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# MAINS TEST SERIES-2019

(JUNE-2019 to SEPT.-2019)

# MATHEMATICS

Under the guidance of K. Venkanna

TEST CODE: TEST-1: IAS(M)/09-JUNE-2019

PAPER - I : LINEAR ALGEBRA, CALCULUS & 3D

Time: 3 Hours

Maximum Marks: 250

## INSTRUCTIONS

Each question is printed only in English.

Answer must be written in the medium specified in the admission Certificate issued to you, which must be stated clearly on the cover of the answer-book in the space provided for the purpose. No marks will be given for the answers written in a medium other than that specified in the Admission Certificate.

Candidates should attempt Question Nos. 1 and 5, which are compulsory, and any THREE of the remaining questions selecting at least ONE question from each Section.

The number of marks carried by each question is indicated at the end of the question.

Assume suitable data if considered necessary and indicate the same clearly.

Symbols/notations carry their usual meanings, unless otherwise indicated.

All questions carry equal marks.

**Important Note:** Whenever a question is being attempted, all its parts/ sub-parts must be attempted contiguously. This means that before moving on to the next question to be attempted, candidates must finish attempting all parts/ sub-parts of the previous question attempted. This is to be strictly followed.

Pages left blank in the answer-book are to be clearly struck out in ink. Any answers that follow pages left blank may not be given credit.

(1)

**SECTION - A**

1. (a) Determine the angle between the vectors  $\mathbf{u} = (1, 0, 0)$  and  $\mathbf{v} = (1, 0, 1)$  in  $\mathbb{R}^3$ . (10)

1. (b) The transformation  $T\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -y \\ -x \end{pmatrix}$  defines a reflection in the line  $y = -x$ . Show that  $T$  is linear transformation. Determine the standard matrix of this transformation. Find the image of  $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ . [10]

1. (c) If  $u = \sin^{-1} \frac{x^2 + y^2}{x + y}$ , show that :

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \tan^3 u. \quad (10)$$

1. (d) Show that :

$$\int_0^{\pi/2} \frac{\sin^2 x dx}{\sin x + \cos x} = \frac{1}{\sqrt{2}} \log(1 + \sqrt{2}) \quad [10]$$

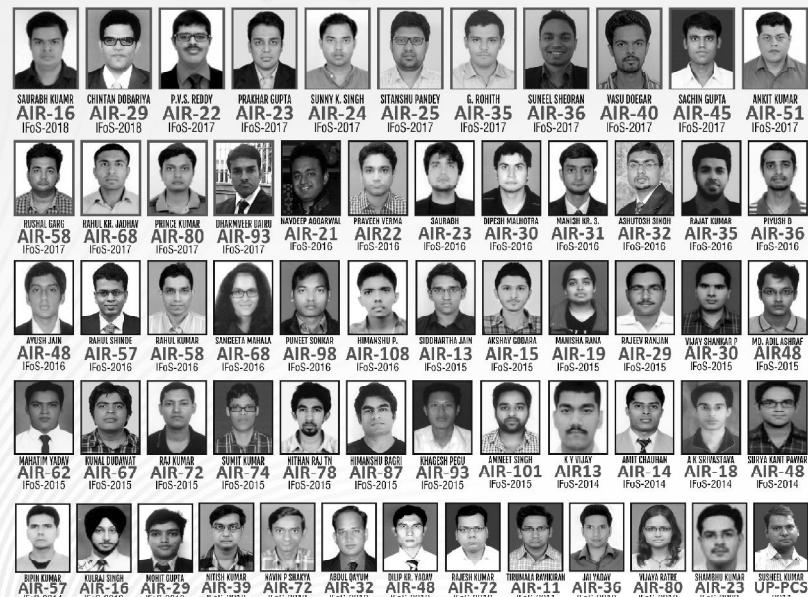
1. (e) P is a point on the plane  $lx + my + nz = p$ . A point Q is taken on the line OP such that  $OP \cdot OQ = p^2$ , prove that the locus of Q is

$$p(lx + my + nz) = x^2 + y^2 + z^2. \quad [10]$$

2. (a) (i) Find the kernel and range of the linear operator  $T(x, y, z) = (x, y, 0)$  and describe transformation geometrically.  
(ii) If  $\alpha, \beta$  are any scalars, then prove that  $A^2 - (\alpha + \beta)A + \alpha\beta I = (A - \alpha I)(A - \beta I)$ , where A is any square matrix of order n and  $I = I_n$ . [23]

(18)

