

AN INDUSTRIAL PROJECT MANAGEMENT COURSE FOR TECHNOLOGY CURRICULUM

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Abstract

Project management knowledge and skills are becoming a must for managers, engineers, and engineering technologists and are often required of employees in many areas of work. Effective project management ensures that a project is completed on time, within budget, and with high quality. Unlike in regular engineering programs, in engineering technology programs most of the students are full time employees at various industries. These students seek technology degrees (especially advanced level degrees such as M.S.) for both earning a special technical skills set required by the job and seeking promotion with greater responsibilities at their workplaces. Interactions with Industry reveal that these technical managers seriously lack project management skills. Not only for graduate curriculum, PM skills are critical for the undergraduate curriculum as well. This fact was recognized during the recent ABET accreditation evaluation of B.S. in Industrial Engineering Technology at the Indiana University Purdue University Fort Wayne (IPFW). This paper proposes an Industrial Management and Control course for a newly developed and approved M.S. in Technology Program offered at the IPFW under Purdue University system. The purpose of this course is to expose the students to analytical tools and techniques to manage the budget, schedule, and quality of projects. The course also develops hands-on skills using computer software for project management, risk management, and resources optimization. The paper outlines the course modules and teaching modalities for both graduate and undergraduate technology programs that are typically offered in the Engineering Technology schools.

Introduction

Project management (PM) knowledge and skills are becoming a must for managers, engineers, and engineering technologists and are often required of employees in many areas of work. Effective project management ensures that a project is completed on time, within budget, and with high quality. Despite this fact, majority of engineers that are graduated from Engineering colleges do not possess the PM skills set hence are required to learn in the field by experience^[1]. They get very little management and leadership training at their formal college education. However, recognizing this need, in the recent years, universities have been offering project management courses^[2].

The requirements for PM skills at both undergraduate and graduate levels have been widely addressed in the published literature. Plemmons^[2] underscores the prospect of PM instructions in undergraduate engineering education. The author argues that market conditions, global

outsourcing, global projects, advanced technology are some of the “business drivers” that need management and leadership skills. If these skills set can be taught in the colleges, companies would not have to run long and costly training programs for new graduates and instead their times can be used for more productive works. Larsen ^[3] presents a case study from Marshall University outlining the necessity of a core course on project management in their Engineering Management Masters Program (EMMP). Wayne State University’s Industrial and Manufacturing Engineering Department ^[4] also offers a course on project management in its EMMP program, exclusively designed for automotive industry. We can have many more examples from the universities offering PM courses.

While it may be common to have a PM course in ‘Engineering’ curriculum ^[5-7], it is not as common in ‘Engineering Technology’ curriculum. Moreover, it can be argued that technology graduates are equally likely to assume more responsibilities as they progress through their careers. Unlike in regular engineering programs, in engineering technology programs most of the students are full time employees at various industries. These students seek Technology degrees (especially advanced level degrees such as M.S.) for both earning a special technical skills set required by the job and seeking promotion with greater responsibilities at their workplaces. Interactions with Industry reveal that these technical managers seriously lack project management skills. This need was echoed during the recent ABET accreditation evaluation review of Industrial Engineering Technology program at Indiana University Purdue University Fort Wayne (IPFW). It has now become even more demanding because of newly approved M.S. in Technology Program at the IPFW. To bridge this gap, this paper presents a proposed course on project management in the Technology graduate curriculum. In addition, the paper also talks about how it can be accommodated in the undergraduate curriculum.

Course Objectives and Outcomes

The proposed Project Management course is a three credit-hour course in a semester system. For the M.S. in Technology degree at the IPFW, a student is required to complete total 33 credit hours. That is divided into four categories: three core courses (9 credits hours), four relevant track courses (12 credit hours), three courses from technical electives (9 credit hours), and a Directed Masters Project (3 credit hours). The Project Management course will be a part of pool of courses offered in the Industrial Technology Track. Students, depending upon their areas of interest, can choose four courses out of currently available five courses in that track. In this course, students learn the concepts of project management and techniques for planning, and controlling of resources to accomplish specific project goals. While the focus is on technically oriented projects, the principles discussed are applicable to the management of any project. It focuses on the methodology that can be employed to plan project implementation and control progress. Topics largely include work breakdown structure, task and schedule development, budgetary control, risk management, and resources optimization. A great deal of learning will take place from the students’ term projects and through analyzing the real world projects and published case studies. As technology programs are known for more hands-on skills set, an emphasis on project management software utilization is a vital part of the learning objectives. Unlike a traditional PM course, it also covers the risk analysis and uncertainty issues in managing a project.

