

No. 1 INSTITUTE FOR IAS/IFoS EXAMINATIONS



### OUR ACHIEVEMENTS IN IAS (FROM 2008 TO 2019)



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# MAINS TEST SERIES-2021

(JUNE to DEC.-2021)

## IAS/IFoS MATHEMATICS

Under the guidance of K. Venkanna

TEST CODE: TEST-4: IAS(M)/11-JULY-2021

PDE, NA & COMPUTER PROG. & MECHANICS AND FLUID DYNAMICS  
(PAPER-II)

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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(1)

**SECTION – A**

1. (a) Find the partial differential equation of the family of planes, the sum of whose x, y, z intercepts is equal to unity. [10]

1. (b) Solve  $(D^3 - 4D^2 D' + 5DD'^2 - 2D'^3) z = e^{y+2x} + (y+x)^{1/2}$ . [10]

1. (c) Find the positive root of  $\log_e x = \cos x$  nearest to five places of decimal by Newton-Raphson method. [10]

1. (d) Use Hamilton's equations to find the equation of motion of the simple pendulum. [10]

1. (e) Find the stream lines and paths of the particles for the two dimensional velocity field :

$$u = \frac{x}{1+t}, v = y, w = 0. \quad [10]$$

2. (a) (i) Find the surface which is orthogonal to the one parameter system  $z = cxy(x^2 + y^2)$  which passes through the hyperbola  $x^2 - y^2 = a^2, z = 0$

$$(ii) \text{ Solve } (x^2 + y^2)(p^2 + q^2) = 1 \quad [18]$$

2. (b) Obtain the Simpson's rule for the integral  $I = \int_a^b f(x)dx$

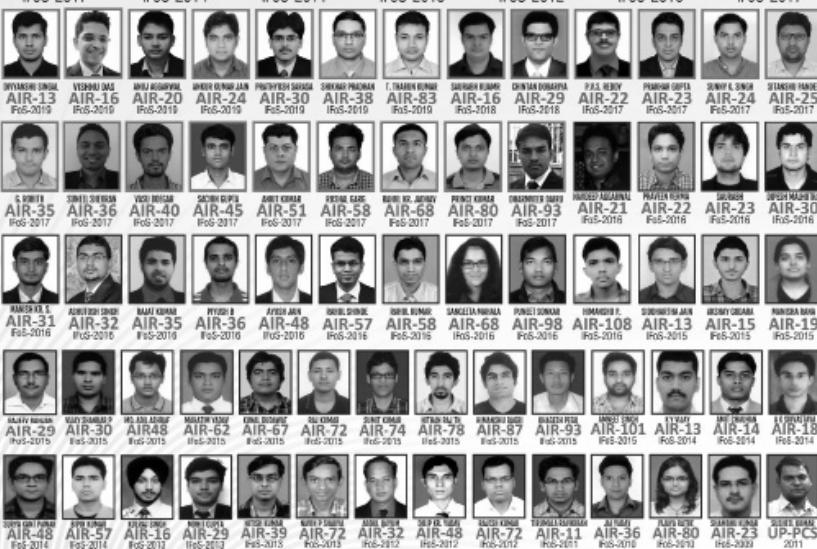
and show that this rule is exact for polynomials of degree  $n \leq 3$ . In general show that the error of approximation for Simpson's rule is given by

$$R = -\frac{(b-a)^5}{2880} f''''(\eta), \eta \in (0,2). \text{ Apply this rule to the integral}$$

$$\int_0^1 \frac{dx}{1+x} \text{ and show that } |R| \leq 0.008333. \quad [17]$$

2. (c) A circular cylinder of radius a and radius of gyration K rolls without slipping inside a field hollow cylinder of radius b. Show that the plane through their axes moves

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**IAS/IFoS MATHEMATICS** (Optional)  
by K. Venkanna

