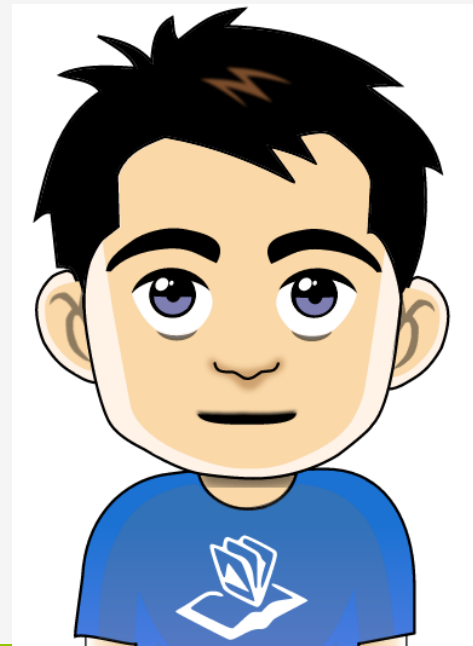


Teaching and Learning Mathematics

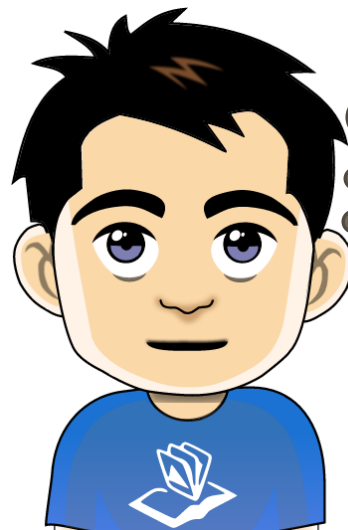
A Student Perspective.....



This is a story of a student X who joined IITB as an undergraduate. The first question that arises when he is made to study maths.....

Why do we
study maths?
How is it related
to my field?

Where am I going
to use this epsilon-
delta....alpha
beta gamma???



Two different Scenarios

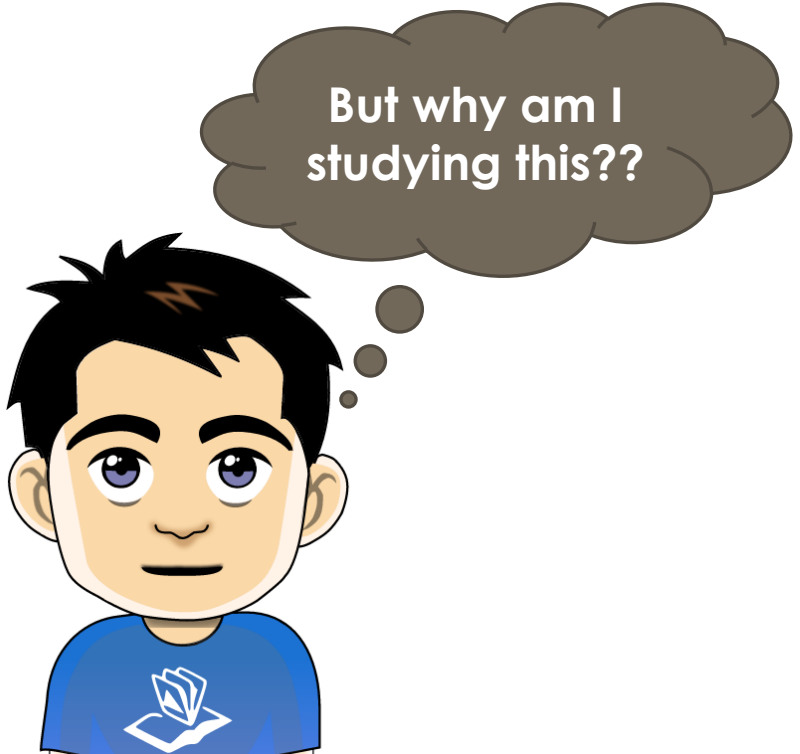
Instructor introduces why his course is useful for students of various departments/disciplines. Where exactly students can use or apply whatever is taught in the course.



Interesting!!!

A cartoon illustration of a young man with black hair and blue eyes, wearing a blue t-shirt with a white graphic of an open book. He has a thoughtful expression. Above his head is a large, dark grey thought bubble containing the text 'Interesting!!!'. Three smaller grey circles lead from the bubble to his head.

Instructor teaches the course without telling the use or applications of course.



But why am I studying this??

A cartoon illustration of a young man with black hair and blue eyes, wearing a blue t-shirt with a white graphic of an open book. He has a questioning expression. Above his head is a large, dark grey thought bubble containing the text 'But why am I studying this??'. Three smaller grey circles lead from the bubble to his head.

