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.

$(12 \times 1 = 12$ 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 $e^{1.4} = 4.0552$.

Turn

16. State Simpson's $1/3^{rd}$ rule.

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 ?

$$(10 \times 4 = 40 \text{ marks})$$

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 :
$$2x_1 + x_2 + x_3 = 5$$
$$3x_1 + 5x_2 + 2x_3 = 15$$
$$2x_1 + x_2 + 4x_3 = 8.$$

    (b) Solve the system by using Triangular factorization method :
$$3x_1 + 2x_2 + x_3 = 10$$
$$2x_1 + 3x_2 + 2x_3 = 14$$
$$x_1 + 2x_2 + 3x_3 = 14.$$

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)