

No. 1 INSTITUTE FOR IAS/IFoS EXAMINATIONS



OUR ACHIEVEMENTS IN IAS (FROM 2008 TO 2019)



HEAD OFFICE: 25/8, Old Rajinder Nagar, Delhi-60. BRANCH OFFICE: 105-106, Top Floor, Mukherjee Tower Mukherjee Nagar, Delhi-9

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Regional Office: H.No. 1-10-237, 2nd Floor, Room No. 202 R.K.'s Kancham's Blue Sapphire Ashok Nagar, Hyderabad-20. Ph.: 9652351152, 9652661152

MAINS TEST SERIES-2020

(JULY to DEC.-2020)

IAS/IFoS

MATHEMATICS

Under the guidance of **K. Venkanna**

TEST CODE: TEST-7: IAS(M)/11-OCT-2020

FULL SYLLABUS (PAPER-I)

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.



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SECTION – A

1. (a) (i) Define a finite dimensional vector space and prove that every finite dimensional vector space has a basis. Is $F[x]$ finite dimensional? Justify.

(ii) Let $V = \mathbb{R}^3(\mathbb{R})$. Find a basis of V which contains $\{(1, 1, 1)\}$.

[10]

1. (b) Let $U = \text{span} \{(1, 3, -2, 2, 3), (1, 4, -3, 4, 2), (2, 3, -1, -2, 9)\}$
 $W = \text{span} \{(1, 3, 0, 2, 1), (1, 5, -6, 6, 3), (2, 5, 3, 2, 1)\}$
 be the subspace of \mathbb{R}^5 .

Find the basis and dimension of U , W , $U + W$ and $U \cap W$.

[10]

1. (c) Show that $f(xy, z - 2x) = 0$ satisfies, under suitable conditions, the equation $x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y} = 2x$. What are these conditions?

[10]

1. (d) Obtain the volume bounded by the elliptic paraboloids given by the equations $z = x^2 + 9y^2$ and $z = 18 - x^2 - 9y^2$.

[10]

1. (e) P is the variable point on the given line and A, B, C are its projections on the axes. Show that the sphere $OABC$ passes through a fixed circle.

[10]

2. (a) Let $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be defined by:
 $T(x_1, x_2, x_3) = (x_1 + x_2, x_2 + x_3, x_3 + x_1)$.
































































Is T invertible? If yes, find $T^{-1}(x_1, x_2, x_3)$.

[10]

2. (b) Let T be the linear transformation from \mathbb{R}^3 into \mathbb{R}^2 defined by: $T(x_1, x_2, x_3) = (x_1 + x_2, 2x_3 - x_1)$.

If $\beta = \{(1, 0, -1), (1, 1, 1), (1, 0, 0)\}$ and $\beta' = \{(0, 1), (1, 0)\}$, what is the matrix of T relative to the pair $\beta\beta'$. Also find rank T and nullity (T).

[10]**No.1 INSTITUTE FOR IAS/IFoS EXAMINATIONS****OUR ACHIEVEMENTS IN IFoS (FROM 2008 TO 2019)****OUR RANKERS AMONG TOP 10 IN IFoS**

| | | | | | | |
|---|---|--|---|---|---|---|
|  AIR-01 IFoS-2019 |  AIR-01 IFoS-2015 |  AIR-03 IFoS-2016 |  AIR-03 IFoS-2014 |  AIR-04 IFoS-2014 |  AIR-04 IFoS-2010 |  AIR-05 IFoS-2019 |
|  AIR-05 IFoS-2017 |  AIR-05 IFoS-2014 |  AIR-05 IFoS-2011 |  AIR-06 IFoS-2015 |  AIR-07 IFoS-2012 |  AIR-09 IFoS-2018 |  AIR-10 IFoS-2017 |
|  AIR-13 IFoS-2019 |  AIR-16 IFoS-2019 |  AIR-20 IFoS-2019 |  AIR-24 IFoS-2019 |  AIR-30 IFoS-2019 |  AIR-38 IFoS-2019 |  AIR-83 IFoS-2019 |
|  AIR-16 IFoS-2019 |  AIR-29 IFoS-2019 |  AIR-22 IFoS-2017 |  AIR-23 IFoS-2017 |  AIR-24 IFoS-2017 |  AIR-25 IFoS-2017 | |
|  AIR-35 IFoS-2017 |  AIR-36 IFoS-2017 |  AIR-40 IFoS-2017 |  AIR-45 IFoS-2017 |  AIR-51 IFoS-2017 |  AIR-58 IFoS-2017 |  AIR-68 IFoS-2017 |
|  AIR-80 IFoS-2017 |  AIR-93 IFoS-2017 |  AIR-21 IFoS-2016 |  AIR-22 IFoS-2016 |  AIR-23 IFoS-2016 |  AIR-30 IFoS-2016 | |
|  AIR-31 IFoS-2016 |  AIR-32 IFoS-2016 |  AIR-35 IFoS-2016 |  AIR-36 IFoS-2016 |  AIR-48 IFoS-2016 |  AIR-57 IFoS-2016 |  AIR-58 IFoS-2016 |
|  AIR-68 IFoS-2016 |  AIR-98 IFoS-2016 |  AIR-108 IFoS-2016 |  AIR-13 IFoS-2015 |  AIR-15 IFoS-2015 |  AIR-19 IFoS-2015 | |
|  AIR-29 IFoS-2015 |  AIR-30 IFoS-2015 |  AIR-35 IFoS-2015 |  AIR-36 IFoS-2015 |  AIR-48 IFoS-2015 |  AIR-57 IFoS-2015 |  AIR-58 IFoS-2015 |
|  AIR-68 IFoS-2015 |  AIR-98 IFoS-2015 |  AIR-108 IFoS-2015 |  AIR-13 IFoS-2015 |  AIR-15 IFoS-2015 |  AIR-19 IFoS-2015 | |

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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



AANCHAL 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. (c) (i) Show that $\int_0^\infty \log\left(x + \frac{1}{x}\right) \frac{dx}{1+x^2} = \pi \log 2$

(ii) Let $E = \{(x, y) \in \mathbf{R}^2 / 0 < x < y\}$. Then evaluate $\iint_E ye^{-(x+y)} dx dy$ [14]

2. (d) (i) Prove that the lines $\frac{x-a+d}{\alpha-\delta} = \frac{y-a}{\alpha} = \frac{z-a-d}{\alpha+\delta}$ and $\frac{x-b+c}{\beta-\gamma} = \frac{y-b}{\beta} = \frac{z-b-c}{\beta+\gamma}$ are coplanar and find the

equation to the plane in which they lie.

(ii) If $x/1 = y/2 = z/3$ represent one of a set of three mutually perpendicular generators of the cone $5yz - 8zx - 3xy = 0$, find the equations of the other two. [16]

3. (a) Let $H = \begin{pmatrix} 1 & i & 2+i \\ -i & 2 & 1-i \\ 2-i & 1+i & 2 \end{pmatrix}$ be a Hermitian matrix. Find

a non-singular matrix P such that $D = P^T H \bar{P}$ is diagonal. [15]

3. (b) (i) Test the convergence of the integral $\int_1^2 \frac{dx}{\sqrt{x^4 - 1}}$.

(ii) Show that the function f , where

$$f(x, y) = \begin{cases} \frac{x^3 - y^3}{x^2 + y^2}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$$

is continuous, possesses partial derivatives but is not differentiable at the origin. [8+12=20]

(3)

3. (c) If Q is a point on the normal to the ellipsoid $\Sigma(x^2/a^2) = 1$ at the point P, such that $3PQ = PG_1 + PG_2 + PG_3$, where G_1, G_2, G_3 are the points where the normal at P meets the yz, zx and xy planes, then the locus of Q is

$$\frac{a^2x^2}{(2a^2 - b^2 - c^2)^2} + \frac{b^2y^2}{(2b^2 - c^2 - a^2)^2} + \frac{c^2z^2}{(2c^2 - a^2 - b^2)^2} = \frac{1}{9} \quad [15]$$

4. (a) (i) Find the condition on a, b, and c so that the following system in unknowns x, y and z has a solution.

$$x + 2y - 3z = a, \quad 2x + 6y - 11z = b, \quad x - 2y + 7z = c$$

- (ii) Find an upper triangular matrix A such that

$$A^3 = \begin{bmatrix} 8 & -57 \\ 0 & 27 \end{bmatrix} \quad [16]$$

4. (b) A flat circular plate has the shape of the region $x^2 + y^2 \leq 1$. The plate, including the boundary where $x^2 + y^2 = 1$, is heated so that the temperature at any point (x, y) is $T(x, y) = x^2 + 2y^2 - x$.

