MATHEMATICS Strategy, Booklist and Sample Answers – By Nitish K Rank – 8 and Maths Topper CSE – 2014

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INSIGHTS 7/24/2015

STRATEGY FOR MATHEMATICS OPTIONAL (UPSC CSE MAINS)

Nitish K, IAS (Rank – 8, CSE – 2014)

His Blog

Who can take Mathematics as an optional?

A large number of aspirants called or messaged me saying that they have decided to or wanted to take Maths and asked me to share my strategy. When I asked them why they wanted to choose Maths, most of them told that it was because of *good performance* of Maths in recent years.

Is Mathematics really performing well in recent years?

On the surface it might look that Maths is doing well. This time around 25-30 candidates have got in the range 290-310. But the problem with Maths optional is *scaling*. Due to *scaling* (I don't know how UPSC does it), a very few number of candidates get high and remaining ones get very low. The ones who get high would have obviously done better than the rest. But due to scaling, difference in marks between the highest and the lowest increases drastically. If the difference in *correct* attempts is say 60-70, then after scaling the difference becomes 110-120. Thus in Maths, marks are *binary*. Either you get high or you get low. There are no average marks in Maths, unlike humanities optional. Therefore one should *not* get attracted to Maths by marks obtained by a *few* successful candidates. A huge majority would have got very low marks in Maths. Thus Maths is performing *well* for say around 10% and *poor* for 90%.

Who are the ones who usually take Maths as an optional?

A large number of those who take Maths as optional come from reputed institutions like IITs, BITS and NITs etc. Due to this the competition is very high.

So back to first question, **who can take Maths as an optional**?

I feel only those who are *very strong* in Maths and have *genuine interest* should take Maths. Unlike humanities optional which can be taken by anybody, Mathematics requires *aptitude*. As there is huge competition, unless one is at the topmost part of the pyramid, Maths would result in low marks. I have seen many people who take Maths in haste, waste attempts and later change optional.

I was not from any IIT, BITS or NIT. I still went for Maths because I felt I am good in Maths. Mine previous performance in Maths boosted my confidence. I had got **99/100 in 10th** (CBSE), 1**00/100 in both 11th and 12th**, **10/10 grade** in all four semesters in Engineering Maths. This is not to boast about myself, but to press the point that Maths should be taken only *if you have good track record* in Maths.

Also given the complexity of topics and huge syllabus, I don't think any coaching institute will be able to fully cover all

the topics. I feel coaching has a limited role and own effort matters more.

Paper I

Booklist and Strategy

Book List

Paper I

1. **Linear Algebra :**
2. Schaum's outline on Linear Algebra: this book has explained linear algebra in a far better and simpler manner than Krishna Series. Due to its clarity, it can be read quickly also.
3. Krishna Series on Matrices
4. **Calculus :**
5. Krishna Series on Differential calculus
6. Krishna Series on Integral calculus
7. Mathematical Analysis by Malik and Arora : a must read book for both Paper I and II
8. **Analytical Geometry :**
9. Krishna Series on Analytical Geometry : this book is better than Shantinarayan and has many solved examples
10. Krishna Series on Analytical Solid Geometry : for Conicoids, Generating Lines
11. **Ordinary Differential Equations:**
12. Ordinary and Partial Differential Equations by MD Raisinghania
13. Advanced Differential Equations by MD Raisinghania : required for Laplace Transforms (Paper-I) and Boundary value problems (Paper-II)
14. **Dynamics and Statics**
15. Krishna Series on Statics
16. Krishna Series on Dynamics
17. **Vector Analysis**
18. Krishna Series on Vector Calculus (~ 330 pages)
19. Schaum's outline on Vector Analysis

Strategy for Paper I:

1. Paper I being easier compared to Paper II, all the topics have to be covered in detail.
2. For **Analytical Geometry**, read all the solved examples given in above mentioned books. Regularly revise particularly skew lines, sphere, cone and conicoids. In many problems you would have to *remember* how to start the problem i.e. you would have to *mug* the approach to solve specific problems.

3. For Calculus, focus more on Calculus of many variables. This is well covered in Malik and Arora. Also many topics of Paper I and Paper II overlap, which can be prepared simultaneously from the above mentioned book.
4. In Statics & Dynamics, try to solve all the problems. You can leave very complex problems which are usually given at the end of every chapter.
5. Make formula sheet for every chapter and revise it regularly. Otherwise you might forget many formulas in exam.
6. Practice makes perfect. Try solving problems with pen and paper with book closed, instead of just reading.