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# IAS/IFoS MATHEMATICS

(Optional)

by K. Venkanna

OUR SUCCESSFUL STUDENTS IN CSE 2018 with HIGHEST MARKS



KANISHAK KATARIA

AIR-01

MARKS  
361/500

K. VARUN REDDY

AIR-07

MARKS  
324/500

TANMAY V. SHARMA

AIR-10

MARKS  
336/500

G.S.S. PRAVEENCHAND

AIR-64

MARKS  
342/500

MANISHA RANA

AIR-67

MARKS  
326/500

DALIP KUMAR

AIR-73

MARKS  
327/500

KHUSHBOO GUPTA

AIR-80

MARKS  
326/500

JAY SHIVANI

AIR-81

MARKS  
336/500

ANCHAL SRIVASTAVA

AIR-110

MARKS  
309/500

HIMANSHU PRAJAPATI

AIR-124

MARKS  
328/500

SUNEEL SHEORAN

AIR-192

MARKS  
325/500

AKASH SINGH

AIR-193

MARKS  
336/500

SACHIN BANSAL

AIR-348

MARKS  
316/500

KATTA RAVI TEJA

AIR-349

MARKS  
322/500

RAJAT BHARDWAJ

AIR-366

MARKS  
302/500

C. VISHNU CHARAN

AIR-406

MARKS  
312/500

PANKAJ KUMAWAT

AIR-443

MARKS  
334/500

SANJAY SAHU

AIR-526

MARKS  
305/500

AMIT KUMAWAT

AIR-600

MARKS  
320/500

And Many More...

2. (b) A window has the form of a rectangle surmounted by a semi-circle. If the perimeter is 40 ft., find its dimensions so that the greatest amount of light may be admitted. [13]

2. (c) (i) A line makes angles  $\alpha, \beta, \gamma, \delta$  with the four diagonals of a cube; prove that  $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta = 4/3$ . [08]

- (ii) Find the equation of the planes through the intersection of the planes  $x + 3y + 6 = 0$ ;  $3x - y - 4z = 0$  and whose perpendicular distance from the origin is unity. [06]

3. (a) Consider the linear transformation  $T(x, y) = (3x + 4y, 5x + 7y)$  of  $\mathbf{R}^2 \rightarrow \mathbf{R}^2$ .

- (i) Prove that  $T$  is invertible and find the inverse of  $T$ .  
(ii) Determine the preimage of the vector  $(1, 2)$ . [15]

3. (b) Show that the following function is discontinuous at  $(0,0)$ :

$$f(x,y) = \begin{cases} \frac{x^3 + y^3}{x-y}, & x \neq y, \\ 0, & x = y. \end{cases}$$

3. (c) Evaluate  $\lim_{x \rightarrow a} \left( 2 - \frac{x}{a} \right)^{\tan\left(\frac{\pi x}{2a}\right)}$

3. (d) (i) Find the equation of the sphere which touches the sphere  $x^2 + y^2 + z^2 - x + 3y + 2z - 3 = 0$  at the point  $(1, 1, -1)$  and passes through the origin.

- (ii) Prove that the condition that the plane  $ux + vy + wz = 0$  may cut the cone  $ax^2 + by^2 + cz^2 = 0$  in perpendicular generators if

$$(b+c)u^2 + (c+a)v^2 + (a+b)w^2 = 0$$

[18]

(3)

4. (a) (i) Solve the following homogeneous system of linear equations. Interpret the set of solutions as a subspace. Sketch the subspace of solutions.

$$x_1 + 2x_2 + 3x_3 = 0$$

$$-x_2 + x_3 = 0$$

$$x_1 + x_2 + 4x_3 = 0$$

(ii) In any vector space V,

(A)  $\alpha\mathbf{0} = \mathbf{0}$  for every scalar  $\alpha$ .

(B)  $0u = \mathbf{0}$  for every  $u \in V$ .

(C)  $(-1)u = -u$  for every  $u \in V$ . [20]

4. (b) Find the volume bounded by the cylinder  $x^2 + y^2 = a^2$  and the cone  $x^2 + y^2 = z^2$ . [14]

4. (c) Prove that the tangent planes to the hyperboloid  $(x^2/a^2) + (y^2/b^2) - (z^2/c^2) = 1$  which are parallel to tangent

planes to the cone  $\frac{b^2c^2x^2}{c^2-b^2} + \frac{c^2a^2y^2}{c^2-a^2} + \frac{a^2b^2z^2}{a^2+b^2} = 0$  cut the surface in perpendicular generators. [16]

(16)

Maths.stackexchange.com is the best online resource for preparation. You can create an account and get your maths questions answered within minutes.

#### Why did I score only 262?

Among all the students in the final list who had Maths as an optional, I have scored the least. My paper - 1 was a complete disaster and I only scored 92 marks in it. In fact I could only attempt 160 marks paper and had to leave 90 marks paper completely.

