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. If $\sum_{r=1}^{n} t_r = \frac{(n+1)(n+2)(n+3)}{12}$ then the value of $\sum_{r=1}^{n} \frac{1}{t_r}$ is

A) $\frac{2n}{n+2}$ B) $\frac{4n}{n+1}$

C) $\frac{8}{(n+1)^2}(1+2+3+....+n)$ D) $\frac{4}{(n+2)(n+1)}(1+2+3+....+n)$

42. The sum 1+3+7+15+31+……to 100 terms is

A) $2^{100}-102$ B) $2^{99}-101$ C) $2^{101}-102$ D) $2^{102}-103$

43. If $\log_{10}^{x}+\frac{1}{2}\log_{10}^{x}+\frac{1}{4}\log_{10}^{x}+......=y$ and $\frac{1+3+5+........+(2y-1)}{4+7+10+.......+(3y+1)}=\frac{20}{7\log_{10}^{x}}, \forall x,y \in N$ then

A) $\log_y x = 5$ B) $\log_{y^3} x = 5$ C) $\log_y x^2 = 10$ D) $\log_{y^5} x = 1$

44. If $a_n = \sum_{r=0}^{n} \frac{1}{^nC_r}$ and $b_n = \sum_{r=0}^{n} \frac{r}{^nC_r}$ then the number of ordered pairs (p, q) such that $c_p + c_q = 1$, where $c_p = \frac{a_p}{b_p}$, is

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

45. Let $S_n (n \geq 1)$ be a sequence of sets defined by

$S_1 = \{0\}, S_2 = \left\{\frac{3}{2}, \frac{5}{2}\right\}, S_3 = \left\{\frac{8}{3}, \frac{11}{3}, \frac{14}{3}\right\}, S_4 = \left\{\frac{15}{4}, \frac{19}{4}, \frac{23}{4}, \frac{27}{4}\right\}, ...,$ then

A) third element in S_{20} is $\frac{439}{20}$ B) third element in S_{20} is $\frac{431}{20}$

C) sum of elements in S_{20} is 589 D) sum of elements in S_{20} is 609

46. When expanded in ascending powers of x, the coefficients of x^2 in $(1-x^2)^{15}$ and $(1+2x)^m(1-3x)^n$ are equal. If $2A-15$ and A are coefficients of x^4 respectively then m, n, A satisfy (Given that m and n are natural numbers each less than 4)

A) $\frac{A}{mn} = 10$ B) $\frac{Am}{n} = 90$ C) $\frac{An}{m} = 40$ D) $Amn = 360$

47. For the A.P. $a_1, a_2, a_3, ..., a_{16}$ it is known that $a_7 + a_9 = a_{16}$. By a geometric triad, we mean a sequence of three terms, a_p, a_q, a_r with $p < q < r$, which are in G.P. Then which of the following are NOT true?

A) The common ratio of every geometric triad a_p, a_q, a_r is an integer

B) No two geometric triads a_p, a_q, a_r; a_m, a_n, a_k have the same common ratio

C) For every geometric triad, there is at least one more geometric triad with the same common ratio

D) All are true

48. If $C_0, C_1, C_2, C_3, ..., C_r, ..., C_n$ are binomial Coefficients such that $C_{n-3}, C_{n-2}, C_{n-1}$ are in Arithmetic progression (where $C_r = {}^nC_r$, $n \in N$), then

A) C_1, C_2, C_3 are in AP
B) C_1, C_2, C_3 are in HP
C) $n = 14$
D) $n = 7$

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

Let x_1, x_2 be the roots of $ax^2+bx+c=0$ and x_3, x_4 be the roots of $px^2+qx+r=0$

49. If a, b, c are in G.P and x_1, x_2, x_3, x_4 are in G.P then p, q, r are is

A) A.P B) G.P C) H.P D) A.G.P

50. If $x_1, x_2, \frac{1}{x_3}, \frac{1}{x_4}$ are in A.P then $\frac{b^2-4ac}{q^2-4pr}$ equals

A) $\frac{a^2}{r^2}$ B) $\frac{b^2}{q^2}$ C) $\frac{c^2}{p^2}$ D) $\frac{a^2}{p^2}$

Paragraph for Questions 51 and 52

Sometimes the identity $x^4+\frac{1}{4}y^4=\left(x^2+xy+\frac{1}{2}y^2\right)\left(x^2-xy+\frac{1}{2}y^2\right)$ can be used to find the sum of terms of a given sequence. Using this or otherwise answer the following questions

51. If $S_n=\sum_{k=1}^{n}\frac{4k}{4k^4+1}$ then S_9

A) $\frac{119}{221}$ B) $\frac{220}{221}$ C) $\frac{180}{181}$ D) $\frac{200}{221}$

52. For $n \in N$, the value of $\dfrac{\left(2^4+\frac{1}{4}\right).\left(4^4+\frac{1}{4}\right).......\left((2n)^4+\frac{1}{4}\right)}{\left(1^4+\frac{1}{4}\right).\left(3^4+\frac{1}{4}\right).\left(5^4+\frac{1}{4}\right).....\left((2n-1)^4+\frac{1}{4}\right)}$

A) $8n^2+8n+1$ B) $8n^2+4n+2$ C) $8n^2+4n+1$ D) $8n^2+6n+1$

Paragraph for Questions 53 and 54

The sum of three real & distinct terms of a strictly increasing G.P. is αS and sum of the squares of these terms is S^2.

53. α^2 lies in

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

54. If $\alpha^2=2,$ then value of r equals (r is common ratio)

A) $\frac{1}{2}\left(5-\sqrt{3}\right)$ B) $\frac{1}{2}\left(3+\sqrt{5}\right)$ C) $\frac{1}{2}\left(\sqrt{5}+\sqrt{3}\right)$ D) $\frac{1}{3}\left(\sqrt{3}+\sqrt{5}\right)$

Paragraph for Questions 55 and 56

$a_1, a_2, a_3, ...$ is an A.P. of distinct terms. We call (p, q, r) an increasing triad if a_p, a_q, a_r are in G.P. and p, q, r are positive integers such that $p < q < r$.

55. For the increasing triad (5, 9, 16), which of the following is NOT TRUE?

A) There is no increasing triad (p, q, r) other than (5, 9, 16)

B) There are infinitely many increasing triads (p, q, r)

C) If a_1 is a multiple of 4, then every term in the AP is an integer

D) If the common difference of the A.P. is $\frac{1}{4}$, then $a_1 = \frac{1}{3}$.

56. For the increasing triad (5, 9, 16), which of the following is TRUE?

A) (21, 37, 65) is not an increasing triad

B) (85, 149, 261) is an increasing triad

C) The ratio of n^{th} term and $(4n+3)^{th}$ term is always $\frac{1}{3}$

D) The ratio of n^{th} term and $(4n+1)^{th}$ term is always $\frac{1}{3}$

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.

	List-I		List-II
P)	If p^{th}, q^{th}, r^{th} and s^{th} terms of an A.P are in G.P then $p-q, q-r, r-s$	1)	are all equal
Q)	If lnx, lny, lnz (x, y, z >1) are in G.P then $2x+\ln(\ln x), 3x+\ln(\ln y), 4x+\ln(\ln z)$	2)	are in A.P
R)	If $n!, 3\times n!$ and $(n+1)!$ are in G.P then $n!, 5\times n!$ and $(n+1)!$	3)	are in G.P
S)	Given an A.P , an G.P and an H.P of positive terms so that their first terms are equal and their $(2n-1)^{th}$ terms are equal then their n^{th} terms	4)	are in H.P

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

58.

List-I		List-II	
P)	The sum of the series $\frac{9}{5^2.2.1}+\frac{13}{5^3.3.2}+\frac{17}{5^4.4.3}+\ldots$ up to ∞, terms is equal to	1)	0
Q)	The series $\frac{8}{5}+\frac{16}{65}+\frac{24}{325}+\ldots$ up to ∞, has the sum equal to	2)	$\frac{1}{2}$
R)	Sum of infinite terms of the series $\frac{1}{1.3}+\frac{2}{1.3.5}+\frac{3}{1.3.5.7}+\frac{4}{1.3.5.7.9}+\ldots$,	3)	$\frac{1}{5}$
S)	If $\frac{1}{1.2.3.4}+\frac{1}{2.3.4.5}+\frac{1}{3.4.5.6}+\ldots$ to n terms is $\frac{1}{18}-f(n)$. Then $\lim\limits_{n\to\infty} f(n)$, is equal to	4)	2

	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.

	List-I		**List-II**
P)	Let $P = ab^2 + a^2b - ac^2 - a^2c,\ Q = bc^2 + b^2c - ba^2 - b^2a$ and $R = ca^2 + c^2a - cb^2 - c^2b$ where a, b, c are distinct positive real numbers. If the quadratic equation $Px^2 + Qx + R = 0$ has equal roots, then a, b, c are in	1)	AP
Q)	If the sides a, b, c of a triangle are in HP, then $\frac{a}{b+c-a}, \frac{b}{c+a-b}, \frac{c}{a+b-c}$ are in	2)	GP
R)	$\frac{a+bx}{a-bx} = \frac{b+cx}{b-cx} = \frac{c+dx}{c-dx}, (x \neq 0)$, then a, b, c, d are in:	3)	HP
S)	If $a, b, c \in R$, and $(a^2+b^2)x^2 - 2(ab+bc)x + (b^2+c^2) \le 0$, $\forall x \in R$ and then a, b, c are in	4)	AGP

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

60.

	List-I		List-II
P)	If $a^2+b^2 \neq 0$, $a, a_1, a_2, a_3.....a_{20}, b$ are in A.P and $a, g_1, g_2, g_3.....g_{20}, b$ are in G.P and $5(a+b)-4ab=0$ then $\frac{a_1+a_{20}}{g_1g_{20}}+\frac{a_2+a_{19}}{g_2g_{19}}+.......+\frac{a_{10}+a_{11}}{g_{10}g_{11}}$ is equal to	1)	7
Q)	The seventh term in the series $S=1+\frac{(1+2)^2}{(1+3)}+\frac{(1+2+3)^2}{(1+3+5)}+\frac{(1+2+3+4)^2}{(1+3+5+7)}+........$	2)	6
R)	If the ratio of the sum to n terms of two A.P's is $(5n+3):(3n+4)$ then the ratio of their 10^{th} terms, in its smallest form is $\frac{a}{b}$ where a and b are relatively prime natural numbers, then $a-b=$	3)	8
S)	If a>0, b>0, c>0 and the minimum value of $a(b^2+c^2)+b(c^2+a^2)+c(a^2+b^2)$ is λabc then λ is	4)	16

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