Find the hottest and coldest points on the plate, and the temperature at each of these points. [16]

4. (c) Prove that in general two generators of the hyperboloid $(x^2/a^2) + (y^2/b^2) - (z^2/c^2) = 1$ can be drawn to cut a given generator at right angles. Also show that if they meet the plane $z = 0$ in P and Q, PQ touches the ellipse $(x^2/a^6) + (y^2/b^6) = c^4/(a^4b^4)$. [18]

(16)

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.

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:

1. **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!
2. **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

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.

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

SECTION - B

5. (a) Solve $\frac{d^2y}{dx^2} - \cot x \frac{dy}{dx} - (1 - \cot x)y = e^x \sin x$. [10]
5. (b) (i) Evaluate $L^{-1}\{3(1 + e^{-s\pi})/(s^2 + 9)\}$.
(ii) Evaluate $L^{-1}\left\{\frac{1}{s^4(s^2 + 1)}\right\}$ [10]
5. (c) Four uniform rods are freely jointed at their extremities and form a parallelogram ABCD, which is suspended by the joint. A, and is kept in shape by a string AC. Prove that the tension of the string is equal to half the weight of all the four rods. [10]
5. (d) A particle is projected vertically upwards from the surface of earth with a velocity just sufficient to carry it to the infinity. Prove that the time it takes to reach a height h is $\frac{1}{3}\sqrt{\frac{2a}{g}\left[\left(1 + \frac{h}{a}\right)^{3/2} - 1\right]}$ where a is the radius of the earth. [10]
5. (e) Verify Green's theorem in the plane for $\int_C [(2xy - x^2)dx + (x^2 + y^2)dy]$, where C is boundary of the region enclosed by $y = x^2$ and $y^2 = x$ described in the positive sense. [10]
6. (a) (i) Solve $(4y + 3x) dy + (y - 2x) dx = 0$.
(ii) Solve $(xy^2 + e^{-1/x^3})dx - x^2y dy = 0$ [14]
6. (b) Find the orthogonal trajectories of cardioids $r = a(1 - \cos \theta)$, a being parameter. [08]

(5)

6. (c) Solve $y = 2px + y^2p^3$. [10]
6. (d) (i) Find $L\{(2/t)(1 - \cosh 2t)\}$.
 (ii) Solve $(D^2 + m^2)x = a \cos nt$, $t > 0$, if x, Dx equal to x_0 and x_1 , when $t = 0$, $n \neq m$. [5+13=18]
7. (a) A solid homogeneous hemisphere of radius r has a solid right circular cone of the same substance constructed on the base ; the hemisphere rests on the convex side of the fixed sphere of radius R . Show that the length of the axis of the cone consistent with stability for a small rolling displacement is $\frac{r}{R+r} \left[\sqrt{\{(3R+r)(R-r)\}} - 2r \right]$. [17]
7. (b) A particle is free to move on a smooth vertical circular wire of radius a . It is projected from the lowest point with velocity just sufficient to carry it to the highest point. Show that the reaction between the particle and the wire is zero after a time $\sqrt{a/g} \cdot \log(\sqrt{5} + \sqrt{6})$. [17]
7. (c) A particle moves with a central acceleration $\mu/(\text{distance})^2$, it is projected with velocity V at a distance R . Show that its path is a rectangular hyperbola if the angle of projection is $\sin^{-1} \left[\frac{\mu}{VR \left(V^2 - \frac{2\mu}{R} \right)^{1/2}} \right]$. [16]
8. (a) (i) Find the directional derivative of $\nabla \cdot (\nabla \phi)$ at the point $(1, -2, 1)$ in the direction of the normal to the surface $xy^2z = 3x + z^2$, where $\phi = 2x^3y^2z^4$.

