Sample Paper
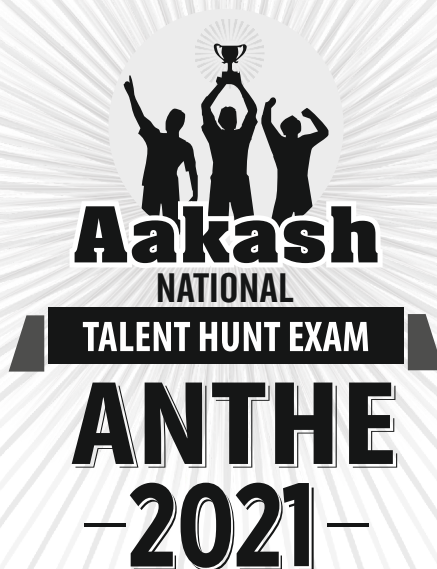
Aakash
NATIONAL
TALENT HUNT EXAM
ANTHE
—2021—

(Class XI Studying Moving to Class XII)

Physics, Chemistry, Mathematics

INSTRUCTIONS FOR CANDIDATE

1. Duration of Test is 1 hr.
2. The Test booklet consists of 35 questions. The maximum marks are 90. There is **no negative marking** for wrong answer.
3. Pattern of the questions are as under:

   (i) This question paper consists of three parts (Physics, Chemistry and Mathematics) each having **five sections**.

   (ii) **Section-I:** This section contains **16** multiple choice questions, which have **only one** correct answer. Each question carries **+2 marks** for correct answer.

   (iii) **Section-II:** This section contains **7** multiple choice questions, in which **more than one** answer may be correct. Each question carries **+4 marks** for correct answer.

   (iv) **Section-III:** This section contains **6** multiple choice questions based on paragraphs, which have **only one** correct answer. Each question carries **+2 marks** for correct answer.

   (v) **Section-IV:** This section contains **3** multiple choice questions based on assertion and reason type, which have **only one** correct answer. Each question carries **+2 marks** for correct answer.

   (vi) **Section-V:** This section contains **3** questions. Each question has two matching Columns. Column-I has four entries (A, B, C, D) and Column-II has four entries (P, Q, R, S). Each entry in Column-I may match with one or more entry in Column-II. Each question carries **+4 marks** for correct answer.

Aakash
+BYJU'S

Aakash National Talent Hunt Exam 2021
SAMPLE PAPER
(*Class XI Studying Moving to Class XII*)

The questions given in sample paper are indicative of the
level and pattern of questions that will be asked in ANTHE-2021)

Time : 1 Hour   **MM : 90**
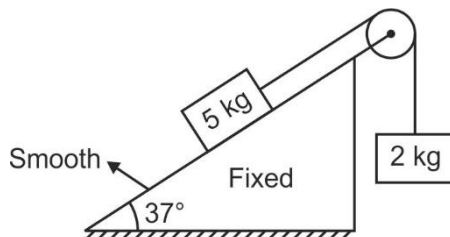
PHYSICS

SECTION-I : SINGLE ANSWER TYPE

This section contains 5 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

1. A physical quantity X depends upon Y and Z according to the relation $X = 2Y^2 + Z$, then choose the correct option regarding dimension of X, Y and Z. ($[P]$ denotes dimensional formula of P)

   (1) $[X] = [Y]$ (2) $[Y] = [Z]$

   (3) $[X] = [Y^2]$ (4) $[X] = [Y^2Z]$

2. If displacement (s) of a particle moving along a straight line as a function of time (t) is given as $s = (2t^2 + t^3)$ m, then acceleration of the particle at $t = 1$ s is

   (1) 4 m/s^2

   (2) 6 m/s^2

   (3) 5 m/s^2

   (4) 10 m/s^2

3. For maximum range along the inclined plane in the shown diagram for a given initial speed v, value of θ must be
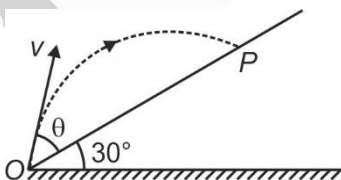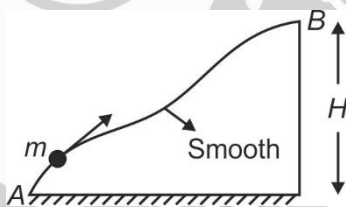