YEARS OF EARNED WORTHINESS OUR TOP-20 RANKERS IN IAS

GANESH KUMAR BASKAR (2019) <b>AIR-07</b> MARKS <b>310/500</b>	KANISHAK KATARIA (2018) <b>AIR-01</b> MARKS <b>361/500</b>	K. VARUN REDDY (2018) <b>AIR-07</b> MARKS <b>324/500</b>	TANMAY V. SHARMA (2018) <b>AIR-10</b> MARKS <b>336/500</b>	ATUL PRAKASH (2017) <b>AIR-04</b> MARKS <b>368/500</b>
ANUBHAV SINGH (2017) <b>AIR-08</b> MARKS <b>375/500</b>	SAGAR KUMAR (2017) <b>AIR-13</b> MARKS <b>299/500</b>	UTSAV KAUSHAL (2016) <b>AIR-14</b> MARKS <b>356/500</b>	MANISH GURWANI (2016) <b>AIR-18</b> MARKS <b>324/500</b>	KUMBHEJKAR Y.V. (2015) <b>AIR-08</b> MARKS <b>298/500</b>
ASHISH S. (2015) <b>AIR-12</b> MARKS <b>284/500</b>	SIDHARTH JAIN (2015) <b>AIR-13</b> MARKS <b>268/500</b>	PRATAP SINGH (2015) <b>AIR-15</b> MARKS <b>283/500</b>	NITISH K. (2014) <b>AIR-08</b> MARKS <b>346/500</b>	HIMANSHU GUPTA (2011) <b>AIR-07</b> MARKS <b>430/500</b>
And Many More...				

like a circular pendulum of length  $(b-a)\left(1+\frac{K^2}{a^2}\right)$  [15]

3. (a) Find the characteristics of the equation  $xp + yq - pq = 0$  and then find the equation of the integral surface through the curve  $z = x/2, y = 0$ . [17]
3. (b) (i) Apply Lagrange's interpolation formula to find  $f(5)$  and  $f(6)$  given that  $f(1) = 2, f(2) = 4, f(3) = 8, f(7) = 128$ .  
(ii) Using Newton's forward formula find the number of men getting wages between Rs. 10 and 15 from the following data :

Wages in Rs. :	0 – 10	10 – 20	20 – 30	30 – 40
Frequency :	9	30	35	42

3. (c) If the velocity of an incompressible fluid at the point  $(x,y,z)$  is given by  $\left(\frac{3xz}{r^5}, \frac{3yz}{r^5}, \frac{3z^2 - r^2}{r^5}\right), r^2 = x^2 + y^2 + z^2$ , then prove that the liquid motion is possible and that the velocity potential is  $\frac{z}{r^3}$ . Further, determine the streamlines.
4. (a) The temperature at one end of a bar 50 cm long with insulated sides is kept at  $0^\circ\text{C}$  and the other end is kept at  $100^\circ\text{C}$  until steady state condition prevails. The two ends are then suddenly insulated, so that the temperature gradient is zero at each end thereafter. Find the temperature distribution. [20]

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4. (b) Provide a computer algorithm to solve an ordinary differential equation  $\frac{dy}{dx} = f(x, y)$  in the interval  $[a, b]$  for  $n$  number of discrete points, where the initial value is  $y(a) = \alpha$ , using Euler's method. [15]

4. (c) If the fluid fills the region of space on the positive side of  $x$ -axis, is a rigid boundary, and if there be a source  $+m$  at the point  $(0, a)$ , and an equal sink at  $(0, b)$ , and if the pressure on the negative side of the boundary be the same as the pressure of the fluid at infinity, show that the resultant pressure on the boundary is  $\pi \rho m^2 (a - b)^2 / ab (a + b)$ , where  $\rho$  is the density of the fluid.

[15]

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**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:**

- 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

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**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 Dont's:

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

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#### SECTION - B

5. (a) Find a complete integral of  $p^2 + q^2 - 2px - 2qy + 2xy = 0$  [10]
5. (b) Solve  $r + s - 6t = y \cos x$ . [10]
5. (c) A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Simpson's  $\frac{1}{3}$ rd rule, find the velocity of the rocket at  $t = 80$  seconds.

t(sec):	0	10	20	30	40	50	60	70	80
f(cm/sec <sup>2</sup> ):	30	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

