

No. 1 INSTITUTE FOR IAS/IFoS EXAMINATIONS



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



HEAD OFFICE: 25/8, Old Rajender 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

(OCT. to JAN..-2020-21)

IAS/IFoS

# MATHEMATICS

Under the guidance of **K. Venkanna**

DATE : 13-DEC.-2020

FULL SYLLABUS (PAPER-I)

Common Test (Test-17 for Batch-I) & (Test-9 for Batch-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) If A is both real symmetric and orthogonal, prove that all its eigenvalues are + 1 or – 1. **[10]**

1. (b) Let V be the space of all polynomial functions over F. Let S be the subset of V consisting of the polynomial functions  $f_0, f_1, f_2, \dots$  defined by

$$f_n(x) = x^n, \quad n = 0, 1, 2, \dots$$

Then prove that V is the subspace spanned by the set S. **[10]**

1. (c) If  $f(x, y) = \begin{cases} \frac{x^3 + y^3}{x - y}, & x \neq y \\ 0, & x = y \end{cases}$ , show that the function is

discontinuous at the origin but possesses partial derivatives  $f_x$  and  $f_y$  at every point, including the origin. **[10]**

1. (d) If  $V = \log_e \sin \left\{ \frac{\pi(2x^2 + y^2 + xz)^{1/2}}{2(x^2 + xy + 2yz + z^2)^{1/3}} \right\}$ , find the value of

$$x \frac{\partial V}{\partial x} + y \frac{\partial V}{\partial y} + z \frac{\partial V}{\partial z} \text{ when } x = 0, y = 1, z = 2. \quad \mathbf{[10]}$$

1. (e) If the plane  $2x - y + cz = 0$  cuts the cone  $yz + zx + xy = 0$  in perpendicular lines, find the value of c. **[10]**

2. (a) Let F be a field and let n be a positive integer ( $n \geq 2$ ). Let V be the vector space of all  $n \times n$  matrices over F. Which of the following sets of matrices A and V are subspaces of V?













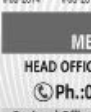






(i) All invertible A;

(ii) All non-invertible A;

(18)

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**OUR ACHIEVEMENTS IN IFoS (FROM 2008 TO 2019)****OUR RANKERS AMONG TOP 10 IN IFoS**

 <b>AIR-01</b> IFoS-2019	 <b>AIR-01</b> IFoS-2015	 <b>AIR-03</b> IFoS-2016	 <b>AIR-03</b> IFoS-2014	 <b>AIR-04</b> IFoS-2014	 <b>AIR-04</b> IFoS-2010	 <b>AIR-05</b> IFoS-2019
 <b>AIR-05</b> IFoS-2017	 <b>AIR-05</b> IFoS-2014	 <b>AIR-05</b> IFoS-2011	 <b>AIR-06</b> IFoS-2015	 <b>AIR-07</b> IFoS-2012	 <b>AIR-09</b> IFoS-2018	 <b>AIR-10</b> IFoS-2017
 <b>AIR-13</b> IFoS-2016	 <b>AIR-16</b> IFoS-2016	 <b>AIR-20</b> IFoS-2016	 <b>AIR-24</b> IFoS-2016	 <b>AIR-30</b> IFoS-2016	 <b>AIR-38</b> IFoS-2016	 <b>AIR-83</b> IFoS-2016
 <b>AIR-35</b> IFoS-2017	 <b>AIR-36</b> IFoS-2017	 <b>AIR-40</b> IFoS-2017	 <b>AIR-45</b> IFoS-2017	 <b>AIR-51</b> IFoS-2017	 <b>AIR-58</b> IFoS-2017	 <b>AIR-68</b> IFoS-2017
 <b>AIR-81</b> IFoS-2016	 <b>AIR-82</b> IFoS-2016	 <b>AIR-85</b> IFoS-2016	 <b>AIR-88</b> IFoS-2016	 <b>AIR-93</b> IFoS-2016	 <b>AIR-98</b> IFoS-2016	 <b>AIR-108</b> IFoS-2016
 <b>AIR-129</b> IFoS-2016	 <b>AIR-148</b> IFoS-2016	 <b>AIR-152</b> IFoS-2016	 <b>AIR-167</b> IFoS-2016	 <b>AIR-174</b> IFoS-2016	 <b>AIR-187</b> IFoS-2016	 <b>AIR-193</b> IFoS-2016
 <b>AIR-198</b> IFoS-2016	 <b>AIR-204</b> IFoS-2016	 <b>AIR-216</b> IFoS-2016	 <b>AIR-224</b> IFoS-2016	 <b>AIR-236</b> IFoS-2016	 <b>AIR-244</b> IFoS-2016	 <b>AIR-254</b> IFoS-2016
 <b>AIR-254</b> IFoS-2016	 <b>AIR-264</b> IFoS-2016	 <b>AIR-274</b> IFoS-2016	 <b>AIR-284</b> IFoS-2016	 <b>AIR-294</b> IFoS-2016	 <b>AIR-304</b> IFoS-2016	 <b>AIR-314</b> IFoS-2016

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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...