Space for Rough Work

(1) 30°

(2) 45°

(3) 37°

(4) 60°

4. In the shown figure, acceleration of 2 kg mass is [$g = 10$ m/s^2]

(1) $\dfrac{10}{7}$ m/s^2

(2) $\dfrac{5}{7}$ m/s^2

(3) 1 m/s^2

(4) 2 m/s^2

5. A particle of mass m is taken very slowly from point A to B as shown. Work done by external agent is equal to

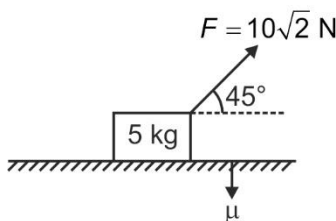

(1) Zero

(2) mgH

(3) $\dfrac{mgH}{2}$

(4) $2mgH$

Space for Rough Work

SECTION-II : MORE THAN ONE ANSWER TYPE

This section contains 2 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **MORE THAN ONE** answer may be correct.

6. $10\sqrt{2}$ N force is applied on 5 kg block placed on rough horizontal surface as shown. Possible values of μ so that block does not move on the surface is

(1) $\dfrac{2}{5}$

(2) $\dfrac{1}{5}$

(3) $\dfrac{1}{2}$

(4) $\dfrac{2}{3}$

7. In the shown figure, spring is light and surface is smooth. Initially, when spring is relaxed, the point mass (1) is given velocity v_0. If U_{max} is the maximum potential energy stored in the spring and v is velocity of mass (1) at this moment, then

(1) $U_{max} = \dfrac{mv_0^2}{4}$

(2) $U_{max} = \dfrac{mv_0^2}{2}$

(3) $v = \dfrac{v_0}{2}$

(4) $v = v_0$

Space for Rough Work

SECTION-III : PARAGRAPH TYPE

This section contains a paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Paragraph for Q. Nos. 8 & 9

In shown figure, uniform disk of radius R is performing pure rolling with acceleration a_0 and angular acceleration α over rough plank which is accelerating horizontally with acceleration a_p.
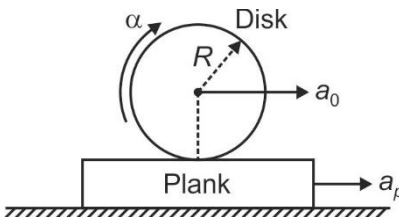
8. Acceleration of point of contact of disk is [Assume angular velocity of disk to be zero at this instant]

    (1) a_p (2) a_0

    (3) $R\alpha$ (4) $(a_0 + a_p)$

9. Correct relation among a_0, a_p and α is

    (1) $a_p = a_0 + R\alpha$

    (2) $a_p = R\alpha$

    (3) $a_0 = R\alpha$

    (4) $a_p = a_0 - R\alpha$

SECTION-IV : ASSERTION & REASON TYPE

This section contains 1 Assertion-Reason type question, which has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

10. **A :** If only conservative forces are acting on a particle, then its mechanical energy remains conserved.

    R : Conservative forces always perform positive work on a particle.

    (1) Both (A) and (R) are true and (R) is the correct explanation of (A)

    (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

    (3) (A) is true but (R) is false

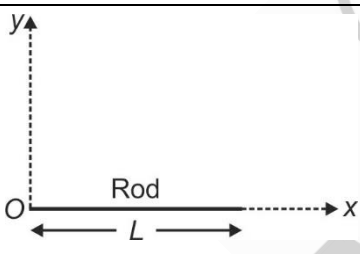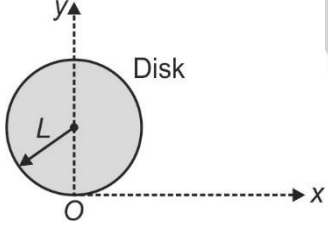   (4) (A) is false but (R) is true

