K19U 0581

Reg. No. : .....

Name : .....

IV Semester B.Sc. Degree (CBCSS – Reg./Supp./Imp.) Examination, April 2019
(2014 Admission Onwards)
Complementary Course in Mathematics
4C 04 MAT – CH : MATHEMATICS FOR CHEMISTRY – IV

Time : 3 Hours Max. Marks : 40

SECTION – A

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

1. Find ∇f (3, – 4) of f = xy.
2. Find the curl V for V = [0, 0, w] with right-handed x, y, z.
3. Give Newton-Raphson formula.
4. Give Newton's forward difference interpolation formula.

SECTION – B

Answer **any 7** questions from among the questions **5** to **13**. These questions carry **2** marks **each**.

5. Find a tangent vector r'(t) and a unit vector u'(t) of $r(t)=\left[t,\frac{4}{t},0\right]$.
6. Find the parametric representation of the straight line passing through (3, 1, 2) in the direction of i + 4k.
7. Find the directional derivative of f = x – y at p (4, 5) in the direction of a = [2, 1].
8. Evaluate $I=\int_C(2xdx+2ydy+4zdz)$ from A (0, 0, 0) and B (2, 2, 2) by showing that F has a potential.

P.T.O.

9. Evaluate $\iint_S F.ndA$ where $F = [x, y, z]$, $S : r = [u \cos v, u \sin v, u^2]$, $0 \leq u \leq 4$, $-\pi \leq v \leq \pi$.

10. Find a unit normal vector of the surface $y^2 + z^2 = a^2$.

11. Solve using Picard's method, $y' = x + y^2$ subject to the condition $y = 1$ when $x = 0$.

12. Using Euler's method find y_1, y_2, y_3 for the initial value problem $y' = y$, $y(0) = 1$, $h = 0.1$.

13. Find a real root of the equation $f(x) = x^3 + x^2 + x + 7 = 0$.

SECTION – C

Answer **any 4** questions from among the questions **14** to **19**. These questions carry **3** marks **each**.

14. Evaluate $\int_C F(r)\, dr$, where $F(r) = [y^2, -x^2]$ and C is the straight line from (0, 0) to (1, 4).

15. Prove that

    a) $\nabla fg = f \nabla g + g \nabla f$

    b) $\nabla\left(\frac{f}{g}\right) = \frac{1}{g^2}(g\nabla f - f\nabla g)$.

16. Find the missing term in the following table :

x	0	1	2	3	4
y	1	3	9	–	81

17. Use Newton-Raphson method to find a root of the equation $x^3 - 2x - 5 = 0$, $x_0 = 2$.

18. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Simpson's $\frac{1}{3}$ rule with $h = 1$.

19. Determine the value of y when $x = 0.2$, using modified Euler's method. Given that $y(0) = 1$ and $y' = x + y$ with $h = 0.1$.

SECTION – D

Answer **any 2** questions from among the questions **20** to **23**. These questions carry **5** marks **each**.

20. Let $f = x + y - z$, $g = xyz$, $u = [z, x, y]$ and $v = [y + z, z + x, x + y]$. Verify the following

    a) $\text{div}(f \nabla g) = f \nabla^2 g + \nabla f \cdot \nabla g$

    b) $\text{curl}(u + v) = \text{curl}u + \text{curl}v$.

21. Verify Stoke's theorem for $F = [y, z, x]$ and S, the paraboloid $z = 1 - (x^2 + y^2)$, $z \geq 0$.

22. From the following table of values of x and y, obtain $\frac{dy}{dx}$ for $x = 1.2$.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

23. Using Runge-Kutta fourth order formula to find the value of y at 0.2 and 0.4, given $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ with $h = 0.2$.