The reasons for the above situation in Paper - 1 are as follows:

- Lack of written practice:** In many topics (especially statics and dynamics) I used to just look at a question and its solution without solving it first. As a result I forgot the exact method in the exam hall!
- Left many topics:** I prepared only 25% 3-D, 80% Calculus and 25% Statics & Dynamics and had to pay a heavy price in the exam.

On the other hand my preparation for paper - 2 was excellent and therefore I scored an amazing 170 marks in it

BHAVESH MISHRA  
AIR-58 in CSE-2014

(15)

Coaching institutions have mastered the art of brainwashing students and creating an atmosphere of gloom and doom around science subjects. There are lots of myths circulating among students. Let's bust these myths.

1. **Maths optional is only for students from IITs:** Definitely not. Anyone willing to put in hard work can easily score very high marks. The best example being **Nitish K (Rank 8) who is not from any IIT.**
2. **There is heavy scaling:** Let the data speak for itself. I attempted 240 marks in Paper 2 and got 170 marks. Now would you call it a scaling?
3. **It plays no role in GS:** Yes it's true that science optional subjects don't overlap with GS but it's equally true that GS has never been a rank decider in UPSC IAS.
4. **There are 3 major things that decides your rank:** Essay, Optional and Interview. Even if one puts in 5 years of efforts in GS the advantage in terms of marks would be around 30 marks or so but 1 year of dedicated effort in maths would give you 50+ marks advantage straightaway.

#### **Do's and Don'ts:**

1. Practice, Practice and Practice. The key to success in maths is filling up as many notebooks as you can, during the preparation stage. The more you sweat during preparation the less you will bleed in the battlefield!
2. Don't read Maths book / notes like GS. It is a recipe for disaster. Rather always study with pen, paper and calculator.
3. While solving examples don't jump to see solution first. Try giving your best shot and after making sure that you are not able to solve it using your present knowledge then only look at the answer. This will ensure that better retention.
4. Generally we make lots of silly mistakes while solving a question. It is best to catch these errors early and not repeat them in exam hall. The best strategy for this is to maintain a notebook of errors that you

#### **Anyone who has done B.Tech / M.Tech / B.Sc / M.Sc and has an interest in Maths.**

Usually commit and their mitigation measures. For example, I commit a lot of mistakes when doing Integration by parts and usually the error involves missing negative (-) sign etc. Therefore whenever I come across such type of question I try to devote extra 1 minute to re-check all my steps.

(4)

#### **SECTION - B**

5. (a) Show that the function  $h(x) = 4x^2 + 3x - 7$  lies in the space  $\text{Span } \{f, g\}$  generated by  $f(x) = 2x^2 - 5$  and  $g(x) = x + 1$ . **[10]**
5. (b) Show that the set  $\{(1, 2, 0, 3), (4, 0, 5, 8), (8, 1, 5, 6)\}$  is linearly independent in  $\mathbb{R}^4$ . The vectors form a basis for a three-dimensional subspace V of  $\mathbb{R}^4$ . Construct an orthonormal basis for V. **[10]**
5. (c) Applying Lagrange's mean value theorem to the function defined by  $f(x) = \log(1+x)$  for all  $x \geq 0$ , show that  $0 < [\log(1+x)]^{-1} - x^{-1} < 1$  whenever  $x > 0$ . **[10]**
5. (d) A sphere of constant radius  $2k$  passes through origin and meets the axes in A, B and C. Find the locus of the centroid of the tetrahedron OABC. **[10]**
5. (e) Find the equations to the tangent planes to the hyperboloid  $2x^2 - 6y^2 + 3z^2 = 5$  which pass through the line  $x + 9y - 3z = 0 = 3x - 3y + 6z - 5$ . **[10]**
6. (a) (i) A square matrix A is said to be involutory if  $A^2 = I$ . Prove that the matrices

$$\begin{bmatrix} 1 & \alpha \\ 0 & -1 \end{bmatrix} \text{ and } \begin{bmatrix} 1 & 0 \\ \alpha & -1 \end{bmatrix} \text{ are involutory for all scalars } \alpha.$$

Determine all  $2 \times 2$  involutory matrices.

- (ii) Determine the rank of the matrix

$$A = \begin{bmatrix} 1 & 2 & -1 & 0 \\ -1 & 3 & 0 & -4 \\ 2 & 1 & 3 & -2 \\ 1 & 1 & 1 & -1 \end{bmatrix}$$

**[10+8=18]**

(5)

6. (b) Let

$$\left\{ v_1 = \begin{bmatrix} i \\ 1 \\ 1 \\ 1 \end{bmatrix}, v_2 = \begin{bmatrix} 1 \\ i \\ 1 \\ 1 \end{bmatrix}, v_3 = \begin{bmatrix} 1 \\ 1 \\ i \\ 1 \end{bmatrix}, v_4 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ i \end{bmatrix} \right\}$$

be as basis of  $\mathbb{C}^4$  and let  $T \in L(\mathbb{C}^4)$ :

$$\begin{aligned} T v_1 &= iv_1 + v_2 - v_3 + v_4, \\ T v_2 &= v_1 + iv_2 + v_3 - iv_4, \\ T v_3 &= -iv_1 + v_2 + iv_3 + v_4, \\ T v_4 &= v_1 - iv_2 + v_3 + iv_4. \end{aligned}$$

What is the matrix of  $T^*$  with respect to this basis  $\{v_1, v_2, v_3, v_4\}$ ? [16]

6. (c) Consider the linear operator  $T(x, y) = (2x, x + y)$  on  $\mathbf{R}^2$ . Find the matrix of  $T$  with respect to the standard basis  $B = \{(1, 0), (0, 1)\}$  of  $\mathbf{R}^2$ . Use the transformation  $A' = P^{-1} AP$  to determine the matrix  $A'$  with respect to the basis  $B' = \{(-2, 3), (1, -1)\}$ . [16]

7. (a) The function  $f$  defined by

$$f(x) = \begin{cases} x^2 + 3x + a, & \text{if } x \leq 1 \\ bx + 2, & \text{if } x > 1 \end{cases}$$

is given to be derivable for every  $x$ . Find  $a$  and  $b$ .

[12]

7. (b) Determine the values of  $p$  and  $q$  for which

$$\lim_{x \rightarrow 0} \frac{x(1 + p \cos x) - q \sin x}{x^3}$$

exists and equals 1.

(10)

(14)

## INTERVIEW

In the interview, you can expect some questions related to mathematics optional. Generally you won't be asked to solve a problem because that ability has been tested in mains. They would like to see whether you have a genuine curiosity regarding mathematics outside what is mentioned in syllabus. In both my UPSC interviews, I was asked about Ramanujan's work. There were questions on Vedic Mathematics, National Mathematics Day, important Indian Mathematical Institutions, Field medalist Manjula Bhargava etc. Hence while preparing for interview, try to be aware about these non-theoretical aspects of maths as well.

*I hope above tips provide some clarity regarding maths optional to UPSC aspirants.  
All the best!*

**BHAVESH MISHRA (AIR-58)**  
**in IAS-2014 Examination**  
**CLASSROOM STUDENT**

**Why Maths?**

**Simply because it is the best performing optional subject in UPSC/IAS.**

**Extremely high scoring:** If you get your maths optional right then you will make it to the final list. This year one of my batch mate in IMS Nitish K (Rank 8) has got a mind boggling 346 marks.

**Certainty:** If you have attempted your paper well then you are sure that you will get good marks. For example this year just by attempting 400 marks paper you could get a decent 260+ marks. Even if you don't get good marks in first attempt but you can be sure that you will increase your marks in subsequent attempt(s).

**Fun:** Mathematics is a delightful subject and therefore doing maths takes you away from somewhat boring humanities.

**Good Impression:** The fact that you have taken Maths makes a good impression on interview board members

**(it happened in my case !).** They are very pleased to see that you have opted for a tough optional.

**Easy paper:** The difficulty level of paper is quite moderate and almost all questions are directly picked from the IMS Test Series / Standard Textbooks.

**WHO SHOULD TAKE IT?**

**Myths around science subjects.**

(13)

asked in mains. If some problem seems very non-intuitive, it would help if the trick to solve such problem is written in your notebook.

### TEST SERIES

Test series is very important for this optional. I had joined IMS test series which helped me in identifying my weak areas. In both CSE and IFoS mains, there were many questions similar to those covered in IMS test series. With enough practice, a candidate can achieve the ability to complete the maths paper in 3 hours. It is important to assess your performance after each test. Necessary steps should be taken to rectify common mistakes that you are committing in the test series. You should be alert not to repeat the same mistakes again & again. As your performance improves with every test, the actual mains paper will seem just like any other test & you will be able to comfortably complete it. Presentation of your answer matters a lot. Your aim should be to make examiner's life as easy as possible so that he/she will award you maximum marks. Only the final answer doesn't matter. Writing proper steps is also important to show the logical flow with which you arrived at the solution. Specifically mention whichever theorem or property you are using in a particular step. Wherever possible, draw neat diagrams with proper labelling. Such small things will collectively fetch you the extra marks that you are expecting from this optional. The habit of writing such detailed answers will not develop overnight and hence you have to consciously work through the test series in this direction.