Space for Rough Work

SECTION-V : MATRIX MATCH TYPE

This section contains 1 Matrix Match type question, which has 2 Columns (Column-I and Column-II). Column-I has four entries (A), (B), (C) and (D), Column-II has four entries (P), (Q), (R) and (S). Match the entries in Column-I with the entries in Column-II. Each entry in Column-I may match with one or more entries in Column-II.
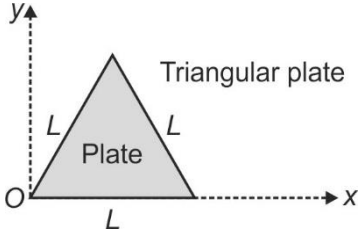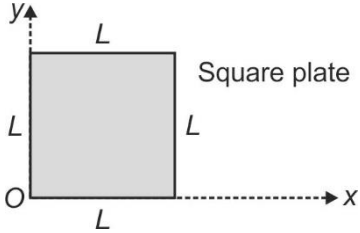
For each entry in Column-I, tick the boxes of all the matching entries in Column-II. For example, if entry (A) in Column-I matches with entries (P) & (S) in Column-II, then tick the boxes (P) & (S). Similarly, tick the boxes for entries (B), (C) and (D).

11. Column-I contain a uniform rigid body and Column-II contain their *x* and *y*-coordinate of centre of mass. Match the entries of Column-I with the entries of Column-II.

	Column-I		Column-II
(A)		(P)	$x = \dfrac{L}{2}$
(B)		(Q)	$y = \dfrac{L}{2\sqrt{3}}$

Space for Rough Work

| (C) | | (R) | $x = 0$ |
| (D) | | (S) | $y = 0$ |

CHEMISTRY

SECTION-I : SINGLE ANSWER TYPE

This section contains 5 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

12. Which one of the following has been arranged in increasing order of bond order as well as bond dissociation energy?

   (1) $O_2^{2-} < O_2^- < O_2^+ < O_2$

   (2) $O_2^{2-} < O_2^- < O_2 < O_2^+$

   (3) $O_2 < O_2^+ < O_2^{2-} < O_2^-$

   (4) $O_2^+ < O_2^{2-} < O_2^- < O_2$

13. Which one of the following isoelectronic ions has the lowest ionisation energy?

   (1) K^+

   (2) Ca^{2+}

   (3) Cl^-

   (4) S^{2-}

Space for Rough Work

14. 100 mL of a sample of aqueous solution containing NaOH only required 50 mL of $\dfrac{M}{2}$ HCl for complete neutralisation. Calculate the molarity of NaOH solution.

    (1) 0.25 M

    (2) 0.8 M

    (3) 0.125 M

    (4) 0.5 M

15. At 27°C, He gas is leaked through a tiny hole into a vessel for 15 minutes. Another unknown gas at the same temperature and pressure as that of He is leaked through the same hole for 15 minutes. After effusion of the gases, the mixture exerts a pressure of 5.7 atm. The helium of the mixture is 0.76 mol. If the volume of the vessel is 4.0 L, what is the molecular mass of the unknown gas? [Use R = 0.08 L atm mol^{-1} K^{-1}]

    (1) 44

    (2) 48

    (3) 64

    (4) 80

16. A certain ideal gas has C_v = a + bT, where a = 25.0 J mol^{-1} K^{-1} and b = 0.03 J mol^{-1} K^{-2}. 2 mol of this gas goes from 300 K and 2.0 L to 600 K and 4.0 L. What is the value of ΔS_{sys}? [log2 = 0.3]

    (1) -12.08 JK^{-1}

    (2) $+24.17$ JK^{-1}

    (3) -32.08 JK^{-1}

    (4) $+64.17$ JK^{-1}

SECTION-II : MORE THAN ONE ANSWER TYPE

This section contains 2 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **MORE THAN ONE** answer may be correct.

