**Applied Maths – what’s it all about?**

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**Introduction**

Unlike most other subjects there is no *Applied Maths* option for Junior Cert so for you the student it is quite difficult to know just what the subject is like at Leaving Cert level.

The best way to get a feel for what the subject is to attend an Applied Maths class; we usually hold a series of classes for interested students in January/Febrauary of 4th year for TY who are interested in finding out more about the subject. Here we start off looking at some typical Ordinary Level questions and then tackle some Higher Level questions. Students are generally pleasantly surprised that they are able to do Higher Level questions after only one or two classes of an introduction.

Here however we try to answer some of your questions in advance.

It is a fascinating subject which deals with solving real-life problems using mathematical models. It overlaps with both the Mathematics course as well as the Physics course. In particular the new Project Maths syllabus is very similar in its approach to Applied Maths. The emphasis is on using different mathematical models to solve everyday problems.

* Unlike any other subject in the Leaving Cert (with the possible exception of the new Project Maths), Applied Maths is about *problem-solving*, so if you like a challenge then Applied Maths is for you.
* The maths is all based around Physics problems
* Applied Maths will instil skills which will last a lifetime; how to analyse a problem, how to represent the problem mathematically, how to solve the maths, and then how to interpret your answer so that it makes sense when applied to real life situations.

**Why study Applied Maths?**

* If you like (and are good at) Maths
* If you are thinking about studying Engineering in college
* It complements the Maths Course and enables students to obtain the bonus points.
* Looks good on your CV (see the Careers section).

See the testimonies at the end of this booklet from other students around the country who studied Applied Maths.

**Do I need to be good at Maths to study Applied Maths?**

Many students are put off doing the subject because they feel that they need to be brilliant at maths. You do need to be reasonably good at maths if you intend taking it at Higher Level, but you certainly don’t need to be an ‘A’ student. If you are a comfortable ‘B’ student then you should have little difficultly lasting the pace.

There is a high Maths content in the course so studying Applied Maths will give you a better understanding of some parts of the Honours Maths course – especially Trigonometry, Calculus (Differentiation and Integration) and Vectors

In studying Applied Maths you will improve on your mathematical skills in areas such as trigonometry, geometry, vectors, differentiation and integration.

**What does the name *Applied Maths* actually mean?**

The subject actually has a very confusing title – after all you can apply maths to almost any situation.

The subject should be called Mathematical-Physics; it’s all about analysing a physics problem and solving it using maths equations.

You may have often heard the phrase “it’s not rocket science”; well this subject *is* rocket science. We study (among many other things) the force required to launch a rocket into orbit and analyse the forces which act on it while it travels through the atmosphere (it’s not as bad as it seems, honest!).

**Do I need to be doing Physics to study Applied Maths?**

It is not necessary to take Physics as a Leaving Cert subject in order to do Applied Maths. There is an overlap, but it’s not as great as you might think. If anything, doing Applied Maths will help you in Physics much more than the other way around in that you will develop a deeper understanding of many of the concepts which only get covered superficially in Physics.

**I want to do Business; wouldn’t I be just wasting my time doing Applied Maths?**

It mightn’t seem obvious but employers in Business and Finance are always looking for graduates from the field of Applied Maths – they already have lots of employees who know about business, what they don’t have is enough people who can offer solutions to unusual problems.

Many Applied Mathematicians get jobs in the business world because they have analytical and problem-solving skills which can be applied to the money markets and/or the stock-exchange.

It is also (relatively) straightforward to get a business (or business management) degree once you have an Science/Engineering degree if you so choose. It is not however straightforward to do it the other way around.

**Who *shouldn’t* study Applied Maths?**This subject doesn’t suit students who just like learning things off by heart.

In fact the questions are designed to catch out those very students and whether that is fair or not is a moot point - you are being warned about it now so if you don’t like it you know what to do. You cannot come out of an Applied Maths exam and say ‘we never did that question before – sir you never covered it with us in class’. It is my job to ‘train’ you to tackle problems which you haven’t come across before.