5. (d) (i) Simplify the expression  $A = XY + \overline{XZ} + X\bar{Y}\bar{Z}(XY + Z)$
- (ii) Simplify the Boolean expression  $Y = \overline{A \cdot B} + \overline{\bar{A}} + B$  Prepare truth table to show that the simplified expression is correct. [10]
5. (e) Prove that the moment of inertia of a triangular lamina ABC about any axis through A in its plane is

$$\frac{M}{6}(\beta^2 + \beta\gamma + \gamma^2)$$

where M is the mass of the lamina and  $\beta, \gamma$  are respectively the length of perpendiculars from B and C on the axis. [10]

6. (a) Form a partial differential equation by eliminating the arbitrary function  $\phi$  from  $\phi(x + y + z, x^2 + y^2 - z^2) = 0$ . What is the order of this partial differential equation ? [08]
6. (b) Solve  $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$ . [09]

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6. (c) Reduce  $x^2 r + 2xy s + y^2 t = 0$  to canonical form and hence solve [15]

6. (d) A tightly stretched elastic string of length  $l$ , with fixed end points  $x = 0$  and  $x = l$  is initially in the position given by  $y = y_0 \sin^3(\pi x/l)$ ,  $y_0$  being constant. It is released from the position of rest. Find the displacement  $y(x, t)$ . [18]

7. (a) Solve the following system of linear equations correct to two decimal places by Gauss seidel method

$$10x + 2y + z = 9$$

$$2x + 20y - 2z = -44$$

$$-2x + 3y + 10z = 22$$

[13]

7. (b) Using fourth order Runge-Kutta method find the solution of the initial value problem

$$y' = 1/(x + y), y(0) = 1$$

in the range  $0.5 \leq x \leq 2.0$ , by taking  $h = 0.5$ . [15]

7. (c) Simplify the boolean expression:

$(a + b) \cdot (\bar{b} + c) + b \cdot (\bar{a} + \bar{c})$  by using the laws of boolean algebra. From its truth table write it in minterm normal form. [10]

7. (d) (i) Convert 1011101.1011 to octal and then to hexadecimal.

(ii) Convert hexadecimal number 2647 to octal.

(iii) Convert hexadecimal number 4A.67 to binary. [12]

8. (a) A uniform straight rod of length  $2a$  is freely movable about its centre and a particle of mass one-third that of the rod is attached by a light inextensible string of length  $a$  to one end of the rod ; show that one period of principal oscillation is  $(\sqrt{5+1})\pi\sqrt{(a/g)}$ . [16]

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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.

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### 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.

(6)

8. (b) An infinite row of equidistant rectilinear vortices is at a distance  $a$  apart. The velocities are of the same numerical strength  $K$  but they are alternately of opposite signs. Find the complex function that determines the velocity potential and the stream function. [17]

8. (c) Given the velocity potential  $\phi = \frac{1}{2} \log \left[ \frac{(x+a)^2 + y^2}{(x-a)^2 + y^2} \right]$  determine the streamlines. [17]