### DURING MAINS

The mains exam schedule does not provide much gap between General Studies & Maths papers. You will generally have 1 day in between. Your notebook containing important formulae & theorems will be very useful at such times. You will be able to go through this summary of each chapter and it will provide much needed confidence before the actual paper. During the main exam, I would advise completing the compulsory questions 1 & 5 first. Then you can choose 3 out of remaining 6 questions. Easier questions like those from topics like linear programming, numerical analysis, linear algebra etc. should be the priority. Even if you don't know the complete answer to any question, write as many steps as you can since partial marks also matter. Once you finish paper 1, don't start immediately analyzing your performance. Irrespective of whether you are very happy or deeply unsatisfied about paper 1, try to forget about it and stay calm for paper 2.

(6)

7. (c) The temperature  $T$  at any point  $(x, y, z)$  in space is  $T = 400 xyz^2$ . Find the highest temperature on the unit sphere  $x^2 + y^2 + z^2 = 1$ . [15]
7. (d) Evaluate the following integral  $\int_0^\infty \int_0^x xe^{-x^2/y} dx dy$  by changing the order of integration. [13]
8. (a) Show that the enveloping cylinder of the conicoid  $ax^2 + by^2 + cz^2 = 1$  with generators perpendicular to  $x$ -axis meets the plane  $z = 0$  in parabolas. [15]
8. (b) Find the surface generated by a line which intersects the lines  $y = a = z$  and  $x + 3z = a = y + z$  and is parallel to the plane  $x + y = 0$ . [15]
8. (c) Show that the surface represented by the equation  $x^2 + y^2 + z^2 - yz - xz - xy - 3x - 6y - 9z + 21 = 0$  is a paraboloid of revolution the coordinates of the focus being  $(1, 2, 3)$  and the equations to axis are  $x = y - 1 = z - 2$ . [20]

## OUR TOPPER'S MARKS LIST (IAS)

- For your final selection, optional subject marks are crucial.
- Choose Optional Subject based on Your Graduation Studies & Score Highest Marks.
- Now Mathematics has become one of the most Cherished Optional Paper among Science Graduates, especially Students with Mathematics background including D.Tech.
- In the new pattern of exam, the average marks of successful candidates in Maths is more than 300 out of 500
- Mathematics (Opt.) has proven to be the Most Reliable and High Scoring Subject in IAS/IFoS.
- IMS has been successfully providing consistent results since its inception.

### MARKS ARE BEFORE YOU AND YOU SHOULD ANALYZE YOURSELF

	<b>KANISHAK KATARIA</b>	<b>AIR-01</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	133	
GENERAL STUDIES-I (PAPER-II)	250	098	
GENERAL STUDIES-II (PAPER-III)	250	117	
GENERAL STUDIES-III (PAPER-IV)	250	117	
GENERAL STUDIES-IV (PAPER-V)	250	116	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	170/250	361/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	191/250	942	
WRITTEN TOTAL	1750	942	
PERSONALITY TEST	275	179	
TOTAL FINAL	2025	1121	
	<b>K. VARUN REDDY</b>	<b>AIR-07</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	113	
GENERAL STUDIES-I (PAPER-II)	250	097	
GENERAL STUDIES-II (PAPER-III)	250	113	
GENERAL STUDIES-III (PAPER-IV)	250	117	
GENERAL STUDIES-IV (PAPER-V)	250	121	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	178/250	324/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	146/250	885	
WRITTEN TOTAL	1750	885	
PERSONALITY TEST	275	182	
TOTAL FINAL	2025	1067	
	<b>TANMAY V. SHARMA</b>	<b>AIR-10</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	138	
GENERAL STUDIES-I (PAPER-II)	250	091	
GENERAL STUDIES-II (PAPER-III)	250	111	
GENERAL STUDIES-III (PAPER-IV)	250	097	
GENERAL STUDIES-IV (PAPER-V)	250	104	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	168/250	336/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	168/250	342/500	
WRITTEN TOTAL	1750	877	
PERSONALITY TEST	275	187	
TOTAL FINAL	2025	1064	
	<b>G.S.S. PRAVEENCHAND</b>	<b>AIR-64</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	119	
GENERAL STUDIES-I (PAPER-II)	250	098	
GENERAL STUDIES-II (PAPER-III)	250	107	
GENERAL STUDIES-III (PAPER-IV)	250	106	
GENERAL STUDIES-IV (PAPER-V)	250	101	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	175/250	342/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	167/250	342/500	
WRITTEN TOTAL	1750	873	
PERSONALITY TEST	275	157	
TOTAL FINAL	2025	1030	
	<b>DALIP KUMAR</b>	<b>AIR-73</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	117	
GENERAL STUDIES-I (PAPER-II)	250	084	
GENERAL STUDIES-II (PAPER-III)	250	115	
GENERAL STUDIES-III (PAPER-IV)	250	109	
GENERAL STUDIES-IV (PAPER-V)	250	097	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	171/250	327/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	156/250	327/500	
WRITTEN TOTAL	1760	849	
PERSONALITY TEST	275	179	
TOTAL FINAL	2025	1028	
	<b>JAY SHIVAN</b>	<b>AIR-81</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	117	
GENERAL STUDIES-I (PAPER-II)	250	096	
GENERAL STUDIES-II (PAPER-III)	250	101	
GENERAL STUDIES-III (PAPER-IV)	250	098	
GENERAL STUDIES-IV (PAPER-V)	250	103	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	164/250	336/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	172/250	336/500	
WRITTEN TOTAL	1750	854	
PERSONALITY TEST	275	171	
TOTAL FINAL	2025	1025	
	<b>KHUSHBOO GUPTA</b>	<b>AIR-80</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	141	
GENERAL STUDIES-I (PAPER-II)	250	088	
GENERAL STUDIES-II (PAPER-III)	250	103	
GENERAL STUDIES-III (PAPER-IV)	250	093	
GENERAL STUDIES-IV (PAPER-V)	250	103	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	175/250	326/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	161/250	326/500	
WRITTEN TOTAL	1750	854	
PERSONALITY TEST	275	171	
TOTAL FINAL	2025	1025	
	<b>AANCHAL SRIVASTAVA</b>	<b>AIR-110</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	125	
GENERAL STUDIES-I (PAPER-II)	250	090	
GENERAL STUDIES-II (PAPER-III)	250	107	
GENERAL STUDIES-III (PAPER-IV)	250	106	
GENERAL STUDIES-IV (PAPER-V)	250	109	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	152/250	309/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	167/250	309/500	
WRITTEN TOTAL	1750	846	
PERSONALITY TEST	275	171	
TOTAL FINAL	2025	1017	
	<b>HIMANSHU PRAJAPATI</b>	<b>AIR-124</b>	<b>IAS-2018</b>
<b>SUBJECT</b>	<b>Max. Marks</b>	<b>Marks Obtained</b>	
ESSAY (PAPER-I)	250	113	
GENERAL STUDIES-I (PAPER-II)	250	075	
GENERAL STUDIES-II (PAPER-III)	250	104	
GENERAL STUDIES-III (PAPER-IV)	250	099	
GENERAL STUDIES-IV (PAPER-V)	250	094	
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	168/250	328/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	160/250	328/500	
WRITTEN TOTAL	1750	813	
PERSONALITY TEST	275	201	
TOTAL FINAL	2025	1014	

