

**SIXTH SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT)
EXAMINATION, MARCH 2017**

(UG-CCSS)

Mathematics

MM 6B 11—NUMERICAL METHODS

Time : Three Hours

Maximum : 30 Weightage

Part I

*Answer all twelve questions.
Each question carries $\frac{1}{4}$ weightage.*

1. The backward difference $\nabla y_n =$ _____.
2. A real root of the equation $x^3 - x - 1 = 0$ lies in the interval _____.
3. Write Newton Raphson formula.
4. Write the relation connecting forward difference operator Δ and shift operator E .
5. $\frac{1}{2} (E^{\frac{1}{2}} + E^{-\frac{1}{2}}) =$ _____.
6. Write Newton's forward difference interpolation formula.
7. Define Trapezoidal rule.
8. Define the characteristic polynomial of a square matrix A .
9. If the eigen values of the matrix A are $-2, 4, 6$. Then the order A is _____.
10. Write Taylor's series for $y(x)$ around $x = x_0$.
11. Let $x_i = -1, 0, 3, 6$ and $y_i = 3, -6, 39, 45, i = 0, 1, 2, 3$. Then the divided difference $|x_0, x_1|$ is _____.
12. The process of finding the value of x for a certain value of y is called _____.

(12 \times $\frac{1}{4}$ = 3 weightage)

Part II

*Answer all nine questions.
Each question carries 1 weightage.*

13. Find the forward difference table for the following values : $y(1) = 24, y(3) = 120, y(5) = 336, y(7) = 720$.
14. Show that $e^x \left(u_0 + x\Delta u_0 + \frac{x^2}{2} \Delta^2 u_0 + \dots \right) = u_0 + u_1 x + u_2 \frac{x^2}{2} + \dots$
15. Write Gauss forward formula.

Turn over

16. If $y_1 = 4, y_3 = 12, y_4 = 19$ and $y_x = 7$, find x .

17. Find the characteristic polynomial of the matrix $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$.

18. If $A = \begin{bmatrix} 2 & 0 \\ 3 & 1 \end{bmatrix}$ then the spectral radius is _____.

19. What is $y(0.01)$ for the equation $\frac{dy}{dx} + y = 0$ with $y(0) = 1$ using Euler's method.

20. Define central difference operator δ .

21. Find the sum of eigen values of a matrix whose characteristic equation $\lambda^2 - 2\lambda - 3 = 0$.

(9 × 1 = 9 weightage)

Part III

Answer any five questions.

Each question carries 2 weightage.

22. Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$ using the method of False Position.

23. Find the missing term in the following table :—

x :	0	1	2	3	4
y :	1	3	9	—	81

24. Evaluate $I = \int_0^6 \frac{1}{1+x} dx$ using Simpson's 3/8 rule.

25. Determine the largest eigen value and the corresponding eigen vector of the matrix :

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

26. Given $\frac{dy}{dx} = 1 + y^2$, where $y(0) = 0$. Find $y(0.2)$ by Runge-Kutta method.

27. Given the differential equation $\frac{dy}{dx} = \frac{x^2}{y^2 + 1}$ with the initial condition $y = 0$ when $x = 0$. Use Picard's method to obtain y for $x = 0.25$.

28. Certain values of x and $\log_{10}x$ are (300, 2.4771), (304, 2.4829), (305, 2.4843), (307, 2.4871). Find $\log_{10}301$ by Newton's divided difference method.

(5 × 2 = 10 weightage)

Part IV

Answer any two questions.

Each question carries 4 weightage.

29. Solve the equations $2x + 3y + z = 9$, $x + 2y + 3z = 6$, $3x + y + 2z = 8$ by LU decomposition. From the following table of values of x and y , obtain $\frac{dy}{dx}$ for $x = 1.2$.

30. The population of a certain town is given below. Find the rate of growth of the population in 1931 :

Year	:	1931	1941	1951	1961	1971
Population (in lakhs)	:	40.62	60.80	79.95	103.56	132.65

31. Determine the value of y when $x = 0.1$ and $x = 0.2$ modified Euler's method. Given that $y(0) = 0$ and $\frac{dy}{dx} = 1 - y$.

(2 × 4 = 8 weightage)