# IMPROVED MATHEMATICS LEARNING BY MODULAR TECHNOLOGY IN TECHNICAL EDUCATION

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**ABSTRACT**

*Significance of engineering mathematics is trending to peaks with increase in global technology. Pertaining to the present state of scenario, fresh graduates need to be enhanced in mathematical application view-point for the developing industry. The intent of this paper is to promote technical education students in learning engineering mathematics through special modules designed for the purpose. For designing the modules, the curriculum has been divided into various stages and correspondingly graphical user interfaces has been developed. Efforts were made to attract the students as per their interests developing four methods of accessing the modules. As competitive and placement examinations prerequisite mathematics, the developed modules help students in effective preparation approach. The present work emphasizes on effective mathematics learning through information technology. Furthermore focus is given to several fundamental programs to enhance student's performance.*

**Keyword**: - *Engineering mathematics, graphical user interface, Information technology, active and interactive learning, modules.*

## 1. INTRODUCTION

Engineering is an art where the use of imagination and deliberate choice is needed to fashion the everyday products we use, and the environment in which we all live. Advances in the use of information technology and computers have transformed engineering analytical techniques, and production and management processes. These advances will surely continue, creating opportunities for all engineers, both in the way knowledge can be acquired, and then applied. The role of mathematics in engineering education is one of these opportunities. There is clear agreement that mathematical skills are essential. The questions are what, and when, and how they should be taught? These questions need answering. In particular, the level of mathematical skills needed at entry to engineering courses

In 1998, Susan and Groat [21] emphasized that understanding of learning styles is fundamental to our individual approaches to teaching and believes that it can have an impact on the teaching approaches of all the faculty. In the same year, SAZHIN [19], discussed ideas in teaching mathematics to engineering students and the implementation of these ideas into the teaching of mechanical engineering students at Brighton University.

## 2. METHODOLOGY

This paper discusses the systematic pedagogical development of the first year engineering mathematics module. The key objectives for this paper are:

i) Provide more practice in specific mathematical methods present in the first year course.
ii) Promote a deeper learning environment understanding levels.
iii) Encourage self learning.
iv) Development of learning attitude, communication skills and time management skills.

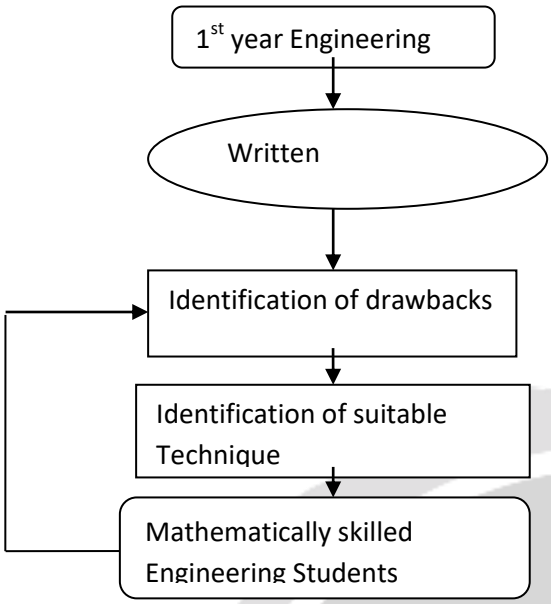


**Fig1**: Modular technology model

This process is essentially to develop teaching, learning practices necessarily student-centered. To do this it was necessary to be fully aware of the background and abilities of the students in order to tackle the issues associated with such a curriculum design challenge. This was accomplished in two ways: mathematical diagnostic testing at entry level and learning styles. The former provided information of the new students' mathematical skills and the latter indicated particular predominant learning preferences. Such information then helped to provide clarity with regard to developing module content, teaching methods that afford students a more balanced learning environment. The development of the first-year mathematics module was deemed essential to fulfill the objectives above. The module of teaching and learning was designed emphasizing 1) the basic formulae, 2) the dynamic mathematical methods, 3) student's small group activity.

Certain techniques are followed in this regard which help both the teacher and the student to work on with ease and comfort by **Modular Technology (MT)**. Fig.1 shows the illustration of the whole process of the module.

All of the techniques are explained with suitable examples:

**2.1 Technique– I-Basic gallery:**

Another important aspect in pedagogy is to build upon previous knowledge. Many higher education students enter colleges/ universities with gaps in necessary prerequisite knowledge of mathematical topics; this can hinder significantly the introduction of new mathematical ideas through novel approaches. A model is been designed for frequent revision of the basic formulae by conducting different activities like asking particular students to prepare charts for different basic topics, one minute games, multiple choice questionnaire, puzzles, etc.