## WHY MATHEMATICS

It is very important for a UPSC aspirant to have genuine interest in mathematics if he/she wants to choose this optional. Maths used to be my favourite subject in school and in IITB also I had pursued additional courses in mathematics out of interest. Since the syllabus is large & requires considerable practice, it is necessary to have a genuine interest. Apart from my inherent inclination, this optional offers certain advantages which made it an obvious choice. In this optional, the marks you get are almost proportional to your efforts. With proper hard work, a candidate can comfortably attempt all the questions in exam and expect to score around 50% marks even after heavy scaling which can offer the necessary edge in this intense competition. Such candidate generally would not find any question surprising in mains. This kind of certainty is not present in humanities optionals.

## THE SYLLABUS

The prescribed syllabus for maths is quite large which makes it necessary to stick to limited sources. I relied on notes provided by Venkanna Sir at IMS for covering the syllabus. Since these notes were very comprehensive, I didn't have to spend time scanning reference books for relevant material. Venkanna Sir's classroom coaching helped me in completing the syllabus in a disciplined manner. Initially I would underline important theorems, formulae, results mentioned in the notes. Then i used to compile them in a notebook and this was useful for revision. So eventually i had a notebook with just the crux of the matter. I would advise all candidates with maths optional to prepare such a summary for all topics. Due to large syllabus, there is a natural tendency to skip a few chapters. But for the sake of compulsory questions, it is necessary to know at least basics of each chapter. The physics related chapters of statics, dynamics, mechanics are generally left untouched while preparing maths optional. Regarding these chapters, my preparation was such that i would be able to solve the compulsory 10 mark questions. They are quite manageable once you know the basic theory and there is no point in unnecessarily losing marks. The real analysis/calculus & modern algebra chapters are time consuming but candidates can't afford to skip them.

## PRACTICE

Just knowing theory is not enough. It needs to be accompanied by consistent problem solving practice. It is best to solve questions that have already been

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Mains exam is nearly a marathon for your hand and thus you get very much trained for facing them. Test Series also provided me another pool of questions to practise. They also helped in developing the ability of answer writing which definitely can't be developed overnight. I attended Test Series of IMS and luckily many questions of Test Series appeared in both IFoS Exam and CSE. I would also request all the candidates to give the test series by coming to classroom if possible and stick to the timelines as it really helps in completion of syllabus.