17. In a hydrogen like sample, electron is in 2nd excited state and the binding energy of 4th state of this sample is 13.6 eV, then

    (1) Binding energy of 2nd excited state of this sample is 24.17 eV

    (2) Three different photons will be released if electrons make a transition to the ground state from the second excited state

    (3) If 23 eV photon is used, the KE of ejected electron is 1 eV

    (4) 2nd line in the Balmer series of this sample has same energy value as first excitation energy of H-atoms

Space for Rough Work

18. 25 mL of 0.50 M H_2O_2 solution is added to 50 mL of 0.20 M $KMnO_4$ in acid solution. Which of the following statement(s) is/are true? $(2MnO_4^- + 6H^+ + 5H_2O_2 \longrightarrow 2Mn^{2+} + 8H_2O + 5O_2)$

    (1) 0.010 mol of O_2 is liberated

    (2) 0.005 mol of $KMnO_4$ does not react

    (3) 0.0125 mol of O_2 is evolved

    (4) In the final solution, there are only water molecules and Mn^{2+} ions

SECTION-III : PARAGRAPH TYPE

This section contains a paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Paragraph for Q. Nos. 19 & 20

1 mole of a real gas is placed in a container at T K, its density (d) varies with pressure (p) given as $d = 2p - 0.2p^2$, where d in gm/L and p in atm.

19. At what pressure density of the gas will attain its maximum value?

    (1) 10 atm

    (2) 5 atm

    (3) 2.5 atm

    (4) 1.25 atm

20. When 1 mol of the above gas attain maximum density, then volume of container (in litre) is given as [M = molar mass of the gas in gm/mol]

    (1) 5 M

    (2) $\dfrac{M}{5}$

    (3) 2 M

    (4) $\dfrac{M}{2}$

Space for Rough Work

SECTION-IV : ASSERTION & REASON TYPE

This section contains 1 Assertion-Reason type question, which has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

21. **A :** $H_3PO_4 + 2NaOH \xrightarrow{\Delta} Na_2HPO_4$

    Equivalent weight of H_3PO_4 in the above reaction is 49.

    R : n-Factor of $H_3PO_4 = 2$.

    (1) Both (A) and (R) are true and (R) is the correct explanation of (A)

    (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

    (3) (A) is true but (R) is false

    (4) (A) is false but (R) is true

SECTION-V : MATRIX MATCH TYPE

This section contains 1 Matrix Match type question, which has 2 Columns (Column-I and Column-II). Column-I has four entries (A), (B), (C) and (D), Column-II has four entries (P), (Q), (R) and (S). Match the entries in Column-I with the entries in Column-II. Each entry in Column-I may match with one or more entries in Column-II.

For each entry in Column-I, tick the boxes of all the matching entries in Column-II. For example, if entry (A) in Column-I matches with entries (P) & (S) in Column-II, then tick the boxes (P) & (S). Similarly, tick the boxes for entries (B), (C) and (D).

	P	Q	R	S
A.	✓	☐	☐	✓
B.	☐	☐	☐	☐
C.	☐	☐	☐	☐
D.	☐	☐	☐	☐

Space for Rough Work

22. Match the electronic transitions in a sample of H-atoms given in Column-I with the observations given in Column-II.

	Column-I		Column-II
(A)	$n = 6 \longrightarrow n = 3$	(P)	10 lines in spectrum
(B)	$n = 7 \longrightarrow n = 3$	(Q)	Spectral lines in visible region
(C)	$n = 5 \longrightarrow n = 2$	(R)	6 lines in spectrum
(D)	$n = 6 \longrightarrow n = 2$	(S)	Spectral lines in infrared region

MATHEMATICS

SECTION-I : SINGLE ANSWER TYPE

This section contains 6 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

23. $\cos 2\theta$ cannot be written as (for $\theta \in R$)

    (1) $2\cos^2\theta - 1$

    (2) $1 - 2\sin^2\theta$

    (3) $\cos^2\theta - \sin^2\theta$

    (4) $2\sin\theta \cos\theta$

24. The number of solutions of the equation $z^2 + \bar{z} = 0$, where z is a complex number, is

    (1) Zero

    (2) 1

    (3) 2

    (4) 4

25. Sum of series $1 + 4 + 7 + 10 + 13 + \ldots$ upto 15 terms is

    (1) 280

    (2) 310

    (3) 330

    (4) 360

Space for Rough Work

26. If p, q and r are real and $4p^2 + 9q^2 + 16r^2 - 6pq - 12qr - 8pr = 0$, then p, q and r are in

    (1) AP

    (2) GP

    (3) HP

    (4) Arithmetico Geometric Progression

27. The value of (tan45° + cot135° + sin30°) is

    (1) 3

    (2) $\dfrac{1}{2}$

    (3) $\dfrac{\sqrt{3}}{2}$

    (4) $\dfrac{5}{2}$

28. The domain of $f(x) = \sqrt{16 - x^2}$ is

    (1) [0, 4]

