A Review on the Influence of Mathematics Education on Millennial Engineering Students

Ravindar B[1, a)], Ravi Kiran G[2, b)], Geetha M[3, c)]
[1, 2]*School of Sciences,SR University, Warangal,India*
[3]*School of Business, SR University, Warangal, India*

[a)] **Corresponding Author:***b.ravindar@sru.edu.in*

Abstract

One of the most important areas of human endeavour that mathematics serves is the field of engineering. There have been new avenues of mathematical study inspired by recent advances in the engineering realm. There are several instances of this, such as control theory, signal processing, and coding theory. Given the inherent mathematical nature of engineering, it is clear that mathematics play an essential part in engineering curriculum. There has been a significant shift in the focus of mathematics education for engineers in the previous two decades due to both changing needs in the engineering field and the insufficient mathematical skills of engineering students. There has been a shift to using more contemporary methods and tools in the mathematics instruction given to engineering students as a result of recent advances in technology and computing. The purpose of this study is to offer light on the curriculum, teaching, and measurement-assessment practises necessary for a successful mathematics education in engineering for millennial students.

INTRODUCTION

Due to the ever-increasing speed of technological advancement, many engineers will need constant upgrading in their areas of specialty. This might need learning new skills and theoretical frameworks. Engineering graduates nowadays cannot afford to be mathematically illiterate [1].Both the changing needs of the engineering industry and the low mathematical proficiency of engineering students have necessitated a significant shift in the focus of mathematics education during the last two decades. There has been a shift to using more contemporary methods and tools in the mathematics instruction given to engineering students as a result of recent advances in technology and computing.

Students pursuing engineering degrees in college sometimes struggle due to a lack of proficiency in elementary mathematics. Many pupils seem to have no trouble determining the right answers to test and exam questions by using tried and true methods. However, individuals often make mistakes because they don't fully grasp the underlying theories [2]. While problem solving and creative thinking are among the most crucial talents for an engineer to have, many students struggle in these areas [3]. The demographics of the student body have also shifted, with a rise in the proportion of overseas students. Almost wherever engineers work, new requirements emerge in tandem with technological advancements.

Mathematics education for engineering students has been affected by changes in educational technologies, the nature of the engineering profession, and the anticipated additional demands on students' mathematical ability and profile variations.Curriculum, instruction, and evaluation strategies for engineering mathematics courses are all explored here.

METHODOLOGY

This study, which employed a survey approach, aimed to have a discussion on how mathematics is being taught to engineers in the twenty-first century. The purpose of the survey method, as a research technique, is to provide an accurate and detailed description of a condition, either in the past or the present.

OUTCOMES

1. Curriculum

Many reports stressed the need of a solid background in mathematics for engineers. Varying branches of engineering need different amounts and types of mathematics, but they can all agree that they need at least some fundamental mathematics [4]. The best engineering mathematics courses are those that are integrated within a broader engineering curriculum that offers students an opportunity to see firsthand the most important conceptual and theoretical advances in related fields. In engineering programs, mathematics is taught in a variety of ways, but all must meet some minimum standards [1].

In 2002, the Mathematics Working Group of the European Society for Engineering Education undertook a comprehensive investigation on the subject matter of engineering mathematics. In that research, a fundamental programme with four stages was created. Throughout their time in engineering school, students will pass through these tiers, which are meant to mirror the hierarchical erection of maths and the ways in which abstract concepts may be applied in the actual world [1].

Five categories—calculus and analysis; discrete mathematics; linear algebra; geometry; probability and statistics—have been created within the three primary stages.The core zero is the prerequisite coursework that an incoming first-year engineering student should complete. Engineering mathematics students will find in the core zero content that may serve as a firm

foundation for their studies. Algebra, Calculus, Analysis, Discrete Math, Geometry, Trigonometry, and Probability &Statistics are the 5 main topics covered in Core Zero [1].

The information at core level one builds on core zero and is considered as foundational to all engineering specialties in that it gives the fundamental grasp of numerous mathematical ideas. Engineers may utilize the information presented in the first core level to better comprehend and create theory, as well as wisely pick methods for analyzing engineering issues. This topic will be imparted in the initial phases of a college degree [1].

There is a natural progression from the first level's foundational information to the second. This technology is sophisticated enough to solve even the most basic of practical engineering issues. Subject areas will cherry-pick various sections of level two content to study.

At the third level, engineers should be able to apply the mathematical methods learned to a variety of real-world challenges. These more complex strategies expand upon the information covered in the introductory and intermediate courses. It's likely that rather than being presented in its own mathematical unit, this content will be integrated into the units covering the engineering disciplines to which it most directly applies.

2. Procedures for Instruction and Evaluation

According to Lopez's [5] review of the literature, millennial **s**tudentsmust respond to changes in both the engineering field and their student body. The need for a more complete learning support system becomes more apparent when considering a student body that is more demographically diverse. As a result, there is a lot of discussion over the best way to adapt to these changes [4].

Here are a few issues that colleges of engineering have to deal with:

- To meet the mathematical requirements of all engineering fields in a single course, and the challenge of coming to a consensus on what should be covered between mathematics and engineering departments.
- Declining mathematical proficiency among incoming engineering students.
- The easing of requirements for admission and the rise in the number of overseas students.
- A deficiency in the number-crunching department's employees.
- Challenges posed by overcrowded classrooms and a lack of resources for teachers.
- Reductions in both mathematical material and classroom time.

In an effort to find solutions to these issues, educational establishments and professionals have started using innovative teaching strategies. Problem- and project-based learning, student assistance programmes, online provision, visual bases, mathematical software programmes, online instructional resources, computer-aided valuation, and flexible, formative, and summative assessment are some examples of these (Broadbridge& Henderson, 2008) [4].

Many engineering colleges now provide academic support services to their students in an effort to help them navigate the challenges that they encounter when taking mathematics classes.

Many of Indian's universities have MathCentres, which include free online courses, lecture notes, examinations, and videos for the purpose of enhancing mathematics education on their own websites. Students studying engineering at certain of the universities in India have access to the mathematical labs at those institutions.

Following is a list of important ways that teaching and learning might be adapted to meet the requirements and circumstances of the Gen Y Students, based on an examination of contemporary literature in mathematics education for engineering students, which spans from 1995 up to the present time:

- Make advantage of cutting-edge computer-based approaches, such as interactive web-based techniques or software programmes, or both.
- Accommodate a wide range of student abilities and interests.
- Use methods from a variety of fields.
- Use a method of teaching and learning called "problem-based learning" [5].

Doing things as a form of instruction is known as active learning. All student-initiated study falls under the umbrella of "active learning." When a student takes a more active role in his or her education, he or she is more likely to succeed [5]. Besides lectures and discussions, active learning also includes problem-based and online education.

Software programmes and the internet have turn out to be integral parts of engineering math education as a result of the fast development of computer technology over the past few of decades. Matlab, Excel, Minitab, Mathematica, Mapple, and Mathcad are some of the more popular ones [4].

More or less learning strategies, such project-based book learning, the integrated method, and the 4-leaf clover type, are employed in many iterations and combinations [5].

Modifications to testing procedures are a natural consequence of innovations in education.Class exams, cluster projects, single projects, written valuation, and computer-aided valuation are only few of the many evaluation techniques.

Teachers can better meet the requirements of their pupils and the class as a whole with the help of continuous assessment. The student is given the freedom to choose his/her preferred mode of assessment when given this option. This puts the onus of learning on the student, who must choose how best to demonstrate his/her mastery of the material [6].

Following is a description of the mathematics courses offered at first year level, together with information on how they are taught and evaluated, at our University.

B. Tech.,Program

Module	Credits
Calculus & Differential Equations - 20BS101	5
Engineering Mathematics - 20BS102	5

20BS101: Calculus & Differential Equations

Content: Functions and Their Graphs – Shifting and Scaling Graphs – Limit and Continuity of a Function – Limits Involving Infinity; Asymptotes of Graphs – The Derivative of a Function – Differentiation Rules – L Hospital's Rule – Derivatives of some standard functions – Linearization and Differentials – Extreme Values of Functions, Integration – The Definite Integral – Integrals of Transcendental Functions – The Fundamental Theorem of Calculus (without proof)– Indefinite Integrals and the Substitution Method – Definite Integral Substitutions and the Area between Curves – Integration by Parts – Trigonometric Substitutions – Integration of Rational Functions by Partial Fractions. Mean value theorems – Taylor & Maclaurin series expansion, Partial Differentiation, Jacobian, Lagrange's method of multipliers. Review of Differential Equations – Variable Separable Method – Linear, Bernoulli, exact type Equations – Applications on ODE. General Solutions of Linear Equations – Homogeneous Equations with Constant Coefficients – Non homogeneous Equations with Constant Coefficients, Method of variation of parameters – Applications: Electrical Circuits – Mass Spring Systems.

Strategies for Education: Totalpupil effort:45hours.

There will be 45 hours of lectures along with16 hours of tutorials (tutorials - the focus is on reinforcing previous knowledge rather than introducing brand new information).

Assessment: Coursework:Twocomputer-basedorinclasstests (CIE – Continuous Internal Evaluation)(40%).Semester End Examination(SEE) (60%) (3hours).

20BS102 - Engineering Mathematics

We will follow same strategies and assessment as above mentioned course.

CONCLUSION

A university degree that includes coursework in engineering is essential. The relevance of mathematics instruction in engineering programmes cannot be overstated. Variation in mathematics instruction for engineering students has resulted from recent advances in technology and computers, and these innovations have also brought with them the usage of contemporary methodologies and tools. Education in engineering must include the use of computers and the internet.

By analyzing the curriculum, teaching techniques, and assessment procedures, the purpose of this study is to provide some insight on by what means the math education, which is avital aspect of engineering tutoringfor millennial **s**tudents, should be.

REFERENCES

1. Mustoe L and Lowson D, SEFI Mathematics Working Group, SEFI HQ, Brussells, Belgium, 2002.
2. Norbert Gruenwald and Sergiy Klymchuk, The 6th Baltic Region Seminar on Engineering Education, 2002.
3. Jonathan Patrick Adams and Stefan Kaczmarczyk and Phil D. Picton and Peter Demian, International Conference on Engineering Education, Portugal, 2007.
4. Broadbridge P and Henderson S, Final Australian Mathematical Sciences Institute, 2008.
5. Lopez A, Australian Mathematical Sciences Institute, 2007.
6. Wood, L. N. and Smith, G. H., A Symposium on Undergraduate Mathematic, Queensland, 1999.