I hope this writeup clears some of the doubts and gives clarity on maths optional to UPSC IAS aspirants. All the Best

*If anyone wants to contact me, please drop me an email - parthjaiswal512@gmail.com. I will be more than happy to help you.*

Thank You

Parth Jaiswal

AIR-5 in IFoS-2014,  
AIR-299 in CSE-2014

### KUMBHEJKAR YOGESH VIJAY

(AIR-08 in IAS-2015)

(AIR-13 IFoS) & (AIR-143 IAS)

in IFoS-2014 & IAS-2014 Examinations

CLASSROOM STUDENT

### MY BACKGROUND

I am Yogesh Kumbhejkar. I am an Electrical Engineer from IIT Bombay. I secured AIR 13 in Indian Forest Service Exam (IFoS) 2014 with Mathematics & Physics as the optional subjects. For Civil Service Exam (CSE) also, my optional is Mathematics. In IFoS exam, I scored 231/400 (118 + 113) in maths. In 2013 CSE Mains, my maths score was 250/500 (109 + 141). Hence mathematics has helped me in clearing mains in both CSE and IFoS. I was not selected in the final list of CSE 2013. In my second CSE attempt also I appeared for mains in 2014 with Maths as the optional subject. Now i am awaiting the Mains result. This article is a humble attempt to share my experience of maths optional preparation for CSE/IFoS exam. I would be glad if it helps any UPSC aspirant who is undecided about choosing the optional or those who are already preparing with mathematics as their optional.

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SUNEEL SHEORAN AIR-192 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-I (PAPER-II)	250	087		
	GENERAL STUDIES-II (PAPER-III)	250	090		
	GENERAL STUDIES-III (PAPER-IV)	250	105		
	GENERAL STUDIES-IV (PAPER-V)	250	096		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	173/250	325/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	152/250			
	WRITTEN TOTAL	1750	821		
	PERSONALITY TEST	275	182		
	TOTAL FINAL	2025	1003		

AKASH SINGH AIR-193 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	082		
	GENERAL STUDIES-III (PAPER-IV)	250	095		
	GENERAL STUDIES-IV (PAPER-V)	250	101		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	161/250	336/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	175/250			
	WRITTEN TOTAL	1750	827		
	PERSONALITY TEST	275	176		
	TOTAL FINAL	2025	1003		

SACHIN BANSAL AIR-348 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	091		
	GENERAL STUDIES-III (PAPER-IV)	250	109		
	GENERAL STUDIES-IV (PAPER-V)	250	104		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	167/260	316/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	149/250			
	WRITTEN TOTAL	1750	849		
	PERSONALITY TEST	275	138		
	TOTAL FINAL	2025	987		

KATTA RAVI TEJA AIR-349 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	101		
	GENERAL STUDIES-III (PAPER-IV)	250	110		
	GENERAL STUDIES-IV (PAPER-V)	250	105		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	173/260	322/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	149/250			
	WRITTEN TOTAL	1750	808		
	PERSONALITY TEST	275	179		
	TOTAL FINAL	2025	987		

S.GAUTHAM HAJ AIR-353 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	093		
	GENERAL STUDIES-III (PAPER-IV)	250	096		
	GENERAL STUDIES-IV (PAPER-V)	250	085		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	162/250	296/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	134/250			
	WRITTEN TOTAL	1750	791		
	PERSONALITY TEST	275	195		
	TOTAL FINAL	2025	986		

RAJAT BHARDWAJ AIR-366 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	108		
	GENERAL STUDIES-III (PAPER-IV)	250	113		
	GENERAL STUDIES-IV (PAPER-V)	250	107		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	162/250	302/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	140/250			
	WRITTEN TOTAL	1750	845		
	PERSONALITY TEST	275	140		
	TOTAL FINAL	2025	985		

C.VISHNU CHARAN AIR-406 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	093		
	GENERAL STUDIES-III (PAPER-IV)	250	099		
	GENERAL STUDIES-IV (PAPER-V)	250	090		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	153/250	312/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	159/250			
	WRITTEN TOTAL	1750	793		
	PERSONALITY TEST	275	107		
	TOTAL FINAL	2025	980		

PANKAJ KUMAWAT AIR-443 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	106		
	GENERAL STUDIES-III (PAPER-IV)	250	115		
	GENERAL STUDIES-IV (PAPER-V)	250	106		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	176/250	334/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	158/250			
	WRITTEN TOTAL	1750	833		
	PERSONALITY TEST	275	130		
	TOTAL FINAL	2025	971		

SANJAY SAHU AIR-526 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	105		
	GENERAL STUDIES-III (PAPER-IV)	250	106		
	GENERAL STUDIES-IV (PAPER-V)	250	101		
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	134/250	305/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	171/250			
	WRITTEN TOTAL	1750	815		
	PERSONALITY TEST	275	138		
	TOTAL FINAL	2025	953		

