C 21564 (Pages : 3) Name..................................

Reg. No..................................

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 ¼ weightage.

1. The bookward 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. $\frac{1}{2}\left(E^{\frac{1}{2}} + E^{-\frac{1}{2}}\right) =$ ————.
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 × ¼ = 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 $e^x\left(u_0 + x\Delta u_0 + \frac{x^2}{2}\Delta^2 u_0 + \ldots\right) = u_0 + u_1 x + u_2\frac{x^2}{2} + \ldots$.
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)