(14)

Irrespective of whether you are very happy or deeply unsatisfied about paper 1, try to forget about it and stay calm for paper 2.

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.

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 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.

- (ii) A particle moves along the curve $x = 4 \cos t$, $y = 4 \sin t$, $z = 6t$. Find the velocity and acceleration at time $t = 0$ and $t = \frac{1}{2}\pi$. Find also the magnitudes of

the velocity and acceleration at any time t . [12]

8. (b) Find the curvature and torsion of the curve

$$\vec{r} = a(u - \sin u)\vec{i} + a(1 - \cos u)\vec{j} + bu\vec{k} \quad [13]$$

8. (c) Find the work done in moving a particle once around a circle C in the xy -plane, if the circle has centre at the origin and radius 2 and if the force field F is given by $F = (2x - y + 2z)\vec{i} + (x + y - z)\vec{j} + (3x - 2y - 5z)\vec{k}$. [10]

8. (d) By using Gauss divergence theorem

evaluate $\iint_S (x^2 + y^2) dS$, where S is the surface of the cone $z^2 = 3(x^2 + y^2)$ bounded by $z = 0$ and $z = 3$. [15]

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 B.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

| SUBJECT | Max. Marks | Marks Obtained | SUBJECT | Max. Marks | Marks Obtained |
|--|------------|----------------|---|------------|----------------|
| | | | | | |
|  KANISHK KATARIA | 250 | 133 |  K. VARUN REDDY | 250 | 113 |
| ESSAY (PAPER-I) | 250 | 098 | GENERAL STUDIES-I (PAPER-II) | 250 | 097 |
| GENERAL STUDIES-I (PAPER-II) | 250 | 117 | GENERAL STUDIES-II (PAPER-III) | 250 | 113 |
| GENERAL STUDIES-II (PAPER-III) | 250 | 117 | GENERAL STUDIES-III (PAPER-IV) | 250 | 117 |
| GENERAL STUDIES-III (PAPER-IV) | 250 | 116 | GENERAL STUDIES-IV (PAPER-V) | 250 | 121 |
| GENERAL STUDIES-IV (PAPER-V) | 250 | 116 | GENERAL STUDIES-V (PAPER-VI) | 250 | 121 |
| OPTIONAL-I (MATHEMATICS) (PAPER-VII) | 170/250 | 361/500 | OPTIONAL-I (MATHEMATICS) (PAPER-VI) | 178/250 | 324/500 |
| OPTIONAL-II (MATHEMATICS) (PAPER-VIII) | 191/250 | | OPTIONAL-II (MATHEMATICS) (PAPER-VII) | 146/250 | |
| WRITTEN TOTAL | 1750 | 942 | WRITTEN TOTAL | 1750 | 885 |
| PERSONALITY TEST | 275 | 179 | PERSONALITY TEST | 275 | 182 |
| TOTAL FINAL | 2025 | 1121 | TOTAL FINAL | 2025 | 1067 |
| AIR-01 | | | AIR-07 | | |
| IAS-2018 | | | IAS-2018 | | |
|  TANMAY V. SHARMA | 250 | 138 |  G.S.S. PRAVEENCHAND | 250 | 119 |
| ESSAY (PAPER-I) | 250 | 091 | GENERAL STUDIES-I (PAPER-II) | 250 | 098 |
| GENERAL STUDIES-I (PAPER-II) | 250 | 111 | GENERAL STUDIES-II (PAPER-III) | 250 | 107 |
| GENERAL STUDIES-II (PAPER-III) | 250 | 097 | GENERAL STUDIES-III (PAPER-IV) | 250 | 106 |
| GENERAL STUDIES-III (PAPER-IV) | 250 | 104 | GENERAL STUDIES-IV (PAPER-V) | 250 | 101 |
| GENERAL STUDIES-IV (PAPER-V) | 250 | 104 | GENERAL STUDIES-V (PAPER-VI) | 250 | 101 |
| OPTIONAL-I (MATHEMATICS) (PAPER-VII) | 168/250 | 336/500 | OPTIONAL-I (MATHEMATICS) (PAPER-VI) | 175/250 | 342/500 |
| OPTIONAL-II (MATHEMATICS) (PAPER-VIII) | 168/250 | | OPTIONAL-II (MATHEMATICS) (PAPER-VII) | 167/250 | |
| WRITTEN TOTAL | 1750 | 877 | WRITTEN TOTAL | 1750 | 873 |
