IIT-JEE-2013-P2-Model

Time:2:00 PM to 5:00 PM **IMPORTANT INSTRUCTIONS** Max Marks: 180

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 8)	Questions with Multiple Correct Choice	3	-1	8	24
Sec – II(Q.N : 9 – 16)	Questions with Comprehension Type (4 Comprehensions – 2 +2+2+2 = 8Q)	3	-1	8	24
Sec – III(Q.N : 17 – 20)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 –28)	Questions with Multiple Correct Choice	3	-1	8	24
Sec – II(Q.N : 29 – 36)	Questions with Comprehension Type (4 Comprehensions – 2 +2+2+2 = 8Q)	3	-1	8	24
Sec – III(Q.N : 37 – 40)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 48)	Questions with Multiple Correct Choice	3	-1	8	24
Sec – II(Q.N : 49 – 56)	Questions with Comprehension Type (4 Comprehensions – 2 +2+2+2 = 8Q)	3	-1	8	24
Sec – III(Q.N : 57 – 60)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

MATHEMATICS: Max. Marks : 60

SECTION – I

(MULTIPLE CORRECT CHOICE TYPE)

This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE is/ are correct**

41. Feet of normals drawn from a point P on the axis of the parabola $x^2 = 8y$, are A and B (none is origin), the tangents at A and B meet at C. Tangents are drawn from P to the circumcircle of the triangle formed by tangent at vertex and the tangents at A, B to the parabola. Then

A) the circle has radius equal to half the focal radius of A or B

B) the angle between the tangents from P is $2Sin^{-1}\left(\frac{1}{3}\right)$ if A and B are ends of latus rectum

C) If the area of triangle is 32 units, then the points A and Bare $(\pm 8, 8)$

D) the angle between the tangents from P is $2Tan^{-1}\left(\frac{1}{3}\right)$ if A and B are ends of latus rectum

42. The circle $x^2 + y^2 = 9$ cuts the parabola $y^2 = 8x$ in two points P in first quadrant and Q in fourth quadrant. The tangents at P and Q to the parabola meet at S on x-axis and the tangents to the circle at P and Q meet at R on x-axis. Another circle through PQ, such that the length of tangent to it from origin is $\sqrt{18}$ units is drawn, then

A) the center of the new circle drawn is $(10, 0)$

B) the radius of the incircle of the triangle PQR is 2

C) the radius of the circum circle of triangle PQS is 3

D) the radius of the new circle drawn is $6\sqrt{2}$

43. Consider two points, on the parabola $y^2 = 4x$, sum of whose y-coordinates is 3, then

A) The minimum distance from origin to the chord joining them is $\frac{9}{20}$

B) Normals drawn at these points intersect on another normal

C) length of the focal chord through these points is $\frac{5}{2}$

D) area of the region bounded by the chord joining them and the parabola is $\frac{125}{24}$

44. $A(-1, 3)$, $B(1, 5)$ are two excenters of a triangle PQR and the remaining excenter C lies on the circle $x^2 + y^2 - 6x - 2y - 10 = 0$ then the locus of the incenter of triangle PQR is a circle

A) whose center is at $(-3, 7)$

B) whose radius is same as that of the given circle

C) whose intercept on y-axis is $2\sqrt{11}$

D) to which the length of the tangent from origin is 2 units

45. 'P' is a point which moves in the xy plane such that the point 'P' is nearer to the centre of a square than any of the sides. The four vertices of the square are $(\pm a, \pm a)$. The region in which 'P' will move is bounded by parts of parabolas

A) $2ax + y^2 = a^2$ B) $-2ax + y^2 = a^2$ C) $x^2 + 2ay = a^2$ D) $x^2 - 2ay = a^2$

46. The traces of center of a bouncing ball between its consecutive bounces are parabolas, so that its sweep between two consecutive bounces is half the sweep between immediately previous two consecutive bounces . A suitable system of coordinates is taken to represent the line of the bounce as x-axis and the axes of the parabolas as parallel to y-axis, then

A) the ordinates of the vertices form an G. P with common ratio $\frac{1}{8}$

B) The first level of differences of the abscissae form a G. P with common ratio $\frac{1}{8}$

C) the ordinates of the vertices form a G. P with common ratio $\frac{1}{2}$

D) The first level of differences of the abscissae form a G. P with common ratio $\frac{1}{2}$

