Importance of Study of Mathematics in Engineering Education

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Abstract— **The word engineering comes from the Latin word "inenerare," which means "to create." Engineering is a science where the forces of nature are converted for the utility of mankind. Natural forces and mathematical analysis are juxtaposed for the benefit of people. Science and mathematics are integral parts of engineering. Science teaches us about the laws of the natural world and mathematics helps us to establish relationships among different quantities. Both subjects are of paramount importance if you are planning to study engineering at the university level. While in school, you must build a very strong understanding of science and mathematics because these are the foundations upon which your study will be based.**

Index Terms— **Mathematics, Engineering, Technology**
Sub Area   : Applied Mathematics
Broad Area   : Mathematics

I. INTRODUCTION

Maths is founded on simple yet powerful elements — numbers. Numbers, just like the elements of nature, share a complex relationship with every other element in that set. This relationship is universally valid. The equation, $(a+b)2 = a2+b2+2ab$, stands true on Earth, on Jupiter and even if the sun goes down. Because, math doesn't exist in this physical dimension. It exists entirely in the human mind, it's a mental concept, and I think this is the most beautiful concept ever made by the human mind. Maths and human beings are co-dependent to aid each other's growth. When we get to the bottom of it, we see that math is an abstract representation of nature— element to element, shape to shape and relation to relation. This fundamental reason suggests that maths is no different from nature. Hence, any real-world problem can be solved in maths and any maths solution is effective in the real world. Of course this statement doesn't hold true in love and war. Those topics are out of the scope of this discussion.

Mathematics may be more important now than ever. Math is the language of technology, and it is used to solve problems in engineering, economics, communication and many other diverse fields. Math enables us to advance our understanding of our ever-changing world and to manage the technologies that help us to live successful and productive lives. Strong math skills are vital as we move forward in the information age.

From the elementary level, awareness of science, technology, engineering and mathematics (STEM) fields is included in school curriculum. Apart from reading these subjects, students are made aware of the fields and scope of STEM courses. As students pass on to the secondary level, they should study these subjects rigorously to prepare for engineering   courses

If you're considering engineering as an option after school, you must be prepared to deal with a lot of maths and science in most of the subjects that are part of an engineering course. Students planning for a career in engineering should make sure that they take up science and mathematics in the 11th and 12th classes in school. Both the subjects are crucial when you would start preparing for any of the major engineering entrance exams like JEE Main, JEE Advanced, BITSAT and VITEEE.

Mathematics is a methodical application of matter. It is so said because the subject makes a man methodical or systematic. Mathematics makes our life orderly and prevents chaos. Certain qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication   skills.

Mathematics is the cradle of all creations, without which the world cannot move an inch. Be it a cook or a farmer, a carpenter or a mechanic, a shopkeeper or a doctor, an engineer or a scientist, a musician or a magician, everyone needs mathematics in their day-to-day life. Even insects use mathematics in their everyday life for existence. Snails make their shells, spiders design their webs, and bees build hexagonal combs. There are countless examples of mathematical patterns in nature's fabric. Anyone can be a mathematician if one is given proper guidance and training in the formative period of one's life. A good curriculum of mathematics is helpful in effective teaching and learning of the subject. Experience says learning mathematics can be made easier and enjoyable if our curriculum includes mathematical activities and games. Maths puzzles and riddles encourage and attract an alert and open-minded attitude among youngsters and help them develop clarity in their thinking. Emphasis should be laid on development of clear concept in mathematics in a child, right from the primary classes.

If a teacher fails here, then the child will develop a phobia for the subject as he moves on to the higher classes. For

explaining a topic in mathematics, a teacher should take help of pictures, sketches, diagrams and models as far as possible. As it is believed that the process of learning is complete if our sense of hearing is accompanied by our sense of sight. Open-ended questions should be given to the child to answer and he/she should be encouraged to think about the solutions in all possible manners. The child should be appreciated for every correct attempt. And the mistakes must be immediately corrected without any criticism.

The greatest hurdle in the process of learning mathematics is lack of practice. Students should daily work out at least 10 problems from different areas in order to master the concept and develop speed and accuracy in solving a problem. Learning of multiplication-tables should be encouraged in the lower classes.