AMIT KUMAWAT AIR-600 IAS-2018	SUBJECT	Max. Marks.	Marks. Obtained		
				ESSAY (PAPER-I)	GENERAL STUDIES-I (PAPER-II)
	GENERAL STUDIES-II (PAPER-III)	250	118		
	GENERAL STUDIES-III (PAPER-IV)	250	079		
	GENERAL STUDIES-IV (PAPER-V)	250	093		
	GENERAL STUDIES-V (PAPER-VI)	250	103		
	OPTIONAL-I (MATHEMATICS) (PAPER-VII)	165/250	322/500		
	OPTIONAL-II (MATHEMATICS) (PAPER-VIII)	185/250			
	WRITTEN TOTAL	1750	805		
	PERSONALITY TEST	275	158		
	TOTAL FINAL	2025	943		

# REPARATION STRATEGY

**for IAS/IFoS  
MATHEMATICS  
(Optional)  
by Successful Candidate  
PARTH JAISWAL**  
**(AIR-5 IFoS) & (AIR-299 IAS)**  
**in IFoS-2014 & IAS-2014 Examinations**  
**CLASSROOM STUDENT**

## MY BACKGROUND

Hello, My name is Parth Jaiswal. I come from Jaipur, Rajasthan. I completed my graduation in Computer Science discipline from IIT Delhi in 2013. Soon afterwards I started preparing for Civil services and Indian Forest Service, aiming for the attempt of year 2014.

Luckily I was able to clear both the examinations in my first attempt. I secured AIR-5 in IFoS-2014 and AIR-299 in CSE-2014. My optional subject was Mathematics. In case of Forest Service Examination, candidate is required to choose 2 Optionals, thus my second optional was Forestry with Mathematics as my first optional. I secured 250/400 (125+125) marks in IFoS Exam and 300/500 (147+153) marks in CSE in Maths. Thus I would give much credit for my success to my correct choice of optional as well as performance in it. I am writing this to share my experience with Maths as an optional subject and would feel happy if I am able to clear some of the doubts as well as apprehensions regarding it which many UPSC aspirants possess.

## Why I Chose Mathematics?

I chose **Mathematics** because of my inherent interest in it from childhood. I have performed well in this in my throughout education and thus was confident enough to handle it well. Another reason for choosing it was, I wanted to have my optional from my background and thus Maths proved to be appropriate choice. Having a science background, I found it much easier to study than any other subject, many of which we have to study for GS prep. **I would like to assert few points regarding it very clearly.**

- This subject is vast in syllabus and takes more time to study than other optionals.

- It also requires consistent practise. But the positive part is - If you are thorough with the subject and have practised it well, you can comfortably attempt complete paper with correct answers and thus gives you a great opportunity to score well in your optional (inspite of the scaling often carried out in it) pushing you above the list.
- In this way, this optional gives a bit of security as well as certainty which again comes at a price i.e great amount of hard work. Also IFoS Exam prescribes certain optionals only and Mathematics is one of them. Not all optionals are available for this exam.
- So again it gives you the flexibility of giving IFoS Exam.

## From where to study?

I attended classroom coaching of IMS, Rajinder Nagar. I restricted my preparation to the handouts provided by Venkanna Sir. Because of the voluminous syllabus, it is necessary to gauge the point where you have to stop. I found that the notes quite comprehensive and provided me a holistic coverage of the syllabus in a highly structured manner. I believe that those notes are sufficient from the theory point of view.

For practising questions which is of utmost importance, I solved all the questions given in the notes (whether solved or unsolved) multiple times in my registers. Besides that, I solved the questions of previous year papers provided by sir, again multiple times. I restricted my preparation upto this point. But if any student faces difficulty in understanding any particular topic or finds notes insufficient for it or wants to practise more, he/she can use any reference book for any particular topic which can easily be found on internet or available in market.

But again a word of caution, try to limit your preparation to the concepts relevant to the syllabus and don't delve into unnecessary theorems or proofs otherwise its a slippery slope to a massive ocean. We tend to skip the proofs of various theorems provided in the syllabus while studying them as they are of not much use. Proofs of theorems are generally not asked in the exams. But still I used to go through each and every proof in a brief manner provided in the notes. The reason being it would give me a better insight of the topic and often helped in me developing solutions of questions.

## Test Series:

No optional is complete without writing a test series and it holds true in Maths also. Test Series is as important in your preparation as your notes + books. Firstly, Test Series is the best mode of judging your preparation. You can fairly evaluate your performance with your marks and then focus on the weak topics. Secondly, its a rehearsal of Mains Exam and thus helps you greatly in time management.