



K18U 1001

Reg. No. :

Name :

IV Semester B.Sc. Degree (CBCSS-Reg./Sup./Imp.) Examination, May 2018
 (2014 Admn. Onwards)
COMPLEMENTARY COURSE IN MATHEMATICS
4C04 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. (4×1=4)

1. Find ∇f of $f = xy$.
2. Find the curl V for $V = [yz, 3zx, z]$ with right-handed x, y, z .
3. Give Newton-Raphson formula.
4. State trapezoidal rule.

SECTION – B

Answer any 7 questions from among the questions 5 to 13. These questions carry 2 marks each. (7×2=14)

5. Find a tangent vector $r'(t)$ and a unit vector $u'(t)$ of $r(t) = [10 \cos t, 1, 10 \sin t]$.
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 $f(x, y, z) = 2x^2 + 3y^2 + z^2$ at $p(2, 1, 3)$ in the direction of $a = [1, 0, -2]$.
8. Evaluate $I = \int_C (3x^2 dx + 2yz dy + y^2 dz)$ from $A(0, 1, 2)$ and $B(1, -1, 7)$ by showing that F has a potential.

P.T.O.



9. Evaluate $\iint_S F \cdot n \, dA$ where $F = [3z^2, 6, 6xz]$, $S: r = [u, u^2, v]$, $0 \leq u \leq 2$, $0 \leq v \leq 3$.
10. Find a unit normal vector of the surface $4x - 4y + 7z = -3$.
11. From the Taylor's series of $y(x)$, find $y(0.1)$ correct to four decimal places if $y(x)$ satisfies $y' = x - y^2$ and $y(0) = 1$.
12. Use Picard's method to obtain a series solution for $\frac{dy}{dx} = 1 + xy$, $y(0) = 1$.
13. Find a real root of the equation $f(x) = x^3 - x - 1 = 0$.

SECTION - C

Answer **any 4** questions from among the questions **14 to 19**. These questions carry **3 marks each**. **(4×3=12)**

14. If $f(x, y, z)$ is twice differentiable scalar function, then prove that $\text{div}(\text{curl}) = 0$.
15. Evaluate $\int_C F(r) \cdot dr$, where $F(r) = zi + xj + yk$ and C is $r(t) = \cos t i + \sin t j + 3tk$, $0 \leq t \leq 2\pi$.
16. Use Newton-Raphson method to find a root of the equation $x^3 + x - 1 = 0$, $x_0 = 1$.
17. Determine the value of y when $x = 0.1$, using modified Euler's method. Given that $y(0) = 1$ and $y' = x^2 + y$ with $h = 0.05$.
18. Evaluate $\int_0^{0.6} e^{-x^2} dx$ using Simpson's $\frac{1}{3}$ rule with $h = 0.1$.
19. The table below gives the values of $\tan x$ for $0.10 \leq x \leq 0.30$.

x	0.10	0.15	0.20	0.25	0.30
tan x	0.1003	0.1511	0.2027	0.2553	0.3093

Find $\tan(0.12)$.



SECTION - D

Answer **any 2** questions from among the questions **20 to 23**. These questions carry **5 marks each**. **(2×5=10)**

20. Let $u = [z, x, y]$, $v = [y + z, z + x, x + y]$ and $g = xyz$. Verify the following,
 a) $\text{div}(u \times v) = v \cdot \text{curl } u - u \cdot \text{curl } v$.
 b) $\text{curl}(gv) = (\text{grad } g) \times v + g \text{curl } v$.
21. Verify Stoke's theorem for $F = [x^2, xy]$ and S , the square in the plane $z = 0$ whose sides are along the lines $x = 0$, $y = 0$, $x = a$, $y = a$.
22. From the following table of values of x and y , obtain $\frac{dy}{dx}$ for $x = 2.2$.

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 0.1 and 0.2, given $\frac{dy}{dx} = y - x$, $y(0) = 2$ with $h = 0.1$.