VITEEE 2021 Question Paper May 29 Slot 1

Time Allowed :90 Minutes	**Maximum Marks :**80	**Total Questions :**80

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The question paper contains a total of 80 questions divided into four parts:
   - Part I: Physics (Questions 1 to 25)
   - Part II: Chemistry (Questions 26 to 50)
   - Part III: Mathematics (Questions 51 to 75)
   - Part IV: English & Logical Reasoning (Questions 76 to 80)
2. All questions are multiple-choice with four options, and only one of them is correct.
3. For each correct answer, the candidate will earn 1 mark.
4. There is no negative marking for incorrect answers.
5. The test duration is 12 hours.

1. Find the area bounded by the curve $y = x^2$ and the line $y = 5x$.

(A) 125/6 sq units
(B) 125/3 sq units
(C) 25/6 sq units
(D) 25/3 sq units

---

2. The angle between the line $\frac{x-5}{10} = \frac{y-1}{2} = \frac{z}{11}$ and the plane $2x+3y-6z = 7$ is equal to:

(A) $\sin^{-1}\left(\frac{8}{21}\right)$
(B) $\cos^{-1}\left(\frac{8}{21}\right)$
(C) $\sin^{-1}\left(\frac{40}{21}\right)$
(D) $\pi/2$

---

3. Find the value of the integral $\int x^4 e^x \, dx$.

(A) $e^x(x^4 - 4x^3 + 12x^2 - 24x + 24) + C$
(B) $e^x(x^4 + 4x^3 + 12x^2 + 24x + 24) + C$
(C) $e^x(x^4 - 4x^3 - 12x^2 - 24x - 24) + C$

(D) $x^4e^x - 4x^3e^x + C$

---

4. A curve is given by parametric equations $x = a(1 + \cos\theta)$ and $y = a\sin\theta$. This curve always passes through the fixed point:

(A) (a, a)
(B) $(a, 0)$
(C) $(0, 0)$
(D) $(0, a)$

---

5. The integrating factor of the differential equation $\frac{dy}{dx} + P(x)y = Q(x)$ is x. Then $P(x)$ is equal to:

(A) x
(B) $1/x$
(C) $\ln x$
(D) e^x

---

6. Consider a random variable X with $E[X] = 1$ and $E[X^2] = 1$. Then:

(A) X is a constant
(B) X follows a Normal distribution
(C) X follows a Poisson distribution
(D) X is always zero

---

7. The conic $3x^2 + 6xy + 3y^2 - 4x + 5y = 12$ represents a:

(A) Circle
(B) Parabola
(C) Ellipse
(D) Hyperbola

---

8. The value of $\tan\left[\sin^{-1}\left(\frac{5}{13}\right) + \cot^{-1}\left(\frac{5}{4}\right)\right]$ is equal to:

(A) 63/16
(B) 63/56
(C) 56/63
(D) 16/63

---

9. If the three points $(a, 2, 3)$, $(0, b, 5)$, and $(6, 7, c)$ are collinear, then the constants $a, b,$ and c must satisfy which of the following conditions?

(A) $a = -3, b = 3, c = 9$
(B) $a = 3, b = 4.5, c = 11$
(C) $a = -2, b = 3, c = 7$
(D) a, b, c satisfy $\frac{-a}{6} = \frac{b-2}{7-b} = \frac{2}{c-5}$

---

10. If $\mathbf{a} + 2\mathbf{b} + 3\mathbf{c} = 0$, then the value of the expression $(\mathbf{a} \times \mathbf{b}) + (\mathbf{b} \times \mathbf{c}) + (\mathbf{c} \times \mathbf{a})$ in terms of $(\mathbf{b} \times \mathbf{c})$ is:

(A) $3(\mathbf{b} \times \mathbf{c})$
(B) $6(\mathbf{b} \times \mathbf{c})$
(C) 0
(D) $(\mathbf{b} \times \mathbf{c})$

---

11. The system of linear equations $y + z = 1$, $x + y + z = 1$, and $x + 2y + 2z = a$ is consistent. What is the value of a?

(A) 1
(B) 2
(C) 0
(D) Any real number

---

12. Let $z = \frac{\sqrt{3}}{2} - \frac{i}{2}$. Then the smallest positive integer n such that $(z^{95} + i^{67}) = z^n$ is:

(A) 1
(B) 2
(C) 3
(D) 12

---

13. The function $f(x) = \tan^{-1}(\sin x - \cos x)$ is an increasing function in the interval:

(A) $(0, \pi)$
(B) $(-\pi/4, 3\pi/4)$
(C) $(\pi/4, 5\pi/4)$
(D) $(0, \pi/2)$

---

14. The function $f(x) = |x| + \frac{|x|}{x}$ is:

(A) Continuous everywhere
(B) Discontinuous at $x = 0$
(C) Differentiable everywhere
(D) Even function

---

15. The direction cosines of a line are $\left(\frac{1}{2}, \frac{1}{2}, n\right)$. Then the value of n is:

(A) $\frac{1}{\sqrt{2}}$
(B) $\frac{1}{2}$
(C) $\pm\frac{1}{\sqrt{2}}$
(D) $\pm\frac{1}{2}$

---

16. Let $M = \begin{pmatrix} 5 & 16 & 18 \\ 3 & 2 & 4 \\ 1 & 7 & 7 \end{pmatrix}$. Then the system of linear equations $M\vec{x} = \vec{b}$ has:

(A) A unique solution
(B) Infinitely many solutions for all $\vec{b}$
(C) No unique solution
(D) Exactly two solutions

---

17. If $|z - i| \leq 1$ and $z_1 = 4 + 4i$, then the maximum value of $|iz + z_1|$ is:

(A) 5
(B) 6
(C) $\sqrt{32}$
(D) $\sqrt{41}$

18. If $\mathbf{a} + 2\mathbf{b} + 3\mathbf{c} = \mathbf{0}$, then the value of $(\mathbf{a} \times \mathbf{b}) + (\mathbf{b} \times \mathbf{c}) + (\mathbf{c} \times \mathbf{a})$ is:

(A) $3(\mathbf{b} \times \mathbf{c})$
(B) $6(\mathbf{b} \times \mathbf{c})$
(C) $\mathbf{0}$
(D) $\mathbf{a} \times \mathbf{c}$

---

19. The expression $\mathbf{a} \cdot [(\mathbf{b} \times \mathbf{c}) \times (\mathbf{a} + \mathbf{b} + \mathbf{c})]$ is equal to:

(A) 0
(B) $[\mathbf{abc}]$
(C) $|\mathbf{a}|^2|\mathbf{b}||\mathbf{c}|$
(D) $\mathbf{a} \cdot \mathbf{b} + \mathbf{b} \cdot \mathbf{c} + \mathbf{c} \cdot \mathbf{a}$
