

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH 2019

(CUCBCSS)

Mathematics

MAT 6B 11—NUMERICAL METHODS

Time : Three Hours

Maximum : 120 Marks

Section A*Answer all the twelve questions.**Each question carries 1 mark.*

1. Give an example of a transcendental function.
2. What do you mean by complete pivoting ?
3. What is the advantage of Gauss Jordan method over Gauss Elimination method ?
4. Write Newton's forward difference interpolation formula.
5. Write Lagrange's interpolation formula of degree n .
6. State Trapezoidal rule.
7. What is meant by ill-conditioned system of equations ?
8. What is a differential equation ?
9. Find the degree and order of differential equation $y^1 + ay^2 = 0$.
10. What is interpolation ?
11. What is homogeneous equation ?
12. Give an example of linear function.

(12 × 1 = 12 marks)

Section B*Answer any ten out of fourteen questions.**Each question carries 4 marks.*

13. Use the method of fixed point iteration to find a positive root, between 0 and 1, of the equation $xe^x = 1$.
14. Find a real root of the equation $f(x) = x^3 - x - 1 = 0$.
15. Evaluate $e^{1.24}$, given that $e^{1.1} = 3.0042$ and $e^{1.4} = 4.0552$.
16. State Simpson's 1/3rd rule.

Turn over

17. Explain the limitations of using Newton-Raphson's method.
18. Construct a divided difference table for 4 data points.
19. State the formula of Picard's method to solve the differential equation of type $dy/dx = f(xy)$.
20. Comment the accuracy of Euler's method.
21. What is triangularisation of equations ?
22. State the second order Newton's divided difference interpolation polynomial.
23. What are the limitations of Taylor's series method.
24. Write the fourth order Runge-Kutta formula.
25. By the matrix inversion method solve :

$$2x + y = 1$$

$$x + 3y = 2.$$

26. What is the difference between Gauss elimination and Gauss-Jordan method ?

(10 × 4 = 40 marks)

Section C

Answer any **six** out of nine questions.

Each question carries 7 marks.

27. Solve the system by using Gauss-Jordan method.

$$2x_1 + 4x_2 - 6x_3 = -8$$

$$x_1 + 3x_2 + x_3 = 10$$

$$2x_1 - 4x_2 - 2x_3 = -12.$$

28. Using linear interpolation formula estimate the square root of 2.5 :

X	:	1	2	3	4	5
\sqrt{x}	:	1	1.4142	1.7321	2	2.2361

29. The table below gives the values of distance travelled by a car at various time intervals during the initial running :

Time (s)	:	5	6	7	8	9
Distance (km)	:	10	14.5	19.5	25.5	32

Estimate velocity at time $t = 5$, $t = 7$ and $t = 9$.

30. Evaluate the $\int_a^b x^3 + 1$ by using Trapezoidal rule for the (1, 2) and (1, 1.5).
31. Use Taylor's method to solve the equation $y' = x^2 + y^2$ for $x = 0.25$ and $x = 0.5$ given $y(0) = 1$.
32. Obtain a polynomial using Lagrange formula :

x	:	0	1	2	3
$e^x - 1$:	0	1.7183	6.3891	19.0855

Use the polynomial to estimate the value of $e^{1.5}$.

33. Find the root of the equation $x^2 - 3x + 2$ in the vicinity of $x = 0$ using Newton's Raphson method.
34. Explain the principle of false position method.
35. Given the equation $dy/dx = 3x^2 + 1$ with $y(1) = 2$. Find $y(2)$ by Euler's method using $h = 0.5$ and $h = 0.25$.

(6 × 7 = 42 marks)

Section D

Answer any **two** out of three questions.
Each question carries 13 marks.

36. (a) Use bisection method to find the root of the equation $x^2 - 4x - 10 = 0$.
- (b) Use false position method to determine the root of the equation $f(x) = x^2 - x - 2 = 0$ in the range $1 < x < 3$.
37. (a) Solve the system by using Gauss-Seidel method :

$$\begin{aligned} 2x_1 + x_2 + x_3 &= 5 \\ 3x_1 + 5x_2 + 2x_3 &= 15 \\ 2x_1 + x_2 + 4x_3 &= 8. \end{aligned}$$

- (b) Solve the system by using Triangular factorization method :

$$\begin{aligned} 3x_1 + 2x_2 + x_3 &= 10 \\ 2x_1 + 3x_2 + 2x_3 &= 14 \\ x_1 + 2x_2 + 3x_3 &= 14. \end{aligned}$$

38. Use Runge-Kutta method to estimate $y(0.4)$ when $y'(x) = x^2 + y^2$ with $y(0) = 0$ and assume $h = 0.2$.

(2 × 13 = 26 marks)