Reg. No. : ....

Name : ....

K22U 1728

IV Semester B.Sc. Degree (CBCSS – Supplementary) Examination, April 2022
(2016 – 18 Admissions)
COMPLEMENTARY COURSE IN MATHEMATICS
4C04MAT-CS : Mathematics for Computer Science – IV

Time : 3 Hours

Max. Marks : 40

SECTION – A

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

1. Define divergence of a vector.
2. State Stoke's theorem.
3. Find the divergence of $x\hat{i} + y\hat{j} + z\hat{k}$.
4. Write Lagrange's Interpolation formula.

SECTION – B

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

5. Find the directional derivative of $f = 2x^2 + 3y^2 + z^2$ at the point (2, 1, 3) in the direction of $\hat{i} - 2\hat{k}$.
6. Using Stoke's theorem evaluate $\iint_s (\text{curl } \vec{F}).\hat{n}dA$ where $\vec{F} = z^2\hat{i} + 5x\hat{j}$ and S is the square $0 \le x \le 1$, $0 \le y \le 1$, $z = 1$.
7. Evaluate $\iint_s \vec{F}.\hat{n}dA$ where $\vec{F} = x\hat{j}$ and S is the portion of the sphere $x^2 + y^2 + z^2 = 1$ in the first octant.
8. Using Divergence theorem, evaluate $\iint_s \vec{F}.\hat{n}dA$ where $\vec{F} = x^2\hat{i} + z^2\hat{k}$ and S is the surface of the cube $|x| \le 1, |y| \le 3, |z| \le 2$.

P.T.O.

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

10. Find the Lagrange Interpolating polynomial of degree 2 approximating the function y = ln x defined by the following table of values.

x	2	2.5	3.0
y = ln x	0.69315	0.91629	1.09861

11. Certain corresponding values of x and $\log_{10}x$ are (330, 2.4771), (304, 2.4829), (305, 2.4871) and (307, 2.4871). Find $\log_{10}301$.

12. Using Picard's method, obtain the solution of $\frac{dy}{dx} = x + y^2$, $y(0) = 1$.

13. Given $\frac{dy}{dx} - 1 = xy$ and y(0) = 1, obtain Taylor series for y(x).

SECTION – C

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

14. Find the curvature of $y = x^2$.

15. Find the length of the circular helix $r(t) = \cos t\hat{i} + \sin t\hat{j} + t\hat{k}$ from t = 0 to t = 2π.

16. Using Green's theorem, evaluate $\oint_C \vec{F}.dr$ where $\vec{F} = x^2e^y\hat{i} + y^2e^x\hat{j}$, C is the rectangle with vertices (0, 0), (2, 0), (2, 3), (0, 3).

17. The table below gives the values of tan x for $0.10 \le x \le 0.30$.

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

Find tan 0.40.

18. Find the cubic polynomial which takes the following values : y(1) = 24, y(3) = 120, y(5) = 336 and y(7) = 720.

19. From the Taylor series for y(x), find y(0.1) correct to four decimal places if y(x) satisfies $y' = x - y^2$ and y(0) = 1.

SECTION – D

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

20. For any twice continuously differentiable vector functions $\vec{u}$ and $\vec{v}$, show that $\text{curl}(\vec{u}+\vec{v}) = \text{curl}\,\vec{u} + \text{curl}\,\vec{v}$.

21. Evaluate $\iint_s (7x\hat{i} - z\hat{k}).n\,dA$ for the sphere $S : x^2 + y^2 + z^2 = 4$ using Divergence theorem and verify it directly.

22. From the following table of values of x and y, obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ 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. Given $\frac{dy}{dx} = y - x$ where y(0) = 2, find y(0.1) correct to four decimal places, by Runge-Kutta fourth-order formula.