47. TP and TQ are tangents from T to the parabola $y^2 = 4x$ and the corresponding normals meet at $R(21, -30)$. The equation to the circum circle of the quadrilateral PTQR can be

A) $x^2 + y^2 - 27x + 25y - 24 = 0$ B) $x^2 + y^2 - 11x + 33y - 120 = 0$

C) $x^2 + y^2 - 6x + 32y - 255 = 0$ D) $x^2 + y^2 - 3x - 7y - 48 = 0$

48. Locus of the intersection of the two straight lines passing through (1, 0) and (–1, 0) respectively and including an angle of 45° can be

A) $x^2 + y^2 - 2y - 1 = 0, y > 0$ B) $x^2 + y^2 - 2y - 1 = 0, y < 0$

C) $x^2 + y^2 + 2y - 1 = 0, y < 0$ D) $x^2 + y^2 + 2y - 1 = 0, y > 0$

SECTION - II
(COMPREHENSION TYPE)

This section contains **4 groups of questions.** Each group has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONLY ONE** is **correct.**

Paragraph for Questions 49 and 50

P is closest point to the parabola $y^2 = 64x$ on the circle $x^2 + y^2 - 50x - 24y + 669 = 0$
The tangent at P to the circle meets the parabola $y^2 = -28x$ at a point T. Then

49. Tangent to $y^2 = -28x$ at T can be

A) $7x - y - 1 = 0$ B) $4x - 2y - 7 = 0$ C) $9x - 3y - 7 = 0$ D) $x - 2y - 28 = 0$

50. Normal to $y^2 = -28x$ at T can be

A) $4x - 8y + 63 = 0$ B) $2x + y + 84 = 0$ C) $x + y + 21 = 0$ D) $x - y + 21 = 0$

Paragraph for Questions 51 and 52

The triangle formed by the points $A(-9, 29)$, $B(15,22)$ and $C(3, 13)$ is translated parallel to the y-axis so that the sides AC and BC touch the circles $x^2 + y^2 + 16x - 2y - 35 = 0$ and $x^2 + y^2 - 20x - 4y + 79 = 0$ respectively at A^1 and B^1.

51. The perimeter of the quadrilateral formed by A', B' and the corresponding new positions of A and B is

A) 50 B) $50 - 5\sqrt{2}$ C) $50 + 5\sqrt{2}$ D) $25 + 5\sqrt{2}$

52. The triangle is further translated and two more new tangents are formed. The distance between the new points of contact is written as $a\sqrt{b}$ where a and b natural numbers and b>a, then $\sqrt{b - a^2}$ is

A) 4 B) 3 C) 9 D) 16

Paragraph for Questions 53 and 54

Equilateral triangles of sides 1, 3, 5, ….(2n-1) are placed end-to-end so that their bases are along x-axis with first of such triangle having its vertex on y-axis. The vertices of all other triangles describe a parabola.

53. Equation to the parabola is

A) $4y^2 - 12x - 1 = 0$ B) $4y^2 - 12x - 3 = 0$ C) $4x^2 - 12y - 3 = 0$ D) $4x^2 - 12y - 1 = 0$

54. Focal radius of the vertex of 10^{th} such triangle is

A) 47 B) 36 C) 91 D) 16

Paragraph for Questions 55 and 56

Three circles; $C_1 \equiv x^2 + y^2 - 4 = 0$; $C_2 \equiv x^2 + y^2 + 8x - 6y + 22 = 0$; $C_3 \equiv x^2 + y^2 - 6x - 8y + 23 = 0$ have centers at A, B and C respectively. The circles S_3, S_1, S_2 cut the circles C_1, C_2; C_2, C_3; C_3, C_1 orthogonally. S_3^*, S_1^*, S_2^* are the circles representing the locus of the midpoint of chord of contact of the centers of S_3, S_1, S_2 with respect to C_1, C_2; C_2, C_3; C_3, C_1 respectively.

55. Equation to S_1^* is

A) $x^2 + y^2 + 4x - 3y = 0$ B) $x^2 + y^2 + x - 7y = 0$

C) $x^2 + y^2 + 6x - 14y + 5 = 0$ D) $x^2 + y^2 + 6x - 8y + 8 = 0$

56. The center of the circle that cuts the circles S_3^*, S_1^*, S_2^* orthogonally is

A) (0, 0) B) $(-8, 6)$ C) $(6, 8)$ D) $\left(-\frac{1}{2}, \frac{7}{2}\right)$

SECTION – III

(MATRIX MATCH TYPE)

This section contains **4 multiple choice questions.** Each question has matching lists. The codes for the lists have choices (A), (B), (C), and (D) out of which **ONLY ONE** is correct.