## OUR TOPPER'S MARKS LIST (IAS-2019)

- 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
ESSAY (PAPER-I)		250	122	ESSAY (PAPER-I)		250	132
GENERAL STUDIES-I (PAPER-II)		250	097	GENERAL STUDIES-I (PAPER-II)		250	098
GENERAL STUDIES-II (PAPER-III)		250	100	GENERAL STUDIES-II (PAPER-III)		250	091
GENERAL STUDIES-III (PAPER-IV)		250	081	GENERAL STUDIES-III (PAPER-IV)		250	085
GENERAL STUDIES-IV (PAPER-V)		250	131	GENERAL STUDIES-IV (PAPER-V)		250	143
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	162/250	310/500		OPTIONAL-I (MATHEMATICS) (PAPER-VI)	149/250	316/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	148/250			OPTIONAL-II (MATHEMATICS) (PAPER-VII)	167/250		
WRITTEN TOTAL	1750	841		WRITTEN TOTAL	1750	865	
PERSONALITY TEST	275	205		PERSONALITY TEST	275	163	
TOTAL FINAL	2025	1046		TOTAL FINAL	2025	1028	
	GANESH KUMAR BASKAR	AIR-07	IAS-2019		NIDHI BANSAL	AIR-23	IAS-2019
	SHISHIR GUPTA	AIR-50	IAS-2019		DIVYANSHU SINGHAL	AIR-60	IAS-2019
	KATTA RAVI TEJA	AIR-77	IAS-2019		HARDIK AGARWAL	AIR-96	IAS-2019
	Y. MEGHA SWAROOP	AIR-98	IAS-2019		MAYUR KHANDELWAL	AIR-106	IAS-2019
	KUMAR SHIVASHISH	AIR-108	IAS-2019		SUJIIT SHANKAR	AIR-122	IAS-2019
SUBJECT		Max. Marks.	Marks. Obtained	SUBJECT		Max. Marks.	Marks. Obtained
ESSAY (PAPER-I)		250	123	ESSAY (PAPER-I)		250	118
GENERAL STUDIES-I (PAPER-II)		250	081	GENERAL STUDIES-I (PAPER-II)		250	100
GENERAL STUDIES-II (PAPER-III)		250	091	GENERAL STUDIES-II (PAPER-III)		250	095
GENERAL STUDIES-III (PAPER-IV)		250	080	GENERAL STUDIES-III (PAPER-IV)		250	085
GENERAL STUDIES-IV (PAPER-V)		250	133	GENERAL STUDIES-IV (PAPER-V)		250	122
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	154/250	321/500		OPTIONAL-I (MATHEMATICS) (PAPER-VI)	152/250	306/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	167/250			OPTIONAL-II (MATHEMATICS) (PAPER-VII)	154/250		
WRITTEN TOTAL	1750	829		WRITTEN TOTAL	1750	826	
PERSONALITY TEST	275	184		PERSONALITY TEST	275	182	
TOTAL FINAL	2025	1013		TOTAL FINAL	2025	1008	
	GANESH KUMAR BASKAR	AIR-07	IAS-2019		NIDHI BANSAL	AIR-23	IAS-2019
	SHISHIR GUPTA	AIR-50	IAS-2019		DIVYANSHU SINGHAL	AIR-60	IAS-2019
	KATTA RAVI TEJA	AIR-77	IAS-2019		HARDIK AGARWAL	AIR-96	IAS-2019
	Y. MEGHA SWAROOP	AIR-98	IAS-2019		MAYUR KHANDELWAL	AIR-106	IAS-2019
	KUMAR SHIVASHISH	AIR-108	IAS-2019		SUJIIT SHANKAR	AIR-122	IAS-2019
