IIT JEE 2009 Test Series 5
PHYSICS PART-I

SECTION I

STRAIGHT OBJECTIVE TYPE

This section contains 6 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer.

1. Which pair of functions is identical?

   (a) $\sin^{-1}\ \sin x\ ,\ \sin(\sin^{-1} x)$

   (b) $\log_e e^x, e^{\log_e x}$

   (c) $\log_e x^2, 2\log_e x$

   (d) None of these

2. $\lim \dfrac{\int_0^{x^6} \cos t^2}{x \sin x}$ as x approach 0 is

   (a) 1

   (b) 0

   (c) $\dfrac{\Pi}{2}$

   (d) Cannot be determined

3. $\tan\left[\cos^{-1}\left(\dfrac{4}{5}\right)+\tan^{-1}\left(\dfrac{2}{3}\right)\right]$

   a) 6/17

   b) 7/16

   c) 17/6

   d) None of these

4. $\vec{A}, \vec{B}, \vec{C}$ & $\vec{D}$ are four vectors. Then, $\vec{A}\times\vec{B} \cdot \vec{C}\times\vec{D} + \vec{B}\times\vec{C} \cdot \vec{A}\times\vec{D} + \vec{C}\times\vec{A} \cdot \vec{B}\times\vec{D}$ is
   (a) 1
   (b) 0
   (c) – 1
   (d) 1 or – 1

5. The curve $y - e^{xy} + x = 0$ has a vertical tangent at the point
   (a) (1,1)
   (b) no point
   (c) (0,1)
   (d) (1, 0)

6. If the tangent to the curve $xy + ax + by = 0$ at (1,1) is inclined at an angle $\tan^{-1} 2$ then
   (a) a = 1, b = –2
   (b) a = 1, b = 2
   (c) a = –1, b = 2
   (d) a = –1, b = –2

SECTION II

MULTIPLE CHOICE TYPE QUESTIONS

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct. NO NEGATIVE marking.

7. If z is a complex number and $z^2 + az + b = 0$ has two roots and each of which has unit modulus, then
   (a) |a| < 2
   (b) |b| = 1
   (c) a^2/b is a real number
   (d) a/b is a real number

8. If $\vec{r}.\vec{n_1} = p_1,\ \vec{r}.\vec{n_2} = p_2\ \&\ \vec{r}.\vec{n_3} = p_3$ represent the equations of three planes, then point of intersection of these planes is/are

(a) $\vec{r} = \lambda\ \vec{n_1}\times\vec{n_2} + \mu\ \vec{n_2}\times\vec{n_3} + k\ \vec{n_3}\times\vec{n_1}$

(b) $\vec{r} = \dfrac{p_3\ \vec{n_1}\times\vec{n_2} + p_1\ \vec{n_2}\times\vec{n_3} + p_2\ \vec{n_3}\times\vec{n_1}}{\left[\vec{n_1}\ \vec{n_2}\ \vec{n_3}\right]}$

(c) $\vec{r} = \lambda\vec{n_1} + \mu\vec{n_2} + k\vec{n_3}$

(d) $\vec{r} = \lambda.\ \vec{n_1}\times\ \vec{n_2}\times\vec{n_3}$

9. An ordinate NP of ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ meets the circle $x^2 + y^2 = a2$ in Q. If P us (a cos ϕ, b sin ϕ) and O is the centre of the ellipses, then

(a) $\angle PON = \phi$

(b) $\angle QON = \phi$

(c) Normal at Q must be $y = x \tan \phi$

(d) Normal at P must be $y = x \tan \phi$

(e) the value of C is $\dfrac{1}{100\pi}F$

10. The function f (x) is defined for $x \geq 0$ and has its inverse g (x) which is differentiable. If f (x) satisfies $\int_0^{g(x)} f(t)dt = x^2$ and g (0) = 0 then

(a) f (x) is an odd linear polynomial

(b) f (x) is ome quadratic polynomial

(c) f (2) =1

(d) g (2) = 4

SECTION III

ASSERTION-REASON TYPE

This question contains 4 reasoning type questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

11. STATEMENT-1: $\int_0^{\pi} \sin x \ \{dx\} = \int_0^{\pi} \sin x \ dx$, where {.} denotes the fractional part.

STATEMENT-1: Value of definite integral is not affected by discontinuity at a particular point in an interval.

(a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
(b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(c) STATEMENT-1 is True, STATEMENT-2 is False
(d) STATEMENT-1 is False, STATEMENT-2 is true

12. STATEMENT-1: The eccentricity of the ellipse is $\sqrt{\frac{\sqrt{5}-1}{2}}$ when the normal at one end of a latus-ractum of an ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ passes through one extremity of the minor axis.

STATEMENT-2: The eccentricity of ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is $e=\sqrt{1-\frac{b^2}{a^2}}$.

