

Prototyping Product–Oriented Introduction to Engineering Course

RajeshwarRao Arabelli, K.Raj Kumar, D.Srinivas

Abstract— This course describes an introductory level course to the freshman engineering students to all the branches and of all different specialisations. In this introductory course a lecture based, activity based, assignments based, group discussion based, individual approach based, technical activities, non technical based and skill development topics are put into practice for the professional students and even inspiration, pain storming and brainstorming topics were introduced in this paper to help the introductory level students to design a prototype. Designed prototype can be further developing to convert it to a working model even in the coming years. Details of the lecture topics and prototyping design project are provided in this paper, on par with the discussion on the outcomes of the course. Overall, this introductory course lecture-activity course looks to meet all of our intentions for engineering, and student feedback on this subject has been very assertive.

Index Terms— Introduction to Engineering, Prototype based, activity oriented course.

I. INTRODUCTION

When discussed with the freshman engineering student about the objectives of introduction to engineering course [1], students responded overwhelmingly about learning the things and courses by the different styles like, activity oriented, group discussion and prototype based topics were the best learning practices what they had experienced in this course. Students had given a top priority in involving the product design [2] process, prototyping of the product [3] and this orientation about developing approach even from the freshman course made the students more enthusiastic and active in designing approach and some people requires some motivation to bring out their inner skills that which needed for this course. Asking freshmen engineering students to learn about the basic subjects like chemistry, mathematics, and physics courses that which they had already studied before engineering course makes them more frustrated, so the new courses like introduction to engineering design will make the students to involve in their course and more interest will be created in the students.

Some are exasperated with this new introduction to engineering courses While this innovative course can develop important topics as innovation [4], technical skills, students basically do not perceive the interconnection

Revised Version Manuscript Received on March 10, 2019.

Rajeshwar Rao Arabelli, Assistant Professor, Department of ECE, S R Engineering College, Warangal, Telangana, India

K.Raj Kumar, Associate Professor, Department of ECE, S R Engineering College, Warangal, Telangana, India

D.Srinivas, Assistant Professor, Department of Business Management, S R Engineering College, Warangal, Telangana, India

between these topics (e.g., physics) with which they may be struggling. Furthermore, they may not show interest to work on assignments, activities, group discussions and on presentation part as they are not habituated before and also afraid or tensed or feeling shy at the freshmen engineering level course. Even before joining in engineering different students will have different mentalities and different medium of instructions what they had studied from their childhood level.

To provide freshmen engineering students [6] with a developed activity based, lecture based and interactive based sessions in the course entitled "Introduction to Engineering" in which lecture topics on a variety of "hard" (technical-non technical) and "soft" engineering subjects are put into practice in a group to design prototype.

II. COURSE OVERVIEW

Outline to Engineering is a semester course which offers an acquaintance to the range of multi-disciplinary engineering career prospects, and generates a practical framework for the freshman engineering students study.

This course is made through a session of lectures, activity based sessions, assignments, group-based activities, pain storming sessions, brain storming sessions, presentations, skill development [7] and designing a prototype.

Since the chief attribute of efficacious professional engineers is the ability to communicate effectively, the course focuses on improving required skills. As part of a group students will attempt the Engineers without Borders Challenge, which is an opportunity to devise engineering solutions to a problem by certain developing community [8].

This course offers an interactive learning exposure for students keen about the dynamic field of Engineering Science. Classes will introduce the technical and analytical skills that are vital to pursuing a degree and career in starting level of Engineering. The programme is suitable both for those seeking to gain exposure to the practical applications of scientific theory and for those who aim to pursue further education in the field of Engineering Science.

The Introduction to Engineering course has been designed to provide students with a head start in the fascinating discipline of Engineering. During this course study students will go far beyond what they learn at school, covering the diverse branches of Engineering Science including Civil,



Prototyping Product–Oriented Introduction to Engineering Course

Computers, Electrical, Electronic and Mechanical Engineering. This course will provide an insight into what future study or a career in Engineering might be like..

COURSE OBJECTIVES:

Students will be able to

1. Summarize different engineering disciplines and identify engineering challenges.
2. Evaluating opportunities and design process applicable to real world.
3. Mention the methods for generating ideas to improve the design of existing product.
4. Build multi-disciplinary system perspective.
5. Design a physical model and recognizing the importance of technical report writing.

COURSE OUTCOMES:

At the end of the course, the students will develop an ability to

1. Define various disciplines technology and engineering challenges.
2. Judge the responsibilities as professional engineer in solving the societal problems.
3. Identify new opportunities to formulate and solve engineering problems.
4. Create personal skills and attributes at critical thinking.
5. Predict the importance of oral, written and academic skills.
6. Adopt social context of engineering practice.
7. Apply engineering reasoning to problem solving.
8. Integrate working with multi-disciplinary teams and build team work skills.

III. LECTURE TOPICS

Lectures were involved both of technical and nontechnical topics. Real world Examples and connections to real world phenomena were discussed in detail in this introductory level course to make the topics more interesting to students. In addition to these subjects, important non-technical engineering topics such as recent innovative challenges, technical communication and engineering ethics were also discussed. Other presentations on campus resources for academic problems, conflict resolution, library use, and abroad study curriculum were also discussed.