(iii) All  $A$  such that  $AB = BA$ , where  $B$  is some fixed matrix in  $V$ ;

(iv) All  $A$  such that  $A^2 = A$ .

[18]

2. (b) (i) Examine the convergence of  $\int_1^{\infty} \frac{dx}{x\sqrt{x^2+1}}$ .

(ii) Evaluate  $\iint_E \sin\left(\frac{x-y}{x+y}\right) dx dy$ , where  $E$  is the region

bounded by the co-ordinate axes and  $x + y = 1$  in the first quadrant. [6+10=16]

2. (c) (i) The plane  $lx + my = 0$  is rotated through an angle  $\alpha$  about its line of intersection with the plane  $z = 0$ . Prove that equation to the plane in its new position is  $lx + my \pm z\sqrt{l^2 + m^2} \tan \alpha = 0$ .

(ii) Show that the line  $x + 2y - z = 3$ ,  $3x - y + 2z = 1$  is coplanar with the line  $2x - 2y + 3z = 2$ ,  $x - y + z + 1 = 0$  and find the plane in which these two lines lie.

(iii) Find the equation of the sphere which passes through the points  $(1, 0, 0)$ ,  $(0, 1, 0)$  and  $(0, 0, 1)$  and has its radius as small as possible. [18]

3. (a) (i) Show that the vectors

$$\alpha_1 = (1, 1, 0, 0), \alpha_2 = (0, 0, 1, 1)$$

$$\alpha_3 = (1, 0, 0, 4), \alpha_4 = (0, 0, 0, 2)$$

form a basis for  $\mathbb{R}^4$ . Find the coordinates of each of the standard basis vectors in the ordered basis  $\{\alpha_1, \alpha_2, \alpha_3, \alpha_4\}$ .

(ii) Let  $A = \begin{bmatrix} 6 & -3 & -2 \\ 4 & -1 & -2 \\ 10 & -5 & -3 \end{bmatrix}$ .

(3)

Is A similar over the field R to a diagonal matrix ? Is A similar over the field C to a diagonal matrix ?

**[20]**

3. (b) By using Lagrange Multipliers method find the maximum and minimum values of  $f(x, y, z) = xyz$  subject to the constraint  $x + 9y^2 + z^2 = 4$ . Assume that  $x \geq 0$  for this problem. Why is this assumption needed ?

**[15]**

3. (c) show that the locus of points from which three mutually perpendicular tangents can be drawn to the paraboloid  $ax^2 + by^2 = 2z$  is given by

$$ab(x^2 + y^2) - 2(a + b)z - 1 = 0$$

**[15]**

4. (a) Let T be the linear transformation from  $R^3$  into  $R^2$  defined by  $T(x_1, x_2, x_3) = (x_1 + x_2, 2x_3 - x_1)$ .

(i) If  $\beta$  is the standard ordered basis for  $R^3$  and  $\beta'$  is the standard ordered basis for  $R^2$ , what is the matrix of T relative to the pair  $\beta, \beta'$ ?

(ii) If  $\beta = \{\alpha_1, \alpha_2, \alpha_3\}$  and  $\beta' = \{\beta_1, \beta_2\}$ , where

$$\alpha_1 = (1, 0, -1), \alpha_2 = (1, 1, 1), \alpha_3 = (1, 0, 0), \beta_1 = (0, 1),$$

$$\beta_2 = (1, 0) \text{ what is the matrix of T relative to the pair } \beta, \beta'?$$

**[16]**

4. (b) (i) Show that  $\frac{2}{\pi} < \frac{\sin x}{x} < 1, 0 < x < \pi/2$ .

(ii) Determine  $\lim_{x \rightarrow \left(\frac{\pi}{2} - 0\right)} \left(\frac{\pi}{2} - x\right)^{\tan x}$  as  $x \rightarrow \left(\frac{\pi}{2} - 0\right)$ .