So Applied Maths suits people who like solving puzzles (we like to make it sound more impressive so we call it ‘problem solving’). This means being able to think for yourself, and because almost all of your secondary-school education encourages you to ‘learn the right answer off by heart’ it can make a lot of students uncomfortable. The ability to problem-solve is however a very important skill and is highly-valued by many employers. It is one of the reasons why you often see politicians and business people on the news saying that the country needs more scientists and engineers.

As the name suggests, the course is mathematical in nature, and you do need to be very good at maths to be successful at higher level. In general you should be averaging a ‘B’ or higher, and just because you got an ‘A’ in Maths in the Junior Cert does not necessarily mean that you will be comfortable with the subject, so pay attention to the problems we will cover below to see if you can follow them.

The material itself is similar to that which you would study in Engineering in university, so even if you are not great at maths but want to be an engineer you should consider taking up the subject. Even if you end up taking the Ordinary Level exam at the end it will still stand to you at third level.

**How long is the course?**

The course itself is fairly short (see the syllabus at the end).

There are ten topics but only six questions to do on the exam itself so there is enormous choice.

In fact normally we only cover about 8 topics, and try to ensure we know them very well rather than trying to cover too much. It means that we are normally finished the course by Christmas in sixth year, so there’s a lot of time for revision from then on. The Christmas exam is itself usually a full mock paper.

**What is the format of the paper in the leaving cert exam?**

Time: 2½ hours

Ordinary Level: six questions to be answered out of nine

Higher Level: six questions to be answered out of ten (about 25 minutes per question).

We generally aim to cover 8 (or at most 9) topics (where each topic corresponds to a different question); it’s more advisable to spend your time becoming competent in 8 questions rather than spending time on others and this still allows for ample choice on the day itself.

The exam began in 1970 so there are over 40 years of exam questions. We will cover *all of these* for each topic (many of them are repetitive) so there should be very little on your leaving cert paper that you wouldn’t already have seen.

**What is the paper like at Ordinary Level?**

Applied Maths at the Ordinary Level is probably the easiest subject on the leaving cert curriculum. It is very short and can easily be covered in one year or less. The questions vary very little from year to year so with a just a little practice it should be easy to nail the A.

**What textbook do I need?**

There are a number of textbooks available for studying Applied Maths:

1. *Fundamental Applied* Mathematics (Oliver Murphy); a new addition came out in 2012.
2. *Applied Mathematics Leaving Certificate Foundation Mechanics for Third Level* (Kevin Conliffe).

An accompanying set of solutions is available for both of these textbooks.

I don’t use a textbook however. I have a booklet for each topic we cover. This has a short introduction to the topic but after that it’s all exam questions, arranged in order of difficulty.

You don’t even need to buy exam papers because all exam questions are included in these notes (and anyway exam-papers only go back 10 years or so while we you will receive 40 years worth of questions).

Because some students like to work ahead I also provide a separate booklet containing all the answers.

These solutions/marking schemes are all available from www.thephysicsteacher.ie

**How likely is it that I will get A at Higher Level?**

27% of students on average receive an A in the Leaving Cert.

I used to think that the subject was very difficult because the questions that come up on the Leaving Cert exam were completely different every year. Then I noticed that almost all the questions in the exam papers in recent years were just variations on older questions (some of them 30 years older!).

So now our students cover all questions back to 1970 – that’s 40 years worth of questions.

It may just be a co-incidence, but one of our students recently got the top mark in the country in 2011.

Any student who can get an A Maths should certainly be getting an A in Applied Maths (but with much less effort!)

**Is it possible to study *Applied Maths* in college?**

You can study Applied Maths itself at third level. It is known as ‘Mathsphysics’ in NUI universities and as ‘Theoretical Physics’ in Trinity College.

**I want to study Maths in college – should I take Applied Maths now?**

Applied Maths is an invaluable subject for those who plan to study pure maths in university. Indeed many of those who have studied maths at university say that Applied Maths was a more important preparation than Maths itself!

