K19U 0582

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree (CBCSS – Reg./Supp./Imp.) Examination, April 2019
(2014 Admission Onwards)
COMPLEMENTARY COURSE IN MATHEMATICS
4C04 MAT – ST : Mathematics for Statistics – IV

Time : 3 Hours   Max. Marks : 40

SECTION – A

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

1. In which direction, the directional derivative of a function F(x, y, z) is maximum ?
2. State Gauss divergence theorem.
3. What is n^{th} difference of a polynomial of degree n ?
4. Define forward difference operator.

SECTION – B

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

5. Compute the divergence of the function
   $F = xyz\,\vec{i} + 3x^2y\,\vec{j} + (xz^2 - y^2z)\,\vec{k}$ at (1, 2, –1).
6. Find the directional derivative of the function $2xy + z^2$ in the direction of the vector $\vec{i} + 2\,\vec{j} + 2\,\vec{k}$ at the point (1, –1, 3).
7. Show that derivative of a vector function v(t) of constant length is either the zero vector or is perpendicular to v(t).

8. Show that curl $(\nabla\phi) = 0$.

9. Find the total work done in moving a particle in a force field given by $F = (3x^2 + 6y)\vec{i} - 14yz\,\vec{j} + 20xz^2\,\vec{k}$ from the straight line joining from (0, 0, 0) to (1, 1, 1).

10. Using Green's theorem to evaluate $\int_C xydx + x^2dy$, where C is the curve enclosing the region bounded by the parabola $y = x^2$ and the line $y = x$.

11. Show that $\nabla = \Delta E^{-1}$.

12. Explain Runge Kutta method to solve first order ordinary differential equation.

13. Use Euler's method with h = 0.1 to solve the initial value problem $\frac{dy}{dx} = -y$, $y(0) = 1$ in the range $0 \le x \le 0.3$.

SECTION – C

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

14. Find the value of a if $F = (axy - z^2)\vec{i} + (x^2 + 2yz)\vec{j} + (y^2 - axz)\vec{k}$ is irrotational.

15. Using divergence theorem, show that $\iint_S F \cdot n\,ds = 30$ where $F = 2xy\,\vec{i} + yz^2\,\vec{j} + z\,\vec{k}$ and S is a rectangular parallelopiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1 and z = 3.

16. Find the root of the equation $x^3 + x - 1 = 0$, using Newton Raphson method.

17. Using Taylor series, solve $\frac{dy}{dx} - 1 = xy$, $y(0) = 1$. Also find $y(0.1)$ correct to 4 decimal places.

18. Show that n^{th} divided differences of a polynomial of degree n are constants.

19. Calculate F(1.02) from the following table :

x :	1	1.1	1.2	1.3	1.4
F(x) :	0.8415	0.8912	0.9320	0.9636	0.9855

SECTION – D

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

20. Find curl (curl F) for the function $F = F(x, y, z) = y^2x\,\vec{i} - 3xyz\,\vec{j} + xy\,\vec{k}$.

21. Verify Stoke's theorem for the vector field $F(x, y, z) = 2z\,\vec{i} + 3x\,\vec{j} + 5y\,\vec{k}$ taking σ to be the portion of the paraboloid $z = 4 - x^2 - y^2$, $z \ge 0$ and C to be the positively oriented circle $x^2 + y^2 = 4$ that forms the boundary of σ in the xy plane.

22. Find an approximate value of $\int_{-3}^{3} x^4 dx$ using Simpson's $\frac{1}{3}^{rd}$ rule by taking 7 equidistant co-ordinates and compare it with exact value.

23. Using modified Euler method, solve $\frac{dy}{dx} - \sqrt{xy} = 2$, $y(1) = 1$.