    (2) [−4, 4]

    (3) (−4, 4)

    (4) (−4, 4]

SECTION-II : MORE THAN ONE ANSWER TYPE

This section contains 3 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which **MORE THAN ONE** answer may be correct.

29. If a function $f(x)$ is defined as $f(x) = x^2 + x \ \forall \ x \in R$, then

    (1) $f(2) = 6$

    (2) $f(3) = 12$

    (3) $f(-2) = 2$

    (4) $f(-1) = 2$

Space for Rough Work

30. Let $P = \{1, 2, 3, 4, 5\}$, $Q = \{3, 4, 5, 6, 7\}$ and $R = \{2, 4, 6, 8\}$, then

    (1) $P \cap Q = \{3, 4, 5, 6\}$

    (2) $Q \cap R = \{4, 6, 8\}$

    (3) $P \cap Q \cap R = \{4\}$

    (4) $P \cap Q = \{3, 4, 5\}$

31. Which of the following functions are defined for all real values of x? ([·] represents the greatest integer function)

    (1) $\tan(\log x)$

    (2) $\sin[x] + \cos[x]$

    (3) $\sqrt{\dfrac{9}{8} + \cos 2x + \cos x}$

    (4) $\log(\text{sgn}\sqrt{[x^2]})$

SECTION-III : PARAGRAPH TYPE

This section contains a paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Paragraph for Q. Nos. 32 & 33

Number of nine-lettered words that can be formed by using all the letters of the word 'MEENANSHU'.

32. If alike letters are never adjacent, is

    (1) $9(7!)$

    (2) $10(7!)$

    (3) $11(7!)$

    (4) $12(7!)$

33. If all the vowels and all the consonants are alphabetically ordered among themselves respectively, is

    (1) $^9C_4$

    (2) $(4!)(^9C_4)$

    (3) $(4)(^9C_4)$

    (4) $\dfrac{^9C_4}{4}$

Space for Rough Work

SECTION-IV : ASSERTION & REASON TYPE

This section contains 1 Assertion-Reason type question, which has 4 choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

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34. **A :** The solution of equation $||x^2 - 2x - 3| - |2x + 5|| = |x^2 + 2|$ is $\left(-\infty, \dfrac{-5}{2}\right] \cup [-1, 3]$.

     R : If $||x| - |y|| = |x + y|$, then $xy \leq 0$.

     (1) Both (A) and (R) are true and (R) is the correct explanation of (A)

     (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

     (3) (A) is true but (R) is false

     (4) (A) is false but (R) is true

SECTION-V : MATRIX MATCH TYPE

This section contains 1 Matrix Match type question, which has 2 Columns (Column-I and Column-II). Column-I has four entries (A), (B), (C) and (D), Column-II has four entries (P), (Q), (R) and (S). Match the entries in Column-I with the entries in Column-II. Each entry in Column-I may match with one or more entries in Column-II.

For each entry in Column-I, tick the boxes of all the matching entries in Column-II. For example, if entry (A) in Column-I matches with entries (P) & (S) in Column-II, then tick the boxes (P) & (S). Similarly, tick the boxes for entries (B), (C) and (D).

	P	Q	R	S
A.	✓			✓
B.				
C.				
D.				

