K19U 0123

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.) Examination, April 2019
(2014 Admission Onwards)
CORE COURSE IN MATHEMATICS
6B11MAT – Numerical Methods and Partial Differential Equations

Time : 3 Hours Max. Marks: 48

SECTION – A

All the **4** questions are **compulsory**. They carry **1** mark **each.**

1. Give the condition for convergence in the General Iteration method.
2. Complete the expression $\nabla = ... - E^{-1}$.
3. State Simpson's 1/3 rule of integration.
4. Give the $(n + 1)^{th}$ approximation step in Picard's method.

SECTION – B

Answer **any 8** questions from among the questions **5** to **14.** These questions carry **2** marks **each**.

5. Find an interval which contains the root of the equation $2x^3 - x^2 + x - 6 = 0$.
6. Find a root of the equation $\log x - \cos x = 0$, where x is in radians, correct to two decimal places, using Regula Falsi Method.
7. Using Lagrange's interpolation formula find the approximate value of $\sin(\pi/6.)$.

x	0	$\pi/4$	$\pi/2$
y = sin x	0	0.7071	1

P.T.O.

8. Show that $\Delta\left(\frac{f_i}{g_i}\right) = -\frac{g_i\Delta f_i - f_i\Delta g_i}{g_i g_i + 1}$.

9. Find the approximate value of $\int_0^{\pi} \sin x\,dx$ using trapezoidal rule by dividing the range of integration into six equal parts.

10. The acceleration of a missile during its first 40 seconds of flight is given in the following table. Find the velocity of the missile when t = 40s.

t(s)	0	10	20	30	40
a(m/s²)	30	31.63	33.34	35.47	37.75

11. Write the formula for Runge Kutta Method of order 2.

12. Given $y' = x - y^2$ and y(0) = 1, find y(0.1) using Taylor's series method, correct to two decimal places.

13. Give the Fourier series solution of the one dimensional heat equation, with both ends of the bar kept at temperature 0 and the initial temperature function along the bar is f(x).

14. Solve the equation $u_{yy} = 0$ where u is a function of x and y.

SECTION – C

Answer **any 4** questions from among the questions **15** to **20**. These questions carry **4** marks **each**.

15. Find a root of the equation $2x = \cos x + 3$, where x is in radians, correct to two decimal places, using General iteration method.

16. Prove that $\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$.

17. From the following table find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 3.5.

x	2	2.5	3	3.5	4
y	12	20.125	32	48.375	70

18. Given the differential equation $\frac{dy}{dx} = \frac{x^2}{y^2 + 1}$, with y(0) = 0, use Picard's method to find y when x = 0.5.

19. Use modified Euler's method to the equation $\frac{dy}{dt} = t + \sqrt{y}$, y(0) = 1 to find y(0.2) using three iterations taking h = 0.2.

20. Determine the solution of the heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$, where u(0, t) = 0, u(*l*, t) = 0 and u(x, 0) = x, *l* being the length of the bar.

SECTION – D

Answer **any 2** questions from among the questions **21** to **24**. These questions carry **6** marks **each**.

21. a) Use Newton Raphson method to find $(-10)^{1/3}$, correct to two decimal places.

    b) Find a real root of $x^3 - 3x - 5 = 0$ using Bisection method.

22. Values of x (in degrees) and sin x are given in the following table :

x	15	20	25	30	35	40
y = sin x	0.2588	0.3420	0.4226	0.5	0.5736	0.6428

Determine the value of sin 38° using Newton's backward difference interpolation formula.

23. Use Fourth order Runge-Kutta method to the equation $\frac{dy}{dt} = t + y$, with y(0) = 1 to find y(0.1) and y(0.2).

24. Find the solution u(x, t) of the wave equation with initial deflection

$$f(x) = \begin{cases} \frac{2k}{L}x & \text{if } 0 < x < \\ \frac{2k}{L}(L - x) & \text{if } \frac{L}{2} < x < \end{cases}$$

and initial velocity 0.