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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feasible region. Finally, solve the problem graphically.

Max. $Z = 2x_1 + x_2$

subject to $x_1 + x_2 \geq 5$

$2x_1 + 3x_2 \leq 20$

$4x_1 + 3x_2 \leq 25$

$x_1 , x_2 \geq 0.$ **[10]**

2. (a) (i) Find all normal subgroups in S_4.

(ii) Give an example of a group G, subgroup H and an element $a \in G$ such that $aH\,a^{-1} \subset H$ but $aH\,a^{-1} \neq H$

(iii) List all the conjugate classes in S_3 and verify the class equation. **[18]**

3. (b) (i) If $f(x)=\sqrt{1-x^2}$ when x is rational,

$= 1 - x$ when x is irrational,

then $\int_0^{\bar{1}} f(x)dx=\frac{\pi}{4}$, and $\int_{\underline{0}}^{1} f(x)dx=\frac{1}{2}$.

(ii) The sequence $\alpha_n \equiv 1+\frac{1}{2}+.....+\frac{1}{n}-\log n, \forall n$ is monotonically decreasing and bounded between 0, 1 and converges to a non-zero limit between 0 and 1. **[6+8=14]**

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$f(z)=\dfrac{e^{-z}}{(z-2)^4}$ and compute the residue. **[8+6=14]**

4. (d) Solve the following transportation problem :

		D_1	D_2	D_3	D_4	D_5	D_6	Available
From	O_1	9	12	9	6	9	10	5
	O_2	7	3	7	7	5	5	6
	O_3	6	5	9	12	3	11	2
	O_4	6	8	11	2	2	10	9
		4	4	6	2	4	2	22 (Total)

[10]

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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

the particular integral which passes through the line $x = 1, y = 0$. **[16]**

6. (b) (i) The equation $x^2 + ax + b = 0$ has two real roots α and β. Show that the iteration method

$x_{k+1} = -(ax_k + b)/x_k$

is convergent near $x = \alpha$ if $|\alpha| > |\beta|$ and that

$x_{k+1} = -b/(x_k + a)$

is convergent near $x = \alpha$ if $|\alpha| < |\beta|$.

Show also that the iteration method

$x_{k+1} = -(x^2_k + b)/a$

is convergent near $x = \alpha$ is $2|\alpha| < |\alpha + \beta|$.

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is a rest and there is a cavity in the form of the sphere r = c in it, show that the cavity will be filled up after an interval of time $(2/5\mu)^{1/2}\, c^{5/4}$. **[15]**

8. (a) Determine the characteristics of the equation $z = p^2 - q^2$ and find the integral surface which passes through the parabola $4z + x^2 = 0$, $y = 0$. **[18]**

8. (b) Develop an algorithm for Regula – Falsi method to find a root of $f(x) = 0$ starting with two initial iterates x_0 and x_1 to the root such that $\text{sign}\left(f\left(x_0\right)\right) \neq sign\left(f\left(x_1\right)\right)$. Take n as the maximum number of iterations allowed and eps be prescribed error. **[15]**

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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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.

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KHUSHBOO GUPTA	SUBJECT	Max. Marks	Marks. Obtained
	ESSAY (PAPER-I)	250	141
	GENERAL STUDIES-I (PAPER-II)	250	088
	GENERAL STUDIES-II (PAPER-III)	250	103
	GENERAL STUDIES-III (PAPER-IV)	250	093
	GENERAL STUDIES-IV (PAPER-V)	250	103
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	175/250	326/500
AIR-80	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	151/250	
	WRITTEN TOTAL	1750	854
IAS-2018	PERSONALITY TEST	275	171
	TOTAL FINAL	2025	1025

JAY SHIVANI	SUBJECT	Max. Marks	Marks. Obtained
	ESSAY (PAPER-I)	250	117
	GENERAL STUDIES-I (PAPER-II)	250	096
	GENERAL STUDIES-II (PAPER-III)	250	104
	GENERAL STUDIES-III (PAPER-IV)	250	098
	GENERAL STUDIES-IV (PAPER-V)	250	103
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	164/250	336/500
AIR-81	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	172/250	
	WRITTEN TOTAL	1750	854
IAS-2018	PERSONALITY TEST	275	171
	TOTAL FINAL	2025	1025

AANCHAL SRIVASTAVA	SUBJECT	Max. Marks	Marks. Obtained
	ESSAY (PAPER-I)	250	125
	GENERAL STUDIES-I (PAPER-II)	250	090
	GENERAL STUDIES-II (PAPER-III)	250	107
	GENERAL STUDIES-III (PAPER-IV)	250	106
	GENERAL STUDIES-IV (PAPER-V)	250	109
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	152/250	309/500
AIR-110	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	157/250	
	WRITTEN TOTAL	1750	846
IAS-2018	PERSONALITY TEST	275	171
	TOTAL FINAL	2025	1017

HIMANSHU PRAJAPATI	SUBJECT	Max. Marks	Marks. Obtained
	ESSAY (PAPER-I)	250	113
	GENERAL STUDIES-I (PAPER-II)	250	075
	GENERAL STUDIES-II (PAPER-III)	250	104
	GENERAL STUDIES-III (PAPER-IV)	250	099
	GENERAL STUDIES-IV (PAPER-V)	250	094
	OPTIONAL-I (MATHEMATICS) (PAPER-VI)	168/250	328/500
AIR-124	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	160/250	
	WRITTEN TOTAL	1750	813
IAS-2018	PERSONALITY TEST	275	201
	TOTAL FINAL	2025	1014

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 tendancy 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.

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(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

SANJAY SAHU	SUBJECT	Max. Marks.	Marks. Obtained
AIR-526	ESSAY (PAPER-I)	250	111
IAS-2018	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	305/500
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	171/250	
	WRITTEN TOTAL	1750	815
	PERSONALITY TEST	275	138
	TOTAL FINAL	2025	953

AYUSH KUMAR	SUBJECT	Max. Marks.	Marks. Obtained
AIR-598	ESSAY (PAPER-I)	250	102
IAS-2018	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	298/500
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	153/250	
	WRITTEN TOTAL	1750	800
	PERSONALITY TEST	275	143
	TOTAL FINAL	2025	943

AMIT KUMAWAT	SUBJECT	Max. Marks.	Marks. Obtained
AIR-600	ESSAY (PAPER-I)	250	118
IAS-2018	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	320/500
	OPTIONAL-II (MATHEMATICS) (PAPER-VII)	165/250	
	WRITTEN TOTAL	1750	805
	PERSONALITY TEST	275	138
	TOTAL FINAL	2025	943

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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.

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

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