Space for Rough Work

35. Match the entries of Column-I with those of Column-II.

	Column-I		**Column-II**
(A)	The sum of the series $\dfrac{1}{3\cdot4}+\dfrac{1}{4\cdot5}+...+\dfrac{1}{(n+2)(n+3)}+...$ upto infinite terms, is	(P)	$\dfrac{1}{4}$
(B)	The sum of infinite terms of G.P., $1+\dfrac{2}{3}+\dfrac{4}{9}+\dfrac{8}{27}+...$ is	(Q)	$\dfrac{1}{3}$
(C)	The H.M. of the roots of the equation $(5+\sqrt{2})x^2-(4+\sqrt{5})x+(8+2\sqrt{5})=0$ is H, then $\dfrac{1}{H}$ is	(R)	3
(D)	If A.M. and H.M. of two positive numbers are $\dfrac{1}{9}$ and $\dfrac{1}{4}$ respectively, then their G.M. is	(S)	$\dfrac{1}{6}$

❑   ❑   ❑

Space for Rough Work

33 Year Old Legacy of Delivering Outstanding Results

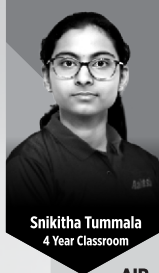**Aakash + BYJU'S**

84230 NEET-UG 2020
69759 Classroom + 14471 Digital & Distance

Akanksha Singh
4 Year Classroom
Perfect Score 720/720
AIR 2

Snikitha Tummala
4 Year Classroom
715/720
AIR 3

1700 JEE (Advanced) 2020
(1560 Classroom + 140 Digital & Distance)

Chirag Falor
4 Year Classroom
Highest Scorer 352/396
AIR 1

Aditya Goel
4 Year Classroom
AIR 65

JEE (Main) 2021 PHASE-III

Pravar Kataria
5 Year Classroom
100 PERCENTILE
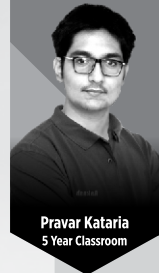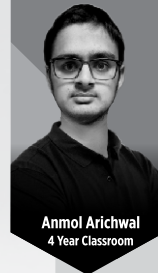
Anmol Arichwal
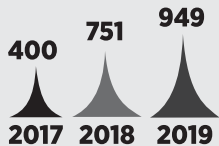4 Year Classroom
100 PERCENTILE

Our Result in Scholarship Exams /Olympiads

949
832 Classroom + 117 Digital & Distance
NTSE (Stage-I) 2019-2020
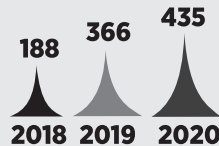
Our 1st Rankers from Classroom Programs

Animesh Kumar Jha	Tanishka	Dev Elvis Kannath	Sriansh Das	Jiya Kejriwal	Supratik Chattopadhyay	Sakshi Hangargekar	Ojaswi Phal Desai
Delhi	Haryana	Kerala	UP	UP	Assam	Goa	Goa

Our performance in Olympiads & Scholarship Exams Over Past 3 Years

NTSE Stage-I
400 (2017), 751 (2018), 949 (2019)

NTSE Stage-II
188 (2018), 366 (2019), 435 (2020)

PRMO
400 (2017), 800 (2018), 1598 (2019)

RMO
90 (2018), 115 (2019), 155 (2020-21 (IOQM))
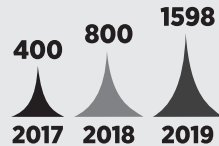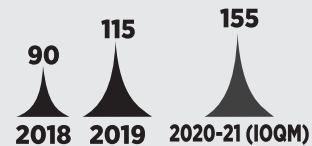
AAKASHIANS OUTSHINE IN CBSE CLASS X BOARD EXAM 2020

Glimpse of our top performers

P Harini
99.8% (499/500)

Rishit Agarwal
99.6% (498/500)

Sneha Barman
99.4% (497/500)

1598	155	620	521
1556 Classroom + 42 Digital & Distance	151 Classroom + 04 Digital & Distance	533 Classroom + 87 Digital & Distance	435 Classroom + 86 Digital & Distance
PRMO 2019	IOQM 2020-21	KVPY Aptitude Test 2019	KVPY Fellowship Award 2020-21
771	**1611**	**1656**	**26**
705 Classroom + 66 Digital & Distance	1477 Classroom + 134 Digital & Distance	1528 Classroom + 128 Digital & Distance	20 Classroom + 06 Digital & Distance
NSEs 2019	IMO (Level-I) 2020-21	NSO (Level-I) 2020-21	INO 2020