II. METHODOLOGY WITH EXAMPLE

Let us start by discussing the following problem. Take any whole number between 1 and 999 inclusive and add the squares of the digits to get a new number. Try 145 and see what happens.Can you see that, whatever number we start with (between 1 and 999) we always get another number which is less than 1000. Let's use this idea to look at a problem. In this problem, take any number (less than 1000), add the squares of its digits, and then go on repeating this until a pattern emerges. For example, if we take the number 193, we get the following sequence of numbers :

193 -> 91 -> 82 -> 68 -> 100 -> 1 -> 1 -> 1 Of course, when we reach 1 we will always get 1 thereafter. You were asked to start at 145, and

you should have got the sequence 145 -> 42 -> 20 -> 4 -> 16 -> 37 -> 58 -> 89 -> 145 and, of course, the sequence then starts repeating itself. Try some numbers yourself to see what patterns you get.

Numbers, like 193, which start a sequence leading to the number 1 are sometimes called 'happy numbers '.

III. EXAM PATTERN OF ENGINEERING ENTRANCE EXAMS

The exam pattern for most of the engineering exams remains the same - you would need to be proficient in chemistry, physics and mathematics. The prescribed syllabus for most of the engineering entrance exams are also quite similar and focus on testing your basic concepts and understanding of these subjects. Your knowledge of thermodynamics and chemical kinetics in chemistry, mechanics of solids & fluids and gravitation in physics and your competence in solving calculus problems and algebraic equations in maths are indicators of your aptitude to study engineering for your higher education after school.

Topics covered in an engineering programme. A typical syllabus for mechanical engineering usually includes the following:
- Linear algebra
- Calculus
- Differential equations
- Numerical method
- Probability and stats
- Fluid dynamics

- Theory of machines
- Thermodynamics
- Reciprocating Air Compressor
- Steam Engineering

These are just a few subjects that might be included in an engineering course syllabus, but that would likely be enough to give you a sneak peek into what studying engineering could be like.

Burkhard Alpers (2010) notes the significance of researching the mathematics used by engineers in their work. He says that in order to provide "a mathematical education of engineering students which is relevant for their later work as engineers, one needs studies that try to capture the mathematical expertise of engineers" (Alpers 2010b). According to Alpers there are only a few studies of engineers' usage of mathematics because "they are not easy to conduct". Of the studies conducted, researchers have concentrated on specific branches of engineering rather than investigate the work of practising engineers generally and some studies have investigated engineering students' mathematics usage. Research methods used to investigate engineers' mathematics usage include ethnography, interviews and investigation of tool usage. Studies focus on usage of school mathematics, mathematical understanding and hidden mathematics. Alpers is of the view that investigating engineering students' work is "unrealistic" because students, unlike engineers, have "no time pressure" in their work, the students do not have to fit into any organisational structure and specific student tasks are not representative of broad engineering practice. However students are far more accessible than practising engineers to participate in studies. Another potential limitation of investigating engineers' mathematics usage is that a lack of familiarity with engineering work could restrict researchers' identification of mathematics usage (Alpers 2010b).

CONCLUSIONS

Engineering is all about applying science and mathematics practically to come up with solutions to problems we face in our daily lives. Make sure you enjoy these subjects and have an aptitude for studying them if you plan to pursue engineering. Another very effective means of spreading the knowledge of mathematics among children is through peer-teaching. Once a child has learned a concept from his teacher, the latter should ask him to explain the same to fellow students. Moreover, in the process all the children will be able to express their doubts on the topic and clear them through discussions in a group. The present age is one of skill-development and innovations. The more mathematical we are in our approach, the more successful we will be. Mathematics offers rationality to our thoughts. It is a tool in our hands to make our life simpler and easier. Let us realize and appreciate the beauty of the subject and embrace it with all our heart. It is a talent which should be compulsorily honed by all in every walk of life.

REFERENCES

[1]The Times Of India- 3rd AUGUST-2015.
[2]https://nrich.maths.org/1314

BIOGRAPHY

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