57.

	Column I		Column II
P.	If (α, β) lies on the circle with center on y-axis and touching x+3y=8 at (2, 2), then the number of possible positive integer values for α	**1.**	5
Q.	The distance between the centres of the smallest circles which cut the circle $x^2+y^2-x-26=0$ and $x^2+y^2-10x-6y-2=0$ orthogonally, is $\alpha\sqrt{\beta}$ where α,β are primes then $\frac{\beta-10\alpha}{3}$ is	**2.**	6
R.	The centroid of triangle ABC, where A, B, C are points on the parabola $4y^2-3y+6x+1=0$, whose normals are concurrent always lie on the line $ax+8y-c=0$ then $a+c=$	**3.**	3
S.	A variable circle always touches the line $y=2x$ at (0, 0), the common chord of this circle and $x^2+y^2+2x+6y-7=0$ will pass through a fixed point (α,β) then $\frac{1}{\alpha}+\frac{1}{\beta}$ is	**4.**	1

	P	Q	R	S
A.	1	4	2	1
B.	2	4	3	3
C.	4	1	1	3
D.	2	3	3	1

58. Three non intersecting circles of radius 2 are described with their centers at the vertices of triangle ABC with $A(0,6), B(0,0)$ and $C(8,0)$. Match the equation satisfied, in the column II, by the radius of the circle drawn to fit the condition given in the column I.

	Column I		Column II
P.	To touch the circle with center at A internally and those with centers at B and C externally	1.	$11x^2 + 144x - 756 = 0$
Q.	To touch the circle with center at C internally and those with centers at B and A externally	2.	$x^2 - 4x - 21 = 0$
R.	Just big enough to contain all the three circles	3.	$5x^2 - 189 = 0$
S.	To touch the circle with center at B internally and those with centers at A and C externally	4.	$x^2 - 28 = 0$

	P	**Q**	**R**	**S**
A.	**3**	**1**	**2**	**4**
B.	**1**	**4**	**2**	**3**
C.	**1**	**3**	**2**	**4**
D.	**3**	**4**	**2**	**1**

59.

	Column I		Column II
P.	1 Number of integer values of α for which the circle $x^2 + y^2 - 2\alpha x - 2\alpha y + 5\alpha - 6 = 0$ lies at the most in two quadrants is	1.	5
Q.	A (0, 6), B(8, 0) and C(8, 12) are the vertices of a ΔABC. If the perpendicular bisector of BC meets the circumcircle at D such that A and D are on the opposite side of BC. Then distance of BD from origin is α then $[\alpha]$, where [.] is GIF, is	2.	9
R.	A circle divides the circumference of circle $S \equiv x^2 + y^2 = 9$, centered at C, in the ratio of 1 : 3. If A and B are the points at which tangents, to the circle S, meet at P, then area of quadrilateral PACB is	3.	2
S.	Let (x, y) lies on $x^2 + y^2 + 4x - 8y - 16 = 0$. Let $a = \max\{(y+2)^2 + (x-3)^2\}$ and $b = \min\{(y+2)^2 + (x-3)^2\}$, then $\sqrt{ab}$ is	4.	6

	P	Q	R	S
A.	3	4	2	3
B.	4	3	2	1
C.	4	2	1	3
D.	3	3	4	1

60.

	Column I		**Column II**
P.	The circum circle of ΔPQR, through the conormal points P,Q,R on $y^2=12x$ always passes through (α,β) then $\alpha+\beta$	1.	$2\sqrt{2}$
Q.	If (α,β) is focus of $x^2+y^2+2xy-7x-5y+14=0$ is on the non-origin side of the tangent at vertex, then the value of $\alpha+\beta$	2.	3
R.	If the lines parallel to y=2 meet the parabola $y^2=12(x+3)$ and get reflected and pass through the point (α,β) then $\alpha+\beta$	3.	$\sqrt{2}$
S.	The length of latusrectum of parabola $x=t^2+t+1,\ y=t^2-t+1,\ t\in R$ is	4.	0

	P	**Q**	**R**	**S**
A.	4	4	2	3
B.	3	2	1	2
C.	4	2	4	3
D.	2	4	4	1