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 $\int_C (2xy\,dx + x^2 dy)$ 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. **(4×1=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 div v = 0 then 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].

8. Calculate $\int_C F(r).dr$ 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 $\int_C F(r).dr$ 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 $\iint_S F.n dA$ 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. **(7×2=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 $\iint_S F.n dA$ 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. **(4×3=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

$\frac{dy}{dx} = y - x;\ y(0) = 2.$ **(2×5=10)**