{1}{3}...+\frac{1}{10050}$.

4. Write a program to find a root of the equation $x^3-2x-1=0$ by bisection method.

5. Write a program to solve the equation $2x-\sin x-1=0$ using fixed point iteration method.

6. Write a program to find a real root of $x^5+3x^2-1=0$ by Newton-Raphosn method.

7. Write a program to compute $\int_0^{\frac{\pi}{2}}\sin x\,dx$ by using Simpson's $\frac{1}{3}$ rule with 200 sub intervals.

8. Evaluate the integral $\int_{0.4}^{1.6}\frac{x}{\sin x}dx$ by weddle's rule by taking 120 sub-intervals.

9. Given $y'=3x+y^2,\ y(1)=1.2,\ h=0.1$. Find $y(1.8)$ R-K method of four order.

10. Write a program to find a root of the equation $x\sin x-1=0$ by secant method.

11. Using iterative formula to compute $\sqrt[7]{125}$. Correct to five significant digits.

12. Find a real root of the equation $\log x = \cos x$ uisng Regula-falsi method. Correct to three significant figures.

13. Fit a linear curve to the data

| $X$ | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|
| $y$ | 13.72 | 12.90 | 12.01 | 11.14 | 10.31 |

14. If the prescribed curve be $f(x) = a + \beta x + \gamma x^2$, estimate $\alpha, \beta$ and $\gamma$ by least square method from the following data.

| $X$ | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| $y$ | 3.97 | 12.85 | 31.47 | 37.38 | 91.29 |

15. Write a program to compute $\int_1^2 \sqrt{\frac{x^2-1}{x}}dx$ by using Simpson's $\frac{1}{6}$ rule using 1000 sub-intervals.

## Group - B

Answer any ***one*** from the following questions : 1×10

Each question carries 10 marks.

16. Evaluate $\int_0^{0.5} e^x dx$ by five-point Gaussian quadrature.

17. Solve the following system of linear equations by LU decomposition method :

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

18. Apply Newton's backward difference formula to obtain the value of $y$ at $x = 1.2$ using the following table.

| $X$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $f(x)$ | 1 | 1.5 | 2.2 | 3.1 | 4.3 |

19. Use Lagrange's interpolation formula to find $f(x)$ when x = 0 from the following table

| $X$ | –1 | –2 | 2 | 4 |
|---|---|---|---|---|
| $f(x)$ | –1 | –9 | 11 | 69 |

20. Solve the following system of equations by Gaussian elimination method.

$3x+2y+z=10,\quad 2x+3y+2z=14,\quad x+2y+3x=14$

21. Solve the following by Eyler's modified method.

$\frac{dy}{dx}=\log(x+y),\ y(0)=2$, at $x=1.4$ with $h=0.2$

22. Solve the following system by Gauss Seidal method.

$20x+5y-2z=14,\ 3x+10y+z=17,\ x-4y+10z=23$

23. Solve the following systems of equation by Gauss-Jacobi's iteration mehtod.

$4x+0.24y+0.08z=8, 0.09x+3y-0.15z=9, 0.04x-0.08y+4z=20$

24. Find by power method, the numerically largest eigen value and the corresponding eigen vector of the following matrix :

$$\begin{bmatrix} 1 & 3 & 2 \\ -1 & 0 & 2 \\ 3 & 4 & 5 \end{bmatrix}$$

25. Find the value of $e^x$ when $x=0.612$ using Newton's forward difference method.

| $X$ | 0.61 | 0.62 | 0.63 | 0.64 | 0.65 |
|---|---|---|---|---|---|
| $f(x)$ | 1.840431 | 1.858928 | 1.877610 | 1.896481 | 1.915541 |

26. The distance (d) that a car has travelled at time (t) is given below :

| Time (t) | 0 | 2 | 0.63 | 0.64 | 0.65 |
|---|---|---|---|---|---|
| Distance (d) | 0 | 40 | 160 | 300 | 380 |

27. Evaluate $y(0.02)$ given $y' = x^2 + y, y(0) = 1$ by modified Euler's method.

28. Write a program to find the value of $y(0.1)$ from the differential equation

$\frac{dy}{dx} = x + y + 100, x(0) = 1.2$ by fourth order Runge Kutta method.

29. If $f(0) = 1$, $f(0.1) = 0.9975$, $f(0.2) = 0.9900$, $f(0.3) = 0.9800$ and hence find $f(0.05)$ using Newton's forward formula.

30. Given $\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2,.8182$, $\log_{10} 659 = 2.8189$, $\log_{10} 661 = 2.8202$, find $\log_{10} 656$ using Newton's forward formula.

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