Two different Scenarios continued..

- While doing the course, X regularly knows and is able to apply the concepts, theorems, methods in his field of interest.
 - X finds the course interesting throughout the period of study.
 - X continues to study for the course regularly with interest and tries to explore more on the subject.
 - X remembers whatever he studied in the course in future as well.
- While doing the course, X has no idea of how this course is helping him.
 - X starts to lose interest in course and finds the course and lectures boring.
 - X stops studying for the course and relies on the night before exam to just somehow get a decent grade.
 - Till the end of the semester he has the same doubt - "Why was I studying this? How was this supposed to help me?"

Possible Methods :

- Introductory note on how is the course useful for the students of different departments/disciplines.

Reference from EE101 slides of 2008.

Mechanical Engineering Department

1. ME309 Automatic Control
2. ME604 Robotics
3. ME358 /402 Mechatronics I/ II
4. ME 360 Power Plant Engineering
5. EN 640 Solar Photovoltaic: Fundamentals, Technologies and Applications
6. ME645 MEMS

Chemical Engineering Department

1. CL358 Instrumentation and Process Control

Aerospace Engineering Department

1. AE 217 Measurements and Instrumentation
2. AE331 Dynamics and Control

Chemistry

1. CH440 ElectroChemistry
2. CH829 MagnetoChemistry

Civil Engineering

1. CE701 Remote Sensing Technology
2. CE716 Digital Processing in Remote Sensing
3. CE763 Digital Methods in Terrain Data Analysis

Physics

1. PH 405 Electronics
2. PH 504 Quantum Electronics
3. PH 525 Electromagnetic Wave Theory

Computer Science and Engineering

1. CS210 Logic Design
2. CS212 Electronics Design Lab
3. CS390 Microprocessor and Interfaces lab

Possible Methods :

- At the end of each topic/module instructor can give some application based problems in class.
- Some Tutorial sheets dedicated to application based problems.
- A section in each tutorial sheet dedicated to application based problems.
- Many of the online material have problem sheets containing significantly high number of application oriented problems.

Utility of a course :

- We often forget the fact that we are not studying(teaching) a course just to study(teach) the content of that particular course but to learn(make students learn) from the course so that we(students) can use in future whatever is learnt(taught) in the course.
- What is the importance of X taking a course if he does not remember what he learnt, after the course ends.
- Instructor should tell X directly what he expects from him and his view of why the course is important and what should be the take away points for him out of the course.

One day Game :

- Nothing drives X as crazy as marks do.
- So one of the key steps to encourage X to study throughout the semester should be “ASSESSMENT THROUGHOUT SEMESTER”.
- Most of the courses in mathematics generally have cent percent weightage devoted to exams(≤ 4). [own experience.]

- A very important factor that often does not get the importance it deserves, for making the study affairs “**One Day Affair**”, is :
Evaluation scheme is a one day affair (grades are primarily decided on the basis of two main exams!).

- X is able to score 70% in just one or two days preparation, he almost has no motivation to be regular and sincere towards learning the subjects.

Practise of Writing Mathematics:

- X simply do not use pen and paper, except in examinations and quite often his pens become stationary or lead to discovery of India in examination halls.
- Even in case X understands the concept/theory, he is unable to convey that mathematically in exams because he never writes math outside examination halls.
- Assessment throughout semester policies can help X learn how to write math. Just for promoting his understanding/intuition some marks can be given for understanding the question and explaining the concept.
- At the minimum some sample problems with explicit solutions can be provided.

Assessment throughout Semester :

- Regular Assignments with weightage can and should be given. (Issues of plagiarism will arise, but 3-4 cases of strict policy is enough to handle it and promote honesty. Just because some such cases can be there, discarding the practise assignments is not justified).
- Weightage to tutorials and class participation should be introduced. It has been implemented successfully in some courses and needs to be made more popular.
- Marks can be given for solving tutorial problems on board, submitting solutions to problems, bringing new questions, posting problems on Moodle etc.
- Students have in past appreciated the habit of heavy discussion on online forums such as Moodle, Piazza, Facebook etc. (Individual tutorial wise groups should be promoted.)

Assessment throughout Semester :

- Project work can be given as part of course. This can help X to explore more on subject other than the routine syllabus.
- At times some friends of X even miss challenge in the course. So providing some challenging problems to solve can make the course more interesting.

Lack of Appreciation:

- **'Direct Words'** of motivation and appreciation to the ones being regular and sincere. Better to appreciate the good than being neutral to good ones and criticizing the rest.

Thank You.

-- Pawan Nagwani, Btech-3, CSE Department