| PERSONALITY TEST | 275 | 187 | PERSONALITY TEST | 275 | 157 |
| TOTAL FINAL | 2025 | 1064 | TOTAL FINAL | 2025 | 1030 |
| AIR-10 | | | AIR-64 | | |
| IAS-2018 | | | IAS-2018 | | |
|  MANISHA RANA | 250 | 130 |  DALIP KUMAR | 250 | 117 |
| ESSAY (PAPER-I) | 250 | 105 | GENERAL STUDIES-I (PAPER-II) | 250 | 084 |
| GENERAL STUDIES-I (PAPER-II) | 250 | 099 | GENERAL STUDIES-II (PAPER-III) | 250 | 115 |
| GENERAL STUDIES-II (PAPER-III) | 250 | 112 | GENERAL STUDIES-III (PAPER-IV) | 250 | 109 |
| GENERAL STUDIES-III (PAPER-IV) | 250 | 100 | GENERAL STUDIES-IV (PAPER-V) | 250 | 097 |
| GENERAL STUDIES-IV (PAPER-V) | 250 | 100 | GENERAL STUDIES-V (PAPER-VI) | 250 | 097 |
| OPTIONAL-I (MATHEMATICS) (PAPER-VII) | 155/250 | 326/500 | OPTIONAL-I (MATHEMATICS) (PAPER-VI) | 171/250 | 327/500 |
| OPTIONAL-II (MATHEMATICS) (PAPER-VIII) | 171/250 | | OPTIONAL-II (MATHEMATICS) (PAPER-VII) | 156/250 | |
| WRITTEN TOTAL | 1750 | 872 | WRITTEN TOTAL | 1750 | 849 |
| PERSONALITY TEST | 275 | 157 | PERSONALITY TEST | 275 | 179 |
| TOTAL FINAL | 2025 | 1029 | TOTAL FINAL | 2025 | 1028 |
| AIR-67 | | | AIR-73 | | |
| IAS-2018 | | | IAS-2018 | | |
|  KHUSHBOO GUPTA | 250 | 141 |  JAY SHIVANI | 250 | 117 |
| ESSAY (PAPER-I) | 250 | 088 | GENERAL STUDIES-I (PAPER-II) | 250 | 096 |
| GENERAL STUDIES-I (PAPER-II) | 250 | 103 | GENERAL STUDIES-II (PAPER-III) | 250 | 104 |
| GENERAL STUDIES-II (PAPER-III) | 250 | 093 | GENERAL STUDIES-III (PAPER-IV) | 250 | 098 |
| GENERAL STUDIES-III (PAPER-IV) | 250 | 103 | GENERAL STUDIES-IV (PAPER-V) | 250 | 103 |
| GENERAL STUDIES-IV (PAPER-V) | 250 | 103 | GENERAL STUDIES-V (PAPER-VI) | 250 | 103 |
| OPTIONAL-I (MATHEMATICS) (PAPER-VII) | 175/250 | 326/500 | OPTIONAL-I (MATHEMATICS) (PAPER-VI) | 164/250 | 336/500 |
| OPTIONAL-II (MATHEMATICS) (PAPER-VIII) | 151/250 | | OPTIONAL-II (MATHEMATICS) (PAPER-VII) | 172/250 | |
| WRITTEN TOTAL | 1750 | 854 | WRITTEN TOTAL | 1750 | 854 |
| PERSONALITY TEST | 275 | 171 | PERSONALITY TEST | 275 | 171 |
| TOTAL FINAL | 2025 | 1025 | TOTAL FINAL | 2025 | 1025 |
| AIR-80 | | | AIR-81 | | |
| IAS-2018 | | | IAS-2018 | | |
|  ANCHAL SRIVASTAVA | 250 | 125 |  HIMANSHU PRAJAPATI | 250 | 113 |
| ESSAY (PAPER-I) | 250 | 090 | GENERAL STUDIES-I (PAPER-II) | 250 | 075 |
| GENERAL STUDIES-I (PAPER-II) | 250 | 107 | GENERAL STUDIES-II (PAPER-III) | 250 | 104 |
| GENERAL STUDIES-II (PAPER-III) | 250 | 106 | GENERAL STUDIES-III (PAPER-IV) | 250 | 099 |
| GENERAL STUDIES-III (PAPER-IV) | 250 | 109 | GENERAL STUDIES-IV (PAPER-V) | 250 | 094 |
| GENERAL STUDIES-IV (PAPER-V) | 250 | 109 | GENERAL STUDIES-V (PAPER-VI) | 250 | 094 |
| OPTIONAL-I (MATHEMATICS) (PAPER-VII) | 152/250 | 309/500 | OPTIONAL-I (MATHEMATICS) (PAPER-VI) | 168/250 | 328/500 |
| OPTIONAL-II (MATHEMATICS) (PAPER-VIII) | 157/250 | | OPTIONAL-II (MATHEMATICS) (PAPER-VII) | 160/250 | |
| WRITTEN TOTAL | 1750 | 846 | WRITTEN TOTAL | 1750 | 813 |
| PERSONALITY TEST | 275 | 171 | PERSONALITY TEST | 275 | 201 |
| TOTAL FINAL | 2025 | 1017 | TOTAL FINAL | 2025 | 1014 |
| AIR-110 | | | AIR-124 | | |
| IAS-2018 | | | IAS-2018 | | |