**I want to study Engineering in college – should I take Applied Maths now?**

If you are considering studying any kind of engineering in college, Applied Maths is very important; all engineering students have to study Applied Maths in first year in college and you will have a head start if you have the Leaving Cert course done beforehand.

**Related Links**

Irish Applied Maths Teachers Association: <http://www.iamta.ie/>

Syllabus: <http://www.curriculumonline.ie/uploadedfiles/PDF/lc_apmaths_sy.pdf>

Careers Portal

Slss

Scoilnet

**Reasons you should consider doing applied maths**

**From Brendan Doheny**

* Many students study Applied Maths for the benefit of their future maths results.

These are students who are chasing the bonus 25 points in honours Maths and who will find maths easier as a result of studying Applied Maths.

* Apart from being a terrific subject (which takes work, like any other), about of 3 in every 10 students will achieve an A1.
* Some universities (like UCC) are accepting a C1 in either Maths OR Applied Maths.
* Many students study Applied Maths to improve their problem solving skills and so produce better HPAT results to ensure they get into medicine.
* The single greatest obstacle for engineering students is passing Applied Maths in college - not a problem for those who studied it in school.

The text in Italics is taken from quotes given to *The Irish Applied Maths Teachers Association (iamta.ie)*

Applied maths has a reputation to be compared to Shrek! To those that don’t know the beast it seems like a big ugly ogre, but really it is quite a lean course.

*As few schools offer Applied Maths as a scheduled class, most that take it on do so outside of school hours. This can be stressful and tiring at first but the end result is worth any hardships suffered.*

There are 10 questions on the paper and the candidate has only to answer six questions.

NO other paper offers this much choice.

*Getting the actual correct answer only gives you a small amount of the marks.*

In total the recall work is minimal possibly 30 formulae in total and the overlap between the courses less than half are unique to Applied Maths Syllabus

*Applied Maths was my favourite subject at school. It was a course completely unlike any other. Lateral and logical thinking are needed for it and solving problems is something I have always been interested in. The subject doesn’t involve enormous amounts of theory that you have to learn off by heart, like in biology, but just encourages you to think and apply principles.*

Is there any subject that you struggle with, any language that you will only manage to do ordinary level in? Then Applied Maths can help you make your points higher!

*Although no points in the Leaving Cert ever come easy, the Applied Maths examiners love to give away marks for writing down basic information and applying simple rules. Applied Maths may seem like a tough subject at first, but given a little time and a good bit of practice it becomes a tremendously satisfying and rewarding subject.*

For those that like to experience the success of solving problems, applied maths is more satisfying than sudoku. If you have always been the student that enjoyed solving the problem maths that were in the primary books, then Applied Maths is for you.

*I soon discovered that Applied Maths is a hugely under-rated subject with a lot of benefits. Firstly, for those people who, like me, have lazy tendencies, and can think of better ways to spend an afternoon than memorising dates until you can’t even remember what year it is any more, Applied Maths is the ideal subject. There is almost no theory and very little writing involved, which is something I greatly appreciated when trying to write poetry essays every weekend.*

If you are doing Higher Level Maths, this course **compliments** it! The Points may be the same but the amount of equations, topics, theorems and methods to recall is less. Plenty of practice in trig identities and geometry, the vectors question is a doosy.

*Applied Maths allows the student to solve real life problems through logical reasoning and creative thought, and in my opinion that is something that no other Leaving Cert subject offers. As a student it seems daunting to take on another subject when school is already difficult and hectic as it is. However, Applied Maths added very little to my work load. Subjects such as Maths and Physics overlap with Applied Maths in many areas such as integration, vectors and mechanics.*

If you are doing Physics then this will sort out about 40% of the entire physics paper for you!

If you are doing both .....

*Applied Maths also made life easier on a number of levels. Whole sections of Maths seemed easier having covered them the year before. Quadratic equations, integration and trigonometry benefited purely because we were using them so often. The mechanics section of physics posed little difficulty for many of us as we knew our UVAST inside and out and in other ways Applied Maths always encouraged you to look outside the box for an easier way of doing things – which is invaluable whatever you’re doing. Although it needed attention, with a little effort it’s definitely a manageable course with relatively little learning off. In short it’s a gift to anyone mathematically inclined who enjoys a challenge*

It will help you if you want to pursue a career in Engineering, Architecture or **any** other **technical** subject.

