



K17U 0636

Reg. No. :

Name :

**IV Semester B.Sc. Degree (CBCSS – Reg./Supple./Imp.) Examination,
 May 2017
 (2014 Admn. Onwards)
 COMPLEMENTARY COURSE IN MATHEMATICS
 4C04MAT-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.

1. Find ∇f where $f(x, y) = (x - 2)(y + 2)$.
2. Evaluate $\int_C (2xydx + x^2dy)$ where C is a smooth curve from point (1, 2) to (3, 4).
3. For the differential equation $Y' = \frac{x^2}{y^2 + 1}$, find the first approximation to y given by Picard's method subject to the condition $y = 0$ when $x = 0$.
4. Give example of an initial value problem. **(4x1=4)**

SECTION – B

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

5. Find a unit normal vector of the cone of revolution $z^2 = 4(x^2 + y^2)$ at the point P : (1, 0, 2).
6. Prove or disprove : If $\text{div } v = 0$ then $\text{curl } v = 0$.
7. Find the directional derivative of $f(x, y, z) = 4x^2 + y^2 + 9z^2$ at P : (2, 4, 0) in the direction of $a = [-2, -4, 3]$.

P.T.O.



8. Calculate $\int_C F(r) \cdot dr$ where $F = [e^x, e^y]$, clockwise along the circle C with centre $(0, 0)$ from $(1, 0)$ to $(0, -1)$.
9. Use Green's theorem to evaluate $\int_C F(r) \cdot dr$ counterclockwise around the boundary curve C of the region R , where $F = [-e^y, e^x]$, R the triangle with vertices $(0, 0)$, $(2, 0)$, $(2, 1)$.
10. Evaluate $\iiint_S F \cdot ndA$ where $F = [x^2, y^2, z^2]$, $S : x + y + z = 4$, $x \geq 0$, $y \geq 0$, $z \geq 0$.
11. Find an approximate value of a real root of the equation $x^3 - 2x - 5 = 0$ by the bisection method.
12. Find a cubic polynomial which takes the following values :
 $y(0) = 1$, $y(1) = 0$, $y(2) = 1$, $y(3) = 10$.
13. Given $\frac{dy}{dx} = x + y$; $y(0) = 0$, compute $y(0.2)$ using Euler's modified method. **(7x2=14)**

SECTION - C

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

14. Find the total length of the hypocycloid $r(t) = [a \cos^3 t, a \sin^3 t]$.
15. Evaluate $\iiint_S F \cdot ndA$ by the divergence theorem where $F = [3xy^2, yx^2 - y^3, 3zx^2]$, S the surface of $x^2 + y^2 \leq 25$, $0 \leq z \leq 2$.
16. Finding divided differences from the following table, obtain $f(x)$ as a polynomial in x .

x	-1	0	3	6	7
$f(x)$	3	-6	39	822	1611



17. Explain the trapezoidal rule for numerical integration.
18. Use the method of false position to find a real root, correct to three decimal places, of the equation $x^3 - x - 4 = 0$.
19. Given $y' = 1 + xy$; $y(0) = 1$, use Taylor's series method to determine $y(0.1)$, correct to four decimal places. **(4x3=12)**

SECTION - D

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

20. a) Find curl and divergence of the vector field $v = [x^2yz, xy^2z, xyz^2]$.
b) Show that the torsion of a plane curve is identically zero.
21. Verify Stoke's theorem for $F = [y^3, -x^3, 0]$, $S : x^2 + y^2 \leq 1$, $z = 0$.
22. The equation $2x = \log_{10} x + 7$ has a root between 3 and 4. Find this root, correct to three decimal places, by regula-falsi method.
23. Use Runge-Kutta fourth-order formula to find $y(0.1)$ and $y(0.2)$, given that
 $\frac{dy}{dx} = y - x$; $y(0) = 2$. **(2x5=10)**