(a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
(b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(c) STATEMENT-1 is True, STATEMENT-2 is False
(d) STATEMENT-1 is False, STATEMENT-2 is true

13. STATEMENT-1: Planes x – 2y + z = 0, 3x – 4y + z = 0, 5x + 7y – 12z = 0 meets on a line.

STATEMENT-2: If $\Delta=\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}=0$ the system of equations $a_1x + b_1y + c_1z = 0$, $a_2x + b_2y + c_2z = 0$, $a_3x + b_3y + c_3z = 0$ has infinitely many solutions.

(a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
(b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(c) STATEMENT-1 is True, STATEMENT-2 is False
(d) STATEMENT-1 is False, STATEMENT-2 is true

14. STATEMENT-1: A random variable a can take values either $\frac{n}{n+1}$ or $\frac{n+1}{n}$ for a given value of n. If n takes the values 1, 2, 3, …, and

$P\left(a=\frac{n}{n+1}\right)=P\left(a=\frac{n+1}{n}\right)=\left(\frac{1}{2}\right)^{n+1}$, then

P (a < 1) = P (a > 1)

STATEMENT-2: A random variable a can take values either $\frac{n}{n+1}$ or $\frac{n+1}{n}$ for a given value of n. If n takes the values 1, 2, 3, …, n and

$P\left(a=\frac{n}{n+1}\right)=P\left(a=\frac{n+1}{n}\right)=\left(\frac{1}{2}\right)^{n+1}$, then

P (a < 1) = P (a > 1) & $\lim_{x\to\infty} x^n = 0$ *for* $0<x<1$.

(a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
(b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(c) STATEMENT-1 is True, STATEMENT-2 is False
(d) STATEMENT-1 is False, STATEMENT-2 is true

SECTION IV

LINKED COMPREHENSION TYPE

This section contains 2 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 4 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

Paragraph for Questions numbers 15 to 17

Let A, B, C be three sets of complex numbers as defined below

$A=\left\{z:\frac{\pi}{4}<Arg\left(\frac{z-4}{z+4}\right)<\frac{\pi}{3}\right\}$

$B=\{z:|z-4i|=4\}$

$C=\{z:\mathrm{Re}(z(5+4i)=-20\}$

15. Number of complex numbers in $A \cap B \cap C$ is
    (a) 0
    (b) 1
    (c) 2
    (d) ∞
16. If z is a point in $A \cap B$ then maximum value of $|z + 4 - 4i| + |z - 4 - 4i|$ is
    (a) 64
    (b) 8
    (c) $8\sqrt{2}$
    (d) 16
17. If z is a point in $A \cap B \cap C$ then $Arg\left(\frac{z+2\sqrt{2}-(4+2\sqrt{2})i}{z-2\sqrt{2}-(4-2\sqrt{2})i}\right)$ is equal to
    (a) $\pi/2$
    (b) $-\pi/2$
    (c) $\pi/4$
    (d) $-\pi/4$

Paragraph for Questions numbers 18 to 20

Let a, b, c ∈ R and a ≠0 and $f(x) = ax^2 + (b - 1)x + c$. Let us define a system of quadratic equations

$ax_1^2 + bx_1 + c = x_2$

$ax_2^2 + bx_2 + c = x_3$

.....

.....

$ax_{n-1}^2 + bx_{n-1} + c = x_n$

$ax_n^2 + bx_n + c = x_1$

where $x_1, x_2, \ldots x_n$ are unknowns. Answer the following questions

18. $f(x_1) + f(x_2) + \ldots + f(x_n) =$
    (a) $x_1 + x_2 + \ldots + x_n$
    (b) $x_1 - x_n$
    (c) $x_n - x_1$
    (d) none of these

19. If $(b-1)^2 - 4ac < 0$, then the given system of quadratic equations has
    (a) No solution
    (b) Only one real solution
    (c) Exactly two solutions
    (d) Nothing can be said

20. If $b^2 + 1 = 2(b + 2ac)$, then for the above system which of the following is true?
    (a) $x_1 > \frac{1-b}{2a}$
    (b) $x_1 = \frac{1-b}{2a}$
    (c) $x_1 < \frac{1-b}{2a}$
    (d) $x_1 = x_2 = x_3 = \ldots = x_n \neq \frac{1-b}{2a}$

Paragraph for Questions numbers 21 to 23

Mr. A has a pair of dice. He adds weight to the six on one die and to the three on the other die, leading to the following probabilities

Face	1	2	3	4	5	6
First Die	0.1	0.1	0.5	0.1	0.1	0.1
Second die	0.1	0.1	0.1	0.1	0.1	0.5.

The faces shown by two dice are independent. He rolls them. Then answer the following questions

21. Probability of getting a total of nine is
    (a) 1/13
    (b) 13/25
    (c) 1/7
    (d) None

22. Probability that two die show the same face, is
    (a) 7/25
    (b) 13/25
    (c) 7/50
    (d) none

23. One of the dice is chosen at random, and rolled, yielding a six. What is the probability that it is the ""first die"?
    (a) 1/6
    (b) 1/13
    (c) 1/7
    (d) none