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.

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.

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.

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

| | | | |
|---|---|--|--|
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 173/250 152/250 1750 275 2025 | Marks Obtained 118 087 090 105 096 325/500 821 182 1003 |
| SUNIL SHEORAN AIR-192 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 167/250 149/250 1750 275 2025 | Marks Obtained 124 091 109 104 105 316/500 849 138 987 |
| SACHIN BANSAL AIR-348 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 162/250 134/250 1750 275 2025 | Marks Obtained 135 086 093 096 085 296/500 791 195 986 |
| S. GAUTHAM RAJ AIR-353 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 153/250 159/250 1750 275 2025 | Marks Obtained 105 093 099 090 094 312/500 793 187 980 |
| C. VISHNU CHARAN AIR-406 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 134/250 171/250 1750 275 2025 | Marks Obtained 111 087 105 106 101 305/500 815 138 953 |
| SANJAY SAHU AIR-526 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 155/250 165/250 1750 275 2025 | Marks Obtained 118 079 093 103 092 320/500 805 138 943 |
| AMIT KUMAWAT AIR-600 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 161/250 175/250 1750 275 2025 | Marks Obtained 114 082 099 095 101 336/500 827 176 1003 |
| AKASH SINGH AIR-193 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 173/250 149/250 1750 275 2025 | Marks Obtained 069 101 110 105 101 322/500 808 179 987 |
| KATTA RAVI TEJA AIR-349 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 162/250 140/250 1750 275 2025 | Marks Obtained 122 093 108 113 107 302/500 845 140 985 |
| RAJAT BHARGAVA AIR-366 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 176/250 158/250 1750 275 2025 | Marks Obtained 093 084 101 115 106 334/500 833 138 971 |
| PANKAJ KUMAWAT AIR-443 IAS-2018 | | | |
|  | SUBJECT ESSAY (PAPER-I) GENERAL STUDIES-I (PAPER-II) GENERAL STUDIES-II (PAPER-III) GENERAL STUDIES-III (PAPER-IV) GENERAL STUDIES-IV (PAPER-V) OPTIONAL-I (MATHEMATICS) (PAPER-VI) OPTIONAL-II (MATHEMATICS) (PAPER-VII) WRITTEN TOTAL PERSONALITY TEST TOTAL FINAL | Max. Marks 250 250 250 250 250 145/250 153/250 1750 275 2025 | Marks Obtained 102 091 104 085 120 298/500 800 143 943 |
| AYUSH KUMAR AIR-598 IAS-2018 | | | |

PREPARATION 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