**Model 1:** Preparation of different charts of all the basic formulae of different topics by the students using textbooks or any other source for display. Participation in small groups is beneficial. In the beginning of the semester, competitions on the basic formulae like answering multiple choice questionnaires, match the following questionnaire or fill in the blank questionnaires are conducted to improve the competitive spirit among the students as shown in Fig:2,3.

**Fig.2** :shows the example of match the following questionnaire that is conducted for I B.Tech students of AITAM college.

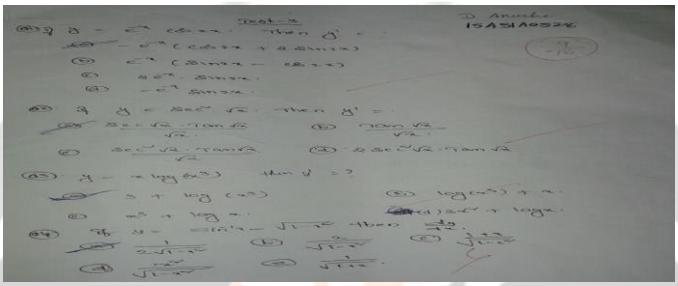

**Fig.3**:shows the example of multiple choice questionnaire that is conducted for I B.Tech students of AITAM college.

**Model -2:** Puzzles with the help of power point documents are conducted to draw the interest of the student towards development of learning attitude.
For example: The question is to solve a partial differential equation: $z(x-y) = px^2 - qy^2$.
Then a puzzle can be to arrange the following in correct order:

Slide-1: $\frac{z}{x+y} = c_2$, Slide-2: $\frac{dz}{z} = \frac{d(x+y)}{(x+y)}$, Slide - 3: $\emptyset\left(\frac{1}{x}+\frac{1}{y}, \frac{z}{x+y}\right) = 0$, Slide -4: $\frac{dx}{x^2} = \frac{dy}{-y^2} = \frac{dz}{z(x-y)}$, Slide- 5: $\frac{1}{x}+\frac{1}{y} = c_1$.
The correct order is: Slide-4, 5, 2, 1, 3.

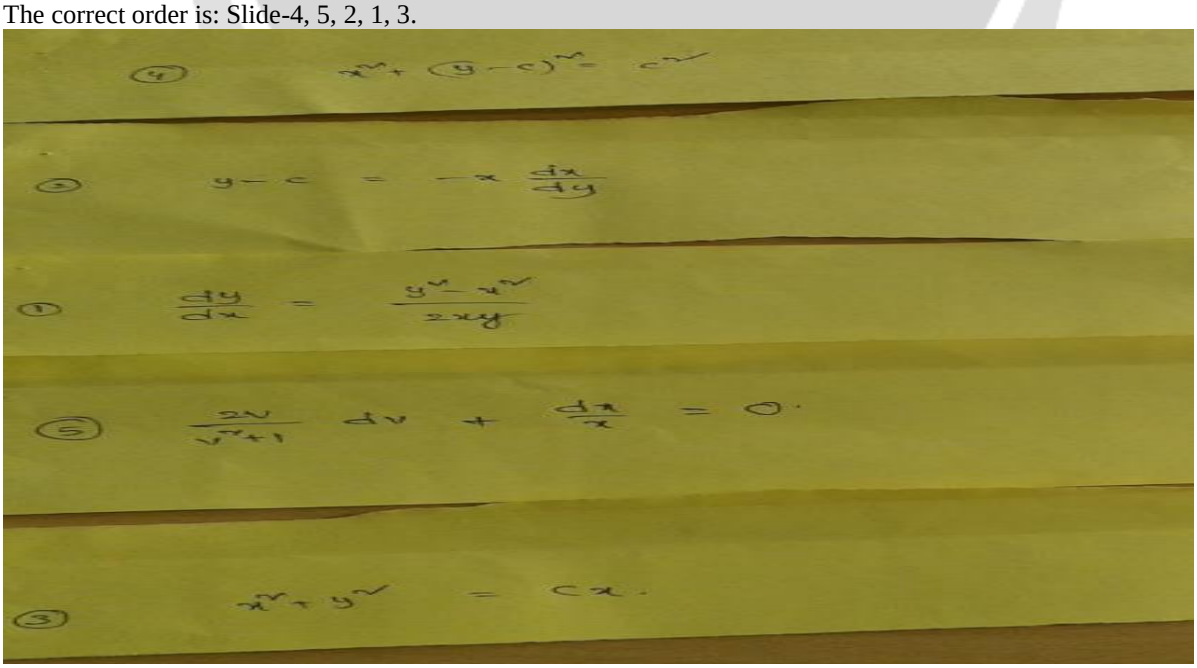

**Fig.4** shows the example of puzzle solved by a I B.Tech students of AITAM college.

**Model – 3**: One minute games are be conducted by asking a series of bit questions to a student or writing the formulae/basic questions on a sheet of paper in one minute and then give his/her score for the correct answers.

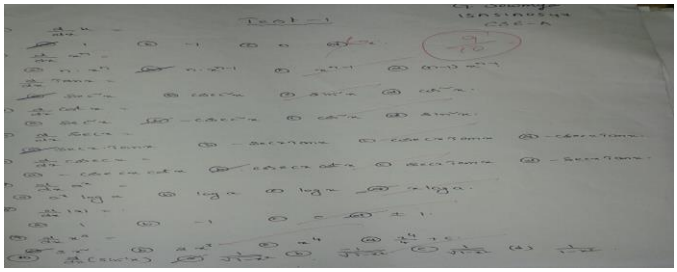

**Fig.5** shows the example of questionnaire that is conducted in 1 minute for I B.Tech students of AITAM college

**2.2 Technique-II**: **Process-Oriented Guided Inquiry Learning:**

A Process Oriented Guided Inquiry Learning (POGIL) classroom consists of any number of students working in small groups on specially designed guided inquiry materials. These materials supply students with data or information followed by leading questions designed to guide them toward formulation of their own valid conclusions -essentially a recapitulation of the scientific method. The instructor serves as facilitator, observing and periodically addressing individual and classroom-wide needs. This style of teaching is more effective than the monotonous lecture based teaching which sometimes has the tendency to weed out potentially good students.

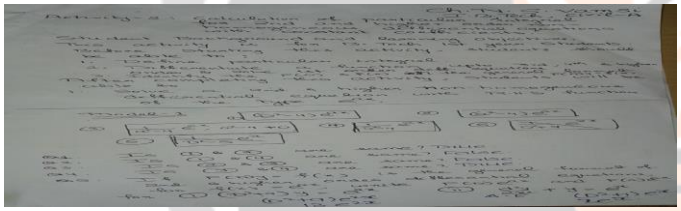

**Fig.6** shows the example of POGIL activity that is conducted for I B.Tech students of AITAM college.

**2.3 Technique-III: Entangled Problems:** Students generally mismatch the method of solving similar pattern problems because of varied techniques of solving a problem and of course because of lack of practice. Some times more than one method can be used to solve a problem leading to ambiguity in students. Different activities are carried out for students to develop capacity to identify the method(s) suitable to solve a problem, like match the following questions, identify the suitable, puzzles, etc. For example: Match the following:

| A | B |
|---|---|
| 1) $J\left(\frac{x,y}{r,\theta}\right)$ | a) $-e^{-x}$ |
| 2) $J\left(\frac{r,\theta}{x,y}\right)$ | b) $-e^{x}$ |
| 3) $J\left(\frac{x,y}{u,v}\right), u = e^{x}siny, v = e^{x}cosy$ | c) $r^{-1}$ |
| 4) $J\left(\frac{u,v}{x,y}\right), u = e^{x}siny, v = e^{x}cosy$ | d) r |

Note: 1. (x, y) & $(r,\theta)$ represent Cartesian coordinates and polar coordinates. The correct match is 1) d, 2) c, 3) a, 4) b.

**2.4 Technique – IV: Identification of Mathematical logic:**

An important pillar in pedagogy is contextualizing learning using an authentic environment and real-world examples. A majority of students have difficulties in connecting mathematics to real world applications and this could be a reason for failure in mathematics. Being fast in mental arithmetic can save money and time, Worksheets and role plays with real life mathematical problems of question like suppose we appoint a person for some work we give him 2 options: Say : i. Rs 100/- per day ii. Rs 50/- per first day, then increase of Rs 5/-per the summing days. Which is better? Algebra is useful in this case. A shopkeeper keeps more stock of a particular type of shoe which has more Sale. Here the concept of MODE applies; the average daily expenditure in a month of a family gives the concept of MEAN; the study of graph helps to find the easy route that can be used by a sailor from one port to another. The trigonometry helps us to find the height of a tree.

## 3. CONCLUSION

The innovative methods of learning and teaching mathematics in engineering education will facilitate the conceptual understanding and constructive learning including novel pedagogies (e.g. collaborative learning, inquiry/puzzles/game based learning), with real-world examples, stimulating motivation and self-efficacy beliefs. The active and interactive learning approach, combined with the entertainment strategy, provides instant individual development. In addition, it offers an enjoyable and constructive learning environment which fosters a more positive attitude towards learning mathematics.

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