*I am currently studying Engineering in U.C.D. one of the core modules of the course is Mechanics, which is little more than Leaving Certificate Applied Maths*

Applied Maths has advantages which I really came to appreciate in those last few days and weeks before the exam,

There was very little theory to be learned

It was a predictable subject with lots of choice.

And most importantly I had two days off after having finished all my other exams in which to try and learn everything.

**Related Careers**

Who would want to employ somebody who has studied Applied Maths?

In short, anybody who would like an employee who can solve problems, so basically everybody.

Applied Maths is like **Engineering for beginners**.
Also **Architects** must know some applied maths.
Degree courses in the **Building industry** contain applied maths modules.

Studying Applied Maths enables students achieve employment and career prospects at the top end of the market in very diverse areas.

The following represent just some of the areas which students in up in after studying Applied Maths.

* Actuary
* Airlines...designing efficient rosters
* Anthropologist...dating fossils
* Architecture
* Astronomy
* Business
* Chemistry
* Computer Programming...animated films, computer games
* Currency Exchange companies
* Designer...computer aided design, nano-technology
* Economics
* Education
* Engineering
* environmental studies
* Forensics
* Genetics...dna codes
* Hardware design...iphones, speakers etc
* Information Technology
* Investment banking
* Maths
* Medicine
* Metereology
* Pharmaceuticals
* Physics
* Planning traffic flow systems for big cities
* Political studies
* Robotics
* Science
* Statistician in the Central Statistics Office or in a casino
* The army ballistics division

**APPLIED MATHEMATICS Syllabus**

**Ordinary and Higher Level Courses**

Knowledge of the relevant parts of the Mathematics course is assumed.

N.B. Those parts of the syllabus which are printed in *italics* belong to the Higher Level course only.

The Higher Level course includes the Ordinary Level course treated in greater depth.

1. Motion of a particle. Displacement, velocity as vectors. Applications of the vector addition law. Description of vectors in terms of unit perpendicular vectors. Elementary treatment of relative motion.
2. Newton’s laws. Mass, momentum. Acceleration and force as vectors. Units and dimensions.
3. Motion in a straight line under uniform acceleration e.g. motion under gravity, motion on smooth and rough inclined planes. Work, potential energy, kinetic energy, power. Application of energy conservation. Motion of connected particles.
4. Equilibrium of a particle under concurrent forces, including friction.
5. Centre of gravity of simple bodies and systems of particles Moments and couples. Equilibrium of a rigid body *or bodies.*
6. Liquid pressure. Thrust on a horizontal surface. Archimede’s Principle.
7. Projectiles. *Projectiles on inclined plane.*
8. Angular velocity. Uniform motion in a circle without gravitational forces. Conical pendulum. Circular orbits.
9. Conservation of momentum. Collisions. Direct collisions, elastic (0 < e ≤ 1) and inelastic (e = o). *Oblique collisions of smooth elastic spheres in two dimensions.*
10. *Simple harmonic motion of a particle in a straight line. (Application of simple harmonic motion to include the simple pendulum*.)
11. *Motion of a rigid body about a fixed axis:*
	1. *Calculation of moments of inertia for a rod, rectangular lamina, circular lamina and compound bodies formed of those. (Sphere is excluded). Application of parallel and perpendicular axes theorems, with proofs done as classwork. Idea of radius of gyration. Application of the conservation of energy principle to a rotating body.*
	2. (b) *Application of the principle of angular momentum: rate of change of angular momentum about a fixed axis equals the total external moment about that axis. Compound pendulum. Simple applications.*
12. *Ordinary differential equations and applications:*
	* 1. *first order, variables separable;*
		2. *Second order reducing to type*

**In conclusion**

Applied Maths is not an easy subject, but it is a wonderfully rewarding subject to take on if you are good at maths and enjoy challenging yourself. It is interesting, challenging, educational, and it is good for careers.