(iii) Find the volume bounded by the cylinder  $x^2 + y^2 = 4$  and the planes  $y + z = 4$  and  $z = 0$ . **[5+5+8=18]**

4. (c) Prove that the projections of the generators of a hyperboloid on coordinate plane are tangents to the section of the hyperboloid by that plane. **[16]**

(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:**

- 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**

**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) (i) Solve  $(2\sqrt{xy} - x)dy + y dx = 0$   
(ii) Solve  $(y + y^3/3 + x^2/2) dx + (1/4) \times (x + xy^2) dy = 0$ . **[10]**
5. (b) (i) Prove  $L\left\{\frac{\cos at - \cos bt}{t}\right\} = \frac{1}{2} \log \frac{s^2 + b^2}{s^2 + a^2}$   
(ii) Evaluate  $\int_0^\infty t^3 e^{-t} \sin t dt$ . **[10]**
5. (c) A heavy uniform rod rests with one end against a smooth vertical wall and with a point in its length resting on a smooth peg; find the position of equilibrium and show that it is unstable. **[10]**
5. (d) A particle moves with a central acceleration which varies inversely as the cube of the distance. If it be projected from an apse at a distance  $a$  from the origin with a velocity which is  $\sqrt{2}$  times the velocity for a circle of radius  $a$ , show that the equation to its path is  $r \cos(\theta / \sqrt{2}) = a$ . **[10]**
5. (e) Verify Green's theorem in the plane for  $\int_C (x^2 - xy^3)dx + (y^2 - 2xy)dy$ ,  
where  $C$  is the square with vertices  $(0, 0)$ ,  $(2, 0)$ ,  $(2, 2)$ ,  $(0, 2)$ . **[10]**
6. (a) (i) Find the equation of the family of oblique trajectories which cut the family of concentric circles at  $30^\circ$ .  
(ii) Reduce the equation  $x^2 p^2 + py(2x + y) + y^2 = 0$  where  $p = dy/dx$  to Clairaut's form and find its complete primitive and its singular solution. **[7+10=17]**

6. (b) Solve  $x^2 (d^3 y/dx^3) + 2x(d^2 y/dx^2) + 2(y/x) = 10(1 + 1/x^2)$ .

[08]

6. (c) Using method of variation of parameters, solve  $d^2y/dx^2 - 2(dy/dx) + y = x e^x \sin x$  with  $y(0) = 0$  and  $(dy/dx)_{x=0} = 0$ .

[12]

6. (d) Solve the initial value problem

$$\frac{d^2y}{dt^2} + y = 8e^{-2t} \sin t, y(0)=0, y'(0)=0$$

by using Laplace-transform

[13]

7. (a) A weight of 60 kg is on the point of motion down a rough inclined plane when supported by a force of 24 kg wt acting parallel to the plane along a line of greatest slope, and is on the point of motion up the plane when pulled in the same direction by force of 36 kg wt. Find the co-efficient of friction and the inclination of the plane.

[17]

7. (b) A heavy particle is attached to one end of an elastic string, the other end of which is fixed. The modulus of elasticity of the string is equal to the weight of the particle. The string is drawn vertically down till it is four times its natural length and then let go. Show that the particle will return to this point in time  $\sqrt{\left(\frac{a}{b}\right)} \left[ \frac{4\pi}{3} + 2\sqrt{3} \right]$ , where  $a$  is the natural length of the string.

[17]

7. (c) A particle is projected with a velocity  $u$  from a point on an inclined plane whose inclination to the horizontal is  $\beta$ , and strikes it at right angles. Show that

(i) The time of flight is  $\frac{2u}{g\sqrt{(1+3\sin^2 \beta)}}$ ,

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) The range on the inclined plane is  $\frac{2u^2}{g} \cdot \frac{\sin \beta}{1+3\sin^2 \beta}$ .

and (iii) The vertical height of the point struck, above the point of projection is  $\frac{2u^2 \sin^2 \beta}{g(1+3\sin^2 \beta)}$ . **[16]**

8. (a) (i) In what direction the directional derivative of  $\phi = x^2 y^2 z$  from  $(1, 1, 2)$  will be maximum and what is its magnitude? Also find a unit normal vector to the surface  $x^2 y^2 z = 2$  at the point  $(1, 1, 2)$ .  
 (ii) Prove that  $\text{curl}[r^n(\mathbf{a} \times \mathbf{r})] = (n+2) r^n \mathbf{a} - n r^{n-2}(\mathbf{r} \cdot \mathbf{a}) \mathbf{r}$ , where  $\mathbf{a}$  is a constant vector. **[12]**
8. (b) Find  $\kappa$  and  $\tau$  for the space curve  $x = t, y = t^2, z = t^3$ . **[08]**
8. (c) If  $F = (x^2 + y - 4) \mathbf{i} + 3xy \mathbf{j} + (2xz + z^2) \mathbf{k}$ , evaluate  $\iint_S (\nabla \times F) \cdot \mathbf{n} dS$  where  $S$  is the surface of the sphere  $x^2 + y^2 + z^2 = 16$  above the  $xy$ -plane. **[15]**
8. (d) Verify Stoke's theorem for  $F = (2x - y) \mathbf{i} - yz^2 \mathbf{j} - y^2 z \mathbf{k}$ , where  $S$  is the upper half surface of the sphere  $x^2 + y^2 + z^2 = 1$  and  $C$  is its boundary. **[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
GENERAL STUDIES-I (PAPER-II)	250	098	GENERAL STUDIES-I (PAPER-II)	250	097
GENERAL STUDIES-II (PAPER-III)	250	117	GENERAL STUDIES-II (PAPER-III)	250	113
GENERAL STUDIES-III (PAPER-IV)	250	117	GENERAL STUDIES-III (PAPER-IV)	250	117
GENERAL STUDIES-IV (PAPER-V)	250	116	GENERAL STUDIES-IV (PAPER-V)	250	121
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	170/250	361/500	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	178/250	324/500
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	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
<b>AIR-01</b>			<b>AIR-07</b>		
<b>IAS-2018</b>			<b>IAS-2018</b>		
 TANMAY V. SHARMA	250	138	 G.S.S. PRAVEENCHAND	250	119
GENERAL STUDIES-I (PAPER-II)	250	091	GENERAL STUDIES-I (PAPER-II)	250	098
GENERAL STUDIES-II (PAPER-III)	250	111	GENERAL STUDIES-II (PAPER-III)	250	107
GENERAL STUDIES-III (PAPER-IV)	250	097	GENERAL STUDIES-III (PAPER-IV)	250	106
GENERAL STUDIES-IV (PAPER-V)	250	104	GENERAL STUDIES-IV (PAPER-V)	250	101
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	168/250	336/500	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	175/250	342/500
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	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
<b>AIR-10</b>			<b>AIR-64</b>		
<b>IAS-2018</b>			<b>IAS-2018</b>		
 MANISHA RANA	250	130	 DALIP KUMAR	250	117
GENERAL STUDIES-I (PAPER-II)	250	105	GENERAL STUDIES-I (PAPER-II)	250	084
GENERAL STUDIES-II (PAPER-III)	250	099	GENERAL STUDIES-II (PAPER-III)	250	115
GENERAL STUDIES-III (PAPER-IV)	250	112	GENERAL STUDIES-III (PAPER-IV)	250	109
GENERAL STUDIES-IV (PAPER-V)	250	100	GENERAL STUDIES-IV (PAPER-V)	250	097
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	155/250	326/500	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	171/250	327/500
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	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
<b>AIR-67</b>			<b>AIR-73</b>		
<b>IAS-2018</b>			<b>IAS-2018</b>		
 KHUSHBOO GUPTA	250	141	 JAY SHIVANI	250	117
GENERAL STUDIES-I (PAPER-II)	250	088	GENERAL STUDIES-I (PAPER-II)	250	096
GENERAL STUDIES-II (PAPER-III)	250	103	GENERAL STUDIES-II (PAPER-III)	250	104
GENERAL STUDIES-III (PAPER-IV)	250	093	GENERAL STUDIES-III (PAPER-IV)	250	098
GENERAL STUDIES-IV (PAPER-V)	250	103	GENERAL STUDIES-IV (PAPER-V)	250	103
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	175/250	326/500	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	164/250	336/500
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	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
<b>AIR-80</b>			<b>AIR-81</b>		
<b>IAS-2018</b>			<b>IAS-2018</b>		
 ANCHAL SRIVASTAVA	250	125	 HIMANSHU PRAJAPATI	250	113
GENERAL STUDIES-I (PAPER-II)	250	090	GENERAL STUDIES-I (PAPER-II)	250	075
GENERAL STUDIES-II (PAPER-III)	250	107	GENERAL STUDIES-II (PAPER-III)	250	104
GENERAL STUDIES-III (PAPER-IV)	250	106	GENERAL STUDIES-III (PAPER-IV)	250	099
GENERAL STUDIES-IV (PAPER-V)	250	109	GENERAL STUDIES-IV (PAPER-V)	250	094
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	152/250	309/500	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	168/250	328/500
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	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
<b>AIR-110</b>			<b>AIR-124</b>		
<b>IAS-2018</b>			<b>IAS-2018</b>		

