K24U 0928

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree (C.B.C.S.S. – Supplementary/One Time Mercy Chance) Examination, April 2024
(2014 to 2018 Admissions)
COMPLEMENTARY COURSE IN MATHEMATICS
4C04 MAT-PH : Mathematics For Physics and Electronics – 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. What curve is given by the parametric representation $r(t) = [3 \cos t, 4 \sin t, t]$.
2. Find the gradient of $f(x, y) = x^2 - y^2$ at $(-1, 3)$.
3. Let $F = [y^2, -x^2]$ and C be the straight line segment from (0, 0) to (1, 4). Find $\int_C F(r) \cdot dr$.
4. State 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**. **(7×2=14)**

5. Prove that $\nabla(fg) = f\nabla g + g\nabla f$.
6. Prove that $v = [2y, 2z, 4x + z]$ is irrotational.
7. Find the value of $\int_C F(r) \cdot dr$, when $F(r) = zi + xj + yk$ and C is $r(t) = \cos ti + \sin tj + 3tk$.

P.T.O.

8. Using Green's theorem, find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
9. Find a real root of the equation $x^3 - x - 1 = 0$, using bisection method.
10. Certain corresponding values of x and $\log_{10}x$ are (300, 2.4771), (304, 2.4829), (305, 2.4843) and (307, 2.4871). Find $\log_{10}301$, using Lagrange's interpolation formula.
11. From the following table evaluate $\int_{7.47}^{7.52} f(x)dx$, using Trapezoidal rule.

x	7.47	7.48	7.49	7.50	7.51	7.52
f(x)	1.93	1.95	1.98	2.01	2.03	2.06

12. 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 $y(0) = 1$.
13. Use Picard's method to obtain a series solution for $\frac{dy}{dx} = 1 + xy$, $y(0) = 1$.

SECTION – C

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

14. Find the tangent to the ellipse $\frac{x^2}{4} + y^2 = 1$ at $P\left(\sqrt{2}, \frac{1}{\sqrt{2}}\right)$.
15. Find the length of the catenary $r(t) = ti + \cosh tj$ from t = 0 to t = 1.
16. Using divergence theorem, evaluate $I = \iint_S \left(x^3 dydz + x^2 y\, dzdx + x^2 z\, dxdy\right)$ where S is the closed surface consisting of the cylinder $x^2 + y^2 = a^2$, $(0 \le z \le b)$ and the circular disks z = 0 and z = b.
17. Find the cubic polynomial which takes the following values : y(1) = 24, y(3) = 120, y(5) = 336 and y(7) = 720.

18. From the following values of x and y obtain $\frac{dy}{dx}$ at 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

19. Using Euler's modified method, find an approximate value of y(x) when x = 0.4, given that $\frac{dy}{dx} = x + y$, $y(0) = 0$ by choosing h = 0.2.

SECTION – D

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

20. Find the torsion of the curve $r(t) = [a \cos t, a \sin t, ct]$.
21. Verify Stoke's theorem for the function $F = yi + zj + zk$ integrated round the paraboloid $z = 1 - (x^2 + y^2)$, $z \ge 0$.
22. A solid of revolution is formed by rotating about the x-axis the area between the x-axis, the lines x = 0 and x = 1 and a curve through the points with the following coordinates :

x	0.00	0.25	0.50	0.75	1.00
y	1.0000	0.9896	0.9589	0.9089	0.8415

Estimate the volume of the solid formed, giving the answer to three decimal places.

23. Use Runge-Kutta fourth order formula to find y(0.2) and y(0.4) given that $y' = \frac{y^2 - x^2}{y^2 - x^2}$, $y(0) = 1$.

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