Lesson Plan

- 1st Week- A brief history of engineering and technology.
- 2nd Week- Engineering Challenges, Assignment on engineering challenges.
- 3rd Week- Opportunity Identification from inspiration
- 4th Week- Pain storming session, Case studies. Assignment
- 5th Week- Brainstorming session, Generating Ideas to solve the customer pain
- 6th Week- SCAMPER Tool, Assignment
- 7th Week-. Sketching, Assignment
- 8th Week- Interaction with peers, Demonstration of projects developed by senior students and Alumni
- 9th Week- Skill development workshop

10th Week- Generating Ideas to Physical model development

11th Week- Technical writing with report

12th Week- Project

13th Week- Project

14th Week- Project



Activity Based sessions



Classroom oriented sessions



Presentation Based Sessions

IV. ASSESSMENT & Results



Painstorming & Braintorming sessions

The assessment process used to evaluate the course outcomes of this course is done in two types. First is Internal assessment, Second one is External Assessment. The internal assessment is done through the evaluation of assignments, activities and presentation skills. The external assessment is done through the evaluation of product design, technical writing, team work and presentation skills [10].

Rubrics:

Criteria	Exemplary - Demonstrates thorough and penetrating understanding the concepts; revelations confirmation of attainment of skills	Proficient - Establishes general /adequate understanding of key concepts; revelations adequate confirmation of attainment of skills	Non voice - Reveals a lack of/little understanding of key concepts; revelations minimal substantiation of attainment of skills
Presentation	The presentation is well organized and delivered within the time limit. The props are useful with appropriate. Speaker maintains clear, audible voice and maintains eye contact.	The presentation is organized and delivered not within the time limit. The props are have limited use. Speaker most of the time maintains clear, audible voice and makes eye contact.	The presentation is dis organized and is not delivered within the time limit. The props don't enhance the release or pitch Speaker is inaudible and doesn't make eye contact.
Assignment / Technical Writing	The report is well organized, well written, and also it demonstrates appropriate application of the skills learned.	The report is somewhat organized but lacks details and also it demonstrates some of the skills learned	The report is not organized and also, it doesn't demonstrate most of the skills learned
Team work	Actively cooperates with other group members in an effectively	Cooperates with other group members in a meagre and reasonable manner	Distracts/discourages other group members from solving problems and getting engaged.
Activity	Student shows full knowledge about problems and its solution. Answers are strengthened by rationalized explanation.	Student has strong competent knowledge and is studious with information. And answer questions at ease.	Student is uncomfortable in knowing information. Seems intolerable and novice and answers basic questions only.
Prototype Design	Demonstrates multiple prototypes - soft or computer model and paper/cardboard models and provide insights gained from each prototype	Demonstrates some prototypes - soft or computer models, paper/cardboard models and cannot fully provide insights gained from each prototype	Demonstrates no prototype development and can't provide insights gained from each prototype

V.CONCLUSION

Introduction to engineering course the first year students will be able to improve the communication skills, analytical skills, design thinking analysis [9], technically, socially and economically. Also they will overcome the stage fear and fear of speaking in front of audience either technically and

nontechnically. In summary, this designing prototyping-oriented introduction to engineering course has proven to be a highly successful way to teach first year students about their majors by providing a multifaceted, hands-on, technical and analytical experience.



ACKNOWLEDGEMENT

The author is grateful for the valuable suggestions and contributions to the development of this Introduction to Engineering course for the first year first semester engineering course that were provided by S R Engineering College Management, Principal, Staff and also Prof. Sridhar Condoor, who assisted in teaching this course.

REFERENCES

1. Paul H Wright, “Introduction to Engineering”, John Wiley Inc. 2. Saeed Moaveni, “Engineering Fundamentals: an Introduction”, Cengage Learning, printed in USA. Karl
2. Kevin Otto, Kristin Wood, “Product Design: Techniques in Reverse Engineering”, Prentice Hall Edition, Jan 15 2013
3. GvilAlok, T.Anushalini and Sridhar Condoor, “Effective approach towards development of product design”, Journal of engineering education transformation, volume 31, No.3, January 2018, ISSN 2349-2473, eISSN 2394-1707
4. Jonathan Cagan, “Creating Breakthrough Products: Innovation to Program Approval”, Publication FT Press ©2002, Edition-2.
5. Aspelund, “The Design Process books”, Bloomsbury Publishing Inc.
6. Reymond B Landis, “Studying Engineering: A rewarding career”, Discovery press.
7. James H. Gilmore, B. Joseph Pine, “Markets of One: Creating Value through Mass Customization” Feb 1, 2000, ISBN 1578512387
8. The Lean Startup: How Today's Entrepreneurs Continuous Successful Businesses by Eric Reis
9. The Art of Tinkering Hardcover date that complies with legal media matrix –by Karen Wilkinson
10. Dr. Syed Musthak Ahmed et al, “Skill development in freshmen by adopting engineering course” Journal of engineering education transformations, special issue, eISSN 2394-1707