PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

Vector Algebra and Vector Calculus - CSIR NET Physics PYQs

Mathematical Physics . All PYQs (2015-2025) with answer key

8 questions . Answer key included

www.physicsbyaaryan.com . www.csirnetphysics.com
Contact: 9501976811

Q1. [June 2015] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2015 June	3.5 M

A particle moves in two dimensions on the ellipse $x^2 + 4y^2 = 8$. At a particular instant it is at the point $(x, y) = (2,1)$ and the x-component of its velocity is 6 (in suitable units). Then the y-component of its velocity is

1. -3
2. -2
3. 1
4. 4

Q2. [June 2017] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2017 June	3.5M

The two vectors $\binom{a}{0}$ and $\binom{b}{c}$ are orthonormal if

1. $a = \pm 1, b = \pm 1/\sqrt{2}, c = \pm 1/\sqrt{2}$
2. $a = \pm 1, b = \pm 1, c = 0$
3. $a = \pm 1, b = 0, c = \pm 1$
4. $a = \pm 1, b = \pm 1/2, c = 1/2$

Q3. [June 2018] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2018 June	3.5M

Consider the three vectors $\vec{v}_1 = 2\hat{i} + 3\hat{k}, \vec{v}_2 = \hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{v}_3 = 5\hat{i} + \hat{j} + a\hat{k}$ where $\hat{i}, \hat{j}$ and $\hat{k}$ are the standard unit vectors in a three-dimensional Euclidean space. These vectors will be linearly dependent if the value of a is

1. $\frac{31}{4}$
2. $\frac{23}{4}$
3. $\frac{27}{4}$
4. 0

Q4. [Dec 2019] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2019 Dec	3.5M

Consider the set of polynomials $\{x(t) = a_0 + a_1 t + \cdots + a_{n-1} t^{n-1}\}$ in t of degree less than n, such that $x(0) = 0$ and $x(1) = 1$. This set

1. constitutes a vector space of dimension n
2. constitutes a vector space of dimension $n - 1$
3. constitutes a vector space of dimension $n - 2$
4. does not constitute a vector space

Q5. [Dec 2019] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2019 Dec	3.5M

The values of a and b for which the force $F = (axy + z^3)\hat{i} + x^2\hat{j} + bxz^2\hat{k}$ is conservative are

1. $a = 2, b = 3$
2. $a = 1, b = 3$
3. $a = 2, b = 6$
4. $a = 3, b = 2$

Q6. [June 2020] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2020 June	3.5M

Two time dependent non-zero vectors $\vec{u}(t)$ and $\vec{v}(t)$, which are not initially parallel to each other, satisfy $\vec{u} \times \frac{d\vec{v}}{dt} - \vec{v} \times \frac{d\vec{u}}{dt} = 0$ at all time t. If the area of the parallelogram formed by $\vec{u}(t)$ and $\vec{v}(t)$ be $A(t)$ and the unit normal vector to it be $\hat{n}(t)$, then

1. $A(t)$ increases linearly with t, but $\hat{n}(t)$ is a constant
2. $A(t)$ increases linearly with t, and $\hat{n}(t)$ rotates about $\vec{u}(t) \times \vec{v}(t)$
3. $A(t)$ is a constant, but $\hat{n}(t)$ rotates about $\vec{u}(t) \times \vec{v}(t)$
4. $A(t)$ and $\hat{n}(t)$ are constants

Q7. [June 2021] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2021 June	3.5M

The volume integral $I = \iiint_V \vec{A} \cdot (\vec{\nabla} \times \vec{A}) d^3x$ is over a region V bounded by a surface $\sum$ (an infinitesimal area element being $\hat{nds}$, where $\hat{n}$ is the outward unit normal). If it changes to $I + \Delta I$ when the vector $\vec{A}$ is changed to $\vec{A} + \vec{\nabla}\Lambda$, then ΔI can be expressed as

1. $\iiint_V \vec{\nabla} \cdot (\vec{\nabla}\Lambda \times \vec{A}) d^3x$
2. $-\iiint_V \nabla^2 \Lambda d^3x$
3. $-\oiint_\Sigma (\vec{\nabla}\Lambda \times \vec{A}) \cdot \hat{n} ds$
4. $\oiint_\Sigma \vec{\nabla}\Lambda . \hat{n} ds$

Q8. [June 2024] . 3.5 marks

Mathematical Physics > Vector Algebra and Vector Calculus

CSIR NET	2024 June	3.5M

Vorticity of a vector field $\vec{B}$ is defined as $\vec{V} = \vec{\nabla} \times \vec{B}$. Given $\vec{B} = kxyz\hat{r}$, where k is a constant, which one of the following is correct?

1. Vorticity is a null vector for all finite x, y, z
2. Vorticity is parallel to the vector field everywhere
3. The angle between vorticity and vector field depends on x, y, z
4. Vorticity is perpendicular to the vector field everywhere

Answer Key

8 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Mathematical Physics	Vector Algebra and Vector Calculus	**1**
Q2	Mathematical Physics	Vector Algebra and Vector Calculus	**3**
Q3	Mathematical Physics	Vector Algebra and Vector Calculus	**1**
Q4	Mathematical Physics	Vector Algebra and Vector Calculus	**4**
Q5	Mathematical Physics	Vector Algebra and Vector Calculus	**1**
Q6	Mathematical Physics	Vector Algebra and Vector Calculus	**4**
Q7	Mathematical Physics	Vector Algebra and Vector Calculus	**3**
Q8	Mathematical Physics	Vector Algebra and Vector Calculus	**4**

Study with PhysicsByAaryan

Full CSIR NET / GATE / JEST / BARC Physics live batch by Aaryan Mehra Sir.
Concept-first teaching, complete PYQ coverage, daily doubt support.

Use coupon CONSISTENCY for Rs. 500 off

Visit
www.physicsbyaaryan.com
www.csirnetphysics.com

Contact
9501976811