Specifically, the course is structured to fulfill the following objectives:

- ♦ Learn the application of scientific thinking to study the real world industry problems.
- ♦ Break large or complex efforts into manageable assignments, including the proper use of Work Breakdown Structures (WBS)
- ♦ Plan, estimate, schedule, and budget work

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- ◆ Understand the project life cycle.
- ◆ Master the basic project management skills.
- ◆ Monitor, document, and report project progress and problems
- ◆ Anticipate and manage risk
- ◆ Understand the project manager's roles and responsibilities
- ◆ Identify project objectives
- ◆ Analyze and establish project requirements
- ◆ Create the task relationship network
- ◆ Utilize precedence analysis for scheduling
- ◆ Schedule and Identify the critical path tasks
- ◆ Control work-in-progress
- ◆ Preparation for Project Management Certification exam.

Class Activities and Grading Policy

The class format will be two 150 minutes lectures each week, fifteen weeks total plus one final exam week. Besides the traditional homework assignments and exams, the students are expected to complete and present their project work to the class. The project can be a research paper and an analysis of real world case study. However, the class activities may vary from one university system to another and also from one instructor to another as some of the universities offer four credit hours courses.

Similarly, the grading policy may vary from one instructor to another. A general guideline followed in the proposed course is as follows:

Case study and homework: 20%
 Article presentation: 15%
 Group Project: 30% (oral and written)
 Exams: 35%

Case Study and Homework

Homework will be assigned upon completion of each major topic. The homework can be designed of two types. First, regular type homework problems that can be solved using the methods and tools learned in the relevant session. The second type of homework problems are more of open ended and 'boundary-spanning' in which student minds are challenged to think critically in order to come up with a practical solution- a close representation of real world problems. Depending upon the class size, students can be assigned to small case studies problem given in the textbooks to reinforce their learning.

Article Presentation

A class can be divided into multiple groups with three to four students in each. Each team reviews one article for the benefit of the class. The team initially identifies a set of two-three articles that they would like to review. These articles should be application oriented, focusing on one or more of the techniques being covered in this course. They submit copies of these articles to the instructor for review by the fourth week of the semester indicating their preference. The instructor would then inform of the assignment of articles in a week time. All the teams would then make a presentation on their assigned article in class towards the end of the semester. These presentations would be peer reviewed based on a set of guidelines. Articles could be found in the relevant management Journals and Magazines that a university subscribes to. Students select papers based

on topic/problem that interests the team and covers some of the techniques discussed in class. Interaction with instructor and with other classmates/teams in this regard is encouraged.

Group Project

Each group (of 3-4 students) identifies a project problem that they would like to work on. This work is meant to be representative of an actual project for which students are likely to be responsible in the real world. While there are no specific requirements for project scope or level of complexity, the project should be comprehensive enough to allow students to demonstrate the understanding of key project management concepts discussed in the class. A detailed guideline on how to prepare the project report and presentation slides is provided to the students early on in the semester.

Exams

In this course, two exams are suggested: one mid semester and one at the end of the semester.

Tentative Course Outline

While the list of topics may be customized, and vary depending upon the course credit hours and the interest local student population, this paper proposes following as the tentative topics for a graduate level project management course in Technology curriculum ^[8-10].

- Project Management Overview
 - Definition of a project
 - Definition of project management
 - Relationship to other management disciplines
- The Project Management Context
 - Stakeholders
 - Project organization
 - The project manager's role
 - Phases of project management
 - Stages of a major project
- Project scope Management
 - Problem definition
 - Determining feasibility
 - Generating project ideas
 - Establishing project objectives
 - Case study
- Project Time Management: Planning, Scheduling and Controlling
 - Work breakdown structure
 - Precedence relationships
 - Sequencing project tasks
 - Precedence diagrams
 - PERT and CPM analyses
 - Cost and time estimating
 - Gantt charts
- Cost Management
 - Resource planning
 - Estimating

- Budgeting
- Control
- Project Quality and Risk Management
 - Planning: tools and techniques
 - Assurance
 - Control
 - Project Risk Management
 - Risk identification
 - Quantification

Accommodating a PM course in Undergraduate Technology Curriculum

As noted by the precedent literature ^[2, 7], PM skills are also critical for undergraduate students as well. Not only to complete their senior design project but also are these skills important to succeed in their post graduation career. This demand can be addressed in multiple ways. For example, by embedding a comprehensive chapter on PM in a relevant course like production planning control, engineering economics; or by offering a separate 2- 3 hours credit course on project management; or even by cross listing the graduate level course in the undergraduate curriculum targeting the senior level students.

Conclusion

In the today's globalized economy and globalized manufacturing, engineers can't afford to be spending their time doing pure engineering jobs. Many a times, they are also required to have other skills set such as planning, scheduling, coordinating, and providing leadership to the various tasks in order to be more competitive. Recognizing the need, universities are offering project management courses at graduate and undergraduