JEE-ADVANCED-2013-P1-Model

Time:09:00 A.M to 12:00 Noon **IMPORTANT INSTRUCTIONS** **Max Marks: 180**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 10)	Questions with Single Correct Choice	2	0	10	20
Sec – II(Q.N : 11 – 15)	Questions with Multiple Correct Choice	4	-1	5	20
Sec – III(Q.N : 16 – 20)	Questions with Integer Answer Type	4	-1	5	20
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Single Correct Choice	2	0	10	20
Sec – II(Q.N : 31 – 35)	Questions with Multiple Correct Choice	4	-1	5	20
Sec – III(Q.N : 36 – 40)	Questions with Integer Answer Type	4	-1	5	20
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Single Correct Choice	2	0	10	20
Sec – II(Q.N : 51 – 55)	Questions with Multiple Correct Choice	4	-1	5	20
Sec – III(Q.N : 56 – 60)	Questions with Integer Answer Type	4	-1	5	20
Total				**20**	**60**

MATHEMATICS: Max.Marks : 60

SECTION I

Single Correct Answer Type

This section contains **10 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

41. A circle is drawn passing through one vertex A with center at vertex C of the square ABCD. The angle subtended by the chord containing the points B and D, at the extremity of the diameter opposite to the extremity of the chord

A) $\frac{\pi}{4}$ B) $\frac{\pi}{3}$ C) $\frac{\pi}{2}$ D) $\frac{\pi}{6}$

42. Center of the smallest circle that is drawn to touch the two parabolas given by $y^2+2x+2y+3=0;\ x^2+2x+2y+3=0$ is

A) $\left(-\frac{7}{4},-\frac{7}{4}\right)$ B) $\left(-\frac{1}{2},-\frac{1}{2}\right)$ C) $\left(-\frac{3}{2},-\frac{3}{2}\right)$ D) $(-1,-1)$

43. The combined equation to two parabolas, both have their axis along x-axis, is given by $y^4-y^2(4x+4-2\sin^2 2\alpha)+\sin^2 2\alpha(4x^2+4x+\sin^2 2\alpha)=0$. The locus of the point of intersection of tangents, one to each of the parabolas, when they include an angle of 90^0 is

A) another parabola

B) circle

C) a line midway between the tangents at vertices

D) a line midway between their directrices

44. Focus and vertex of the parabola that touches x-axis at (1, 0) and x=y at (1, 1) are (h, k) and (p, q) then the value of $25(p+q+h+k)$

A) 35 B) 37 C) 33 D) 39

45. A parabola has focus at (0, 0) and passes through the points (4, 3) and $(-4,-3)$. The number of lattice points (x, y) on the parabola such that $|4x+3y| \le 1000$ is

A) 20 B) 100 C) 40 D) 80

46. If the parametric equations of the parabola are given by $x = 4t^2 - 2t + 1; y = 3t^2 + t + 1$, and the vertex of the parabola also satisfies $y - x = \frac{k}{100}$, then the area of the circle $x^2 + y^2 + 12x - 10y + 2k = 0$ in square units is

A) π B) 3π C) 4π D) 5π

47. Two tangents to the parabola $y^2 = 4x$, one drawn at a point P and another drawn at the point where the normal at the image of P in the axis of the parabola meets the curve again, inlcude an angle $\theta \neq \frac{\pi}{2}$. Then

A) there will be only one such point P on the parabola for any such θ
B) there will be three such points P on the parabola for any such θ
C) No such point P is possible for any given θ
D) P must be one extremity of the latus rectum

48. Consider a family of circles, first circle has the equation $x^2 + y^2 - 8x\cos\frac{\pi}{4} + 4y\sin\frac{\pi}{4} + 9 = 0$ and the other circles are formed in the following way, the circle is

1) rotated in anticlockwise direction about the point $P\left(4\cos\frac{\pi}{4} - \sin\frac{\pi}{12}, -2\sin\frac{\pi}{4} + \cos\frac{\pi}{12}\right)$ on it

2) then enlarged to become equal in size to its director circle

3) the new circle is the second circle of the family and cuts the given circle orthogonally.

This circle is then rotated similarly and enlarged to be equal in size to the director circle of second and to cut it orthogonally.

The similar process of creating new circles is continued. The square of the distance between the centers of the 5^{th} and 10^{th} circles is

A) 528 B) 272 C) 320 D) 476

49. The sides AB and AD of a rectangle ABCD are touched by a circle which cuts the side CD at E, nearer to C. A tangent is drawn to the circle from the vertex C to touch it at V, with integer coordinates, inside the rectangle. The area of the part of the rectangle (but not the circle) included between C, V and E is equal to k. If $AB = 17\frac{1}{3}$, $AD = 8$, radius of circle is 5, then [k], where [.] is GIF, is

A) 5 B) 12 C) 9 D) 6

50. Number of circles that touch a given parabola and one of its fixed focal chords at focus is

A) 0 B) 3 C) 2 D) 1

SECTION II
Multiple Correct Answer(s) Type

This section contains **5 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE are correct.**

51. Chords of a given parabola, meeting it at A and B, are drawn through a fixed point P. Circle with AB as diameter meets the parabola again at C and D. Then

A) CD passes through a fixed point Q

B) Sum of the ordinates of P and Q is zero

C) Absolute value of difference of abscissae of P and Q is 4

D) Absolute value of difference of x-intercepts of CD and AB is 2.

52. The lengths of chords of contact from two points to a circle of radius 5 are 6 and 8, then

A) The distance between the points is $\frac{175}{12}$

B) Two of the four tangents are perpendicular

C) The distance between the points $\frac{25}{12}$

D) Two of four tangents are not perpendicular

53. A circle is drawn to cut the parabola $y^2 = 4x$ in lattice points which are ends of two normal chords, then

A) The center of the circle lies on the axis of the parabola

B) Area of the trapezium formed by the points is 50 units

C) Area of the trapezium formed by the points is 72 units

D) Longest side of the trapezium is always 12 units.

54. Consider the parabola $y^2 = 4x$. If $A(a), B(b), C(c)$ are three conormal points, the normals at which meet at $(9,-6)$ and the points $P(p), Q(q), R(r)$ are three other conormal points the normals at which meet at $(9,6)$ with $b < p < q < a < c < r$ and

$$\Delta = \begin{vmatrix} (a+p)^2 & (a+q)^2 & (a+r)^2 \\ (b+p)^2 & (b+q)^2 & (b+r)^2 \\ (c+p)^2 & (c+q)^2 & (c+r)^2 \end{vmatrix}$$ then

A) $-\Delta$ is a perfect square

B) Δ is even number

C) $-\frac{\Delta}{2}$ is a perfect square

D) $\frac{\Delta}{25}$ is divisible by 5

55. AP is a chord of a circle. BQ is a chord of another circle parallel to AP. The segment AB is common to both the circles. Then the locus of midpoint of PQ is

A) straight line parallel to AB

B) circle

C) parabola

D) pair of lines

SECTION III

Integer Answer Type

This section contains **5 questions.** The answer to each question is single digit integer, ranging from 0 to 9 (*both inclusive*).

56. If a parabola whose vertex is at (0, 1) is to be touched by x axis, then the minimum integer magnitude of the point of contact from origin is ___.

57. Two intersecting tangents including an angle of 60^0 are drawn to a circle of radius 2 units.

A circle is then drawn to touch this circle externally and also the two tangents. Another circle is drawn to touch this circle externally and the also the two tangents. This process is continued indefinitely. The total area of the region between the tangents but not inside any circle, starting from the first circle is A, then [A], is _____where [.] is GIF

58. There are real numbers p and q such that $p < m < q$ is the exhaustive set of values of m for which the line through the point $(-3,8)$ with slope m does not meet the parabola $y = 2x^2 + 3x + 22$, then the value of $\left[\frac{-p}{3}\right] + \left[\frac{-q}{3}\right]$ is_____where [.] is GIF

59. A rectangle of area 70 units is completed with three conormal points with integer coordinates on the parabola $y^2 = 4x$ as its vertices. If the fourth vertex is (a, b) then the value of $\frac{|a| + |b|}{5}$ is

60. Inclination, with the positive x-axis, of shortest normal chord to the parabola $y^2 = 4ax$ is given as $\text{Tan}^{-1}\sqrt{n}$, then n=