SUBJECT		Max. Marks.	Marks. Obtained	SUBJECT		Max. Marks.	Marks. Obtained
ESSAY (PAPER-I)		250	138	ESSAY (PAPER-I)		250	143
GENERAL STUDIES-I (PAPER-II)		250	095	GENERAL STUDIES-I (PAPER-II)		250	095
GENERAL STUDIES-II (PAPER-III)		250	094	GENERAL STUDIES-II (PAPER-III)		250	083
GENERAL STUDIES-III (PAPER-IV)		250	077	GENERAL STUDIES-III (PAPER-IV)		250	083
GENERAL STUDIES-IV (PAPER-V)		250	101	GENERAL STUDIES-IV (PAPER-V)		250	134
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	159/250	317/500		OPTIONAL-I (MATHEMATICS) (PAPER-VI)	152/250	294/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	158/250			OPTIONAL-II (MATHEMATICS) (PAPER-VII)	142/250		
WRITTEN TOTAL	1750	810		WRITTEN TOTAL	1750	832	
PERSONALITY TEST	275	193		PERSONALITY TEST	275	165	
TOTAL FINAL	2025	1003		TOTAL FINAL	2025	997	
	GANESH KUMAR BASKAR	AIR-07	IAS-2019		NIDHI BANSAL	AIR-23	IAS-2019
	SHISHIR GUPTA	AIR-50	IAS-2019		DIVYANSHU SINGHAL	AIR-60	IAS-2019
	KATTA RAVI TEJA	AIR-77	IAS-2019		HARDIK AGARWAL	AIR-96	IAS-2019
	Y. MEGHA SWAROOP	AIR-98	IAS-2019		MAYUR KHANDELWAL	AIR-106	IAS-2019
	KUMAR SHIVASHISH	AIR-108	IAS-2019		SUJIIT SHANKAR	AIR-122	IAS-2019
SUBJECT		Max. Marks.	Marks. Obtained	SUBJECT		Max. Marks.	Marks. Obtained
ESSAY (PAPER-I)		250	138	ESSAY (PAPER-I)		250	131
GENERAL STUDIES-I (PAPER-II)		250	094	GENERAL STUDIES-I (PAPER-II)		250	089
GENERAL STUDIES-II (PAPER-III)		250	086	GENERAL STUDIES-II (PAPER-III)		250	085
GENERAL STUDIES-III (PAPER-IV)		250	074	GENERAL STUDIES-III (PAPER-IV)		250	075
GENERAL STUDIES-IV (PAPER-V)		250	120	GENERAL STUDIES-IV (PAPER-V)		250	115
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	143/250	300/500		OPTIONAL-I (MATHEMATICS) (PAPER-VI)	174/250	343/500	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	157/250			OPTIONAL-II (MATHEMATICS) (PAPER-VII)	169/250		
WRITTEN TOTAL	1750	812		WRITTEN TOTAL	1750	838	
PERSONALITY TEST	275	185		PERSONALITY TEST	275	157	
TOTAL FINAL	2025	997		TOTAL FINAL	2025	995	
	GANESH KUMAR BASKAR	AIR-07	IAS-2019		NIDHI BANSAL	AIR-23	IAS-2019
	SHISHIR GUPTA	AIR-50	IAS-2019		DIVYANSHU SINGHAL	AIR-60	IAS-2019
	KATTA RAVI TEJA	AIR-77	IAS-2019		HARDIK AGARWAL	AIR-96	IAS-2019
	Y. MEGHA SWAROOP	AIR-98	IAS-2019		MAYUR KHANDELWAL	AIR-106	IAS-2019
	KUMAR SHIVASHISH	AIR-108	IAS-2019		SUJIIT SHANKAR	AIR-122	IAS-2019

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, it's 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

	<b>PUNEET DWIVEDI</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	130
		GENERAL STUDIES-I (PAPER-II)	250	101
		GENERAL STUDIES-II (PAPER-III)	250	104
		GENERAL STUDIES-III (PAPER-IV)	250	086
		GENERAL STUDIES-IV (PAPER-V)	250	130
	<b>AIR-123</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	145/250	<b>278/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	133/250	
		WRITTEN TOTAL	1750	829
		PERSONALITY TEST	275	162
		TOTAL FINAL	2025	<b>991</b>
	<b>SHIREEN PRAKASH</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	139
		GENERAL STUDIES-I (PAPER-II)	250	093
		GENERAL STUDIES-II (PAPER-III)	250	089
		GENERAL STUDIES-III (PAPER-IV)	250	086
		GENERAL STUDIES-IV (PAPER-V)	250	139
	<b>AIR-166</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	122/250	<b>254/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	132/250	
		WRITTEN TOTAL	1750	<b>800</b>
		PERSONALITY TEST	275	184
		TOTAL FINAL	2025	<b>984</b>
	<b>RAHUL GOEL</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	111
		GENERAL STUDIES-I (PAPER-II)	250	102
		GENERAL STUDIES-II (PAPER-III)	250	102
		GENERAL STUDIES-III (PAPER-IV)	250	088
		GENERAL STUDIES-IV (PAPER-V)	250	136
	<b>AIR-168</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	128/250	<b>258/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	130/250	
		WRITTEN TOTAL	1750	797
		PERSONALITY TEST	275	187
		TOTAL FINAL	2025	<b>984</b>
	<b>ANKUR KUMAR JAIN</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	128
		GENERAL STUDIES-I (PAPER-II)	250	087
		GENERAL STUDIES-II (PAPER-III)	250	099
		GENERAL STUDIES-III (PAPER-IV)	250	083
		GENERAL STUDIES-IV (PAPER-V)	250	131
	<b>AIR-205</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	173/250	<b>305/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	132/250	
		WRITTEN TOTAL	1750	<b>833</b>
		PERSONALITY TEST	275	146
		TOTAL FINAL	2025	<b>979</b>
	<b>CHIRAG JAIN</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	132
		GENERAL STUDIES-I (PAPER-II)	250	087
		GENERAL STUDIES-II (PAPER-III)	250	088
		GENERAL STUDIES-III (PAPER-IV)	250	085
		GENERAL STUDIES-IV (PAPER-V)	250	130
	<b>AIR-215</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	159/250	<b>294/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	135/250	
		WRITTEN TOTAL	1750	816
		PERSONALITY TEST	275	162
		TOTAL FINAL	2025	<b>978</b>
	<b>VISHNU DAS</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	134
		GENERAL STUDIES-I (PAPER-II)	250	098
		GENERAL STUDIES-II (PAPER-III)	250	086
		GENERAL STUDIES-III (PAPER-IV)	250	075
		GENERAL STUDIES-IV (PAPER-V)	250	118
	<b>AIR-304</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	140/250	<b>270/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	130/250	
		WRITTEN TOTAL	1750	<b>781</b>
		PERSONALITY TEST	275	187
		TOTAL FINAL	2025	<b>968</b>
	<b>DOBARIYA CHINTAN P.</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	130
		GENERAL STUDIES-I (PAPER-II)	250	087
		GENERAL STUDIES-II (PAPER-III)	250	093
		GENERAL STUDIES-III (PAPER-IV)	250	079
		GENERAL STUDIES-IV (PAPER-V)	250	113
	<b>AIR-376</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	149/250	<b>317/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	168/250	
		WRITTEN TOTAL	1750	<b>819</b>
		PERSONALITY TEST	275	143
		TOTAL FINAL	2025	<b>962</b>
	<b>AMIT KUMAWAT</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	122
		GENERAL STUDIES-I (PAPER-II)	250	083
		GENERAL STUDIES-II (PAPER-III)	250	086
		GENERAL STUDIES-III (PAPER-IV)	250	085
		GENERAL STUDIES-IV (PAPER-V)	250	127
	<b>AIR-423</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	150/250	<b>273/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	123/250	
		WRITTEN TOTAL	1750	<b>776</b>
		PERSONALITY TEST	275	176
		TOTAL FINAL	2025	<b>952</b>
	<b>PANKAJ KUMAR</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	106
		GENERAL STUDIES-I (PAPER-II)	250	095
		GENERAL STUDIES-II (PAPER-III)	250	090
		GENERAL STUDIES-III (PAPER-IV)	250	090
		GENERAL STUDIES-IV (PAPER-V)	250	127
	<b>AIR-424</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	158/250	<b>276/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	118/250	
		WRITTEN TOTAL	1750	<b>784</b>
		PERSONALITY TEST	275	168
		TOTAL FINAL	2025	<b>952</b>
	<b>MUNISH KUMAR</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	118
		GENERAL STUDIES-I (PAPER-II)	250	096
		GENERAL STUDIES-II (PAPER-III)	250	095
		GENERAL STUDIES-III (PAPER-IV)	250	095
		GENERAL STUDIES-IV (PAPER-V)	250	112
	<b>AIR-604</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	162/250	<b>256/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	094/250	
		WRITTEN TOTAL	1750	<b>772</b>
		PERSONALITY TEST	275	157
		TOTAL FINAL	2025	<b>929</b>
	<b>ANIL BASAK</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	120
		GENERAL STUDIES-I (PAPER-II)	250	088
		GENERAL STUDIES-II (PAPER-III)	250	093
		GENERAL STUDIES-III (PAPER-IV)	250	088
		GENERAL STUDIES-IV (PAPER-V)	250	128
	<b>AIR-616</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	128/250	<b>251/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	123/250	
		WRITTEN TOTAL	1750	<b>768</b>
		PERSONALITY TEST	275	160
		TOTAL FINAL	2025	<b>928</b>
	<b>VIDYASAGAR</b>	<b>SUBJECT</b>	Max. Marks.	Marks. Obtained
		ESSAY (PAPER-I)	250	117
		GENERAL STUDIES-I (PAPER-II)	250	081
		GENERAL STUDIES-II (PAPER-III)	250	090
		GENERAL STUDIES-III (PAPER-IV)	250	081
		GENERAL STUDIES-IV (PAPER-V)	250	125
	<b>AIR-634</b>	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	149/250	<b>289/500</b>
		OPTIONAL-II (MATHEMATICS) (PAPER-VII)	140/250	
		WRITTEN TOTAL	1750	<b>783</b>
		PERSONALITY TEST	275	143
		TOTAL FINAL	2025	<b>926</b>

## 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