K22U 1724

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree (CBCSS – Supplementary) Examination, April 2022
(2016 – 18 Admissions)
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. Define curl of a vector field.

2. Find the divergence of $x^2\hat{i} + y^2\hat{j}$.

3. Give the parametric representation of the cylinder $x^2 + y^2 = a^2$, $-1 \le z \le 1$.

4. Write Newton's backward difference interpolation formula.

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 (1, 0, 2).

6. The function y = sin x is tabulated below. Using Lagrange's interpolation formula, find the value of $\sin \frac{\pi}{6}$.

x	0	$\pi/4$	$\pi/2$
y = sin x	0	0.70711	1.0

7. Using Picard's method, obtain the solution of
$\frac{dy}{dx} - 1 = xy$, $y(0) = 1$.

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8. Using Euler's method, solve the differential equation $y' = -y$, with the condition $y(0) = 1$. Choose $h = 0.01$ and compute $y(0.04)$.

9. Evaluate $\iint_s \vec{F}.\hat{n}dA$ where $\vec{F} = x^2\hat{i} + 3y^2\hat{k}$ and S is the portion of the plane $x + y + z = 1$ in the first octant.

10. Using Stoke's theorem evaluate $\iint_S (\text{curl } \vec{F}).\hat{n}dA$ where $\vec{F} = y\hat{i} - x\hat{j}$ and S is the circular semidisk $x^2 + y^2 \leq 4$, $x \geq 0$, $z = 0$.

11. Using Divergence theorem, evaluate $\iint_S (x^3\, dydz + x^2y\, dzdx + x^2z\, dxdy)$ where S is the closed surface consisting of the cylinder $x^2 + y^2 = a^2$ $(0 \leq z \leq b)$ and the circular disks $z = 0$ and $z = b$ $(x^2 + y^2 \leq a^2)$.

12. Given that the equation $x^{2.2} = 69$ has a root between 5 and 8, use the method of regular-falsi to determine it.

13. Find the missing term in the following table.

x	0	1	2	3	4
y	1	3	9	–	81

SECTION – C

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

14. Show that the curvature of a circle of radius a is $\frac{1}{a}$.

15. Is the velocity vector $\vec{v} = y_i - x_j$ irrotational ?

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

17. Given the differential equation $\frac{dy}{dx} = \frac{x^2}{y^2+1}$ with the initial condition $y = 0$ when $x = 0$, use Picard's method to obtain y for $x = 0.25$ correct to 3 decimal places.

18. Find a real root of the equation $x = e^{-x}$, using the Newton-Raphson method.

19. The table below gives the values of tan x for $0.10 \leq x \leq 0.30$

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 0.26.

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 function $\vec{v}$, show that $\text{div}(\text{curl}\,\vec{v}) = 0$.

21. 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

22. Verify Stoke's theorem for $F = [z^2, 5x, 0]$ over the square $S : 0 \leq x \leq 1, 0 \leq y \leq 1, z = 1$.

23. Given $\frac{dy}{dx} = 1 + y^2$ where y = 0 when x = 0, find y(0.2) correct to four decimal places, by Runge-Kutta fourth-order formula.