Paper II :

Booklist and Strategy

Booklist

Paper II

1. **Abstract Algebra**: This being my favourite topic, I had referred many books. But as many candidates find this topic tough, I would suggest referring to following books.
2. Abstract Algebra, Group Theory by R Kumar (Vardhaman Publications)
3. Abstract Algebra, Ring Theory by R Kumar (Vardhaman Publications)
4. Abstract Algebra by Joseph Gallian (*optional*)
5. **Real Analysis:**
6. Mathematical Analysis by Malik and Arora
7. Real Analysis by MD Raisinghania
8. **Complex Analysis:**
9. Krishna Series
10. **Linear Programming:**
11. Operations Research by JK Sharma or Kanti Swarup or Krishna Series
12. **Partial Differential Equations:**
13. ODE and PDE by MD Raisinghania
14. Engineering Maths by Grewal : for boundary value problems
15. Advanced Differential Equations by M.D Raisinghania (for boundary value problems)
16. **Numerical Analysis and Computer programming:**
17. Numerical Methods by Jain and Iyengar (but questions are not coming from this book from past few years)
18. Numerical Analysis chapter from Grewal, Engineering Mathematics
19. For Algorithms and flowcharts, I am having soft copy of a book which I will share.
20. **Mechanics and Fluid Dynamics:**
21. Fluid Dynamics by MD Raisinghania
22. Krishna Series, Dynamics for Moment of Inertia and D Alembert's Principle

23. Krishna Series, Rigid Dynamics for Lagrangian and Hamiltonian. (Unfortunately this is a poorly written book with lot of mistakes. Will try to upload material for these topics)

Strategy for Paper – 2 :

1. Usually Paper II is tough for many. Hence if you are able to master it, then you will able to score very high compared to others
2. **Abstract Algebra** is a unique topic. Either you like the topic or you don't. In first case it will be easy otherwise very tough. I loved the topic and did not read it from exam point of view. If you are finding it tough, I would suggest you to do it from 10 markers point of view. There is no point in spending a lot of time on Abstract Algebra as you won't be rewarded proportionately. The same time could be used for studying other topics of Maths or GS, which would fetch much more marks. For 10 markers point of view, read books (a) and (b) mentioned above. Memorize all the theorems. Skip *proofs* of theorems which are big, particularly in Permutation groups, Cayley's theorem, PID, Euclidean Domain and UFDs. On the other hand, if you are comfortable with Abstract algebra and want to do it in a detailed manner, I will shortly share various e-books, pdfs etc.
3. For **Real Analysis** , Malik and Arora is the best. You can supplement it by MD Raisinghania. I felt it is better to leave the proofs. Focus more on Riemann Integral, Improper Integrals and Series and Sequences of functions.
4. **Linear Programming**: I feel books for MBA like JK Sharma are written more clearly that Krishna Series.
5. **PDE:** Even though not mentioned in syllabus, Charpit's method has to be covered as questions are regularly asked. For Boundary Value problems (heat equation etc.) first read from Grewal. For more types of problems you should refer to book (c) mentioned above in the booklist.
6. **Mechanics and Fluid Dynamics:** From last year UPSC has started mixing questions from PDE, Numerical Analysis and Fluid & Rigid Dynamics. Therefore to score high it has become imperative to cover this topic. But the problem is the syllabus has been vaguely defined and there is confusion about which topics are there in syllabus. By analyzing past years question papers. I covered only the following topics. In Fluid dynamics cover Kinematics of Fluids in Motion, Equations of Motions of Inviscid Fluids, Sources and Sinks, Vortex Motion. No need to see proof of any theorems. From Navier Stokes equations, just try to see only solved examples. For Rigid Dynamics, cover those topics mentioned in booklist above.

GENERAL OBSERVATIONS:

1. The fixed space for each question in Mathematics causes lot of disadvantage vis-à-vis other optional, particularly humanities. If you made a mistake while solving a problem and have consumed most of the available space, then despite knowing the correct method you would not have space to rectify your mistake. To tackle this, practice solving problems and write many mock tests. By greater practice you will be able to reduce unforced errors. Also if the problem is new or unfamiliar, I used to briefly solve it in the last page with pencil, later transferring it to main page.
2. A lot of aspirants face the dilemma of how much time to give for Maths compared to GS. There is no hard and fast rule. I used to give 50% of my time (say around 5 hrs per day) for Maths and 50% for GS. Owing to huge syllabus of Maths, candidates generally tend to neglect GS and Essay. This has to be avoided.
3. It is very important to complete at least 80% of syllabus before prelims. Also between prelims and mains, try to do both Maths and GS everyday. Don't lose touch of Maths. The last one month before Mains is very important. During this period keep on revising formulas and practicing problems.

4. Join Test Series programme between Prelims and Mains. This helps you to complete the syllabus in time, gives you practice, improve your speed and accuracy etc. I had joined Venkanna's (IMS) *test series* 4 times (2011,12,13,14) and found them very helpful. I did not attend their classroom coaching and went only for test series programme.

My Sample Answer-scripts:

Scan 07-Nov-26014 9.19 pm

Scan 11-Nov-2014 9.26 pm

Scan 20-Oct-2014 9.20 pm

Scan 25-Oct-2014 9.54 pm

Scan 31-Oct-2014 10.22 am

Scan 28-Oct-2014 9.23 pm

I wrote above tests during last year online test series at IMS.

Related Article:

My Overall Strategy for Essay, GS, Interview

PS: Mathematics Marks in CSE Mains 2014: Paper – 1 – 173; Paper – 2 – 173

Note from Insights:

Please visit His Blog (CLICK HERE) for any queries. and ask him there your doubts. Thank you.