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	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	118
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	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	152/250	
WRITTEN TOTAL	1750	821
PERSONALITY TEST	275	182
TOTAL FINAL	2025	1003

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	124
GENERAL STUDIES-I (PAPER-II)	250	091
GENERAL STUDIES-II (PAPER-III)	250	109
GENERAL STUDIES-III (PAPER-IV)	250	104
GENERAL STUDIES-IV (PAPER-V)	250	105
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	167/250	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	149/250	
WRITTEN TOTAL	1750	849
PERSONALITY TEST	275	138
TOTAL FINAL	2025	987

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	135
GENERAL STUDIES-I (PAPER-II)	250	086
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	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	134/250	
WRITTEN TOTAL	1750	791
PERSONALITY TEST	275	195
TOTAL FINAL	2025	986

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	105
GENERAL STUDIES-I (PAPER-II)	250	093
GENERAL STUDIES-II (PAPER-III)	250	099
GENERAL STUDIES-III (PAPER-IV)	250	090
GENERAL STUDIES-IV (PAPER-V)	250	094
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	153/250	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	159/250	
WRITTEN TOTAL	1750	793
PERSONALITY TEST	275	187
TOTAL FINAL	2025	980

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	111
GENERAL STUDIES-I (PAPER-II)	250	087
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	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	171/250	
WRITTEN TOTAL	1750	815
PERSONALITY TEST	275	138
TOTAL FINAL	2025	953

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	118
GENERAL STUDIES-I (PAPER-II)	250	079
GENERAL STUDIES-II (PAPER-III)	250	093
GENERAL STUDIES-III (PAPER-IV)	250	103
GENERAL STUDIES-IV (PAPER-V)	250	092
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	155/250	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	165/250	
WRITTEN TOTAL	1750	805
PERSONALITY TEST	275	138
TOTAL FINAL	2025	943

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	114
GENERAL STUDIES-I (PAPER-II)	250	082
GENERAL STUDIES-II (PAPER-III)	250	099
GENERAL STUDIES-III (PAPER-IV)	250	095
GENERAL STUDIES-IV (PAPER-V)	250	101
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	161/250	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	175/250	
WRITTEN TOTAL	1750	827
PERSONALITY TEST	275	176
TOTAL FINAL	2025	1003

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	069
GENERAL STUDIES-I (PAPER-II)	250	101
GENERAL STUDIES-II (PAPER-III)	250	110
GENERAL STUDIES-III (PAPER-IV)	250	105
GENERAL STUDIES-IV (PAPER-V)	250	101
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	173/250	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	149/250	
WRITTEN TOTAL	1750	808
PERSONALITY TEST	275	179
TOTAL FINAL	2025	987

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	122
GENERAL STUDIES-I (PAPER-II)	250	093
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	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	140/250	
WRITTEN TOTAL	1750	845
PERSONALITY TEST	275	140
TOTAL FINAL	2025	985

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	093
GENERAL STUDIES-I (PAPER-II)	250	084
GENERAL STUDIES-II (PAPER-III)	250	101
GENERAL STUDIES-III (PAPER-IV)	250	115
GENERAL STUDIES-IV (PAPER-V)	250	106
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	176/250	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	158/250	
WRITTEN TOTAL	1750	833
PERSONALITY TEST	275	138
TOTAL FINAL	2025	971

SUBJECT	Max. Marks	Marks Obtained
ESSAY (PAPER-I)	250	102
GENERAL STUDIES-I (PAPER-II)	250	091
GENERAL STUDIES-II (PAPER-III)	250	104
GENERAL STUDIES-III (PAPER-IV)	250	085
GENERAL STUDIES-IV (PAPER-V)	250	120
OPTIONAL-I (MATHEMATICS) (PAPER-VI)	145/250	
OPTIONAL-II (MATHEMATICS) (PAPER-VII)	153/250	
WRITTEN TOTAL	1750	800
PERSONALITY TEST	275	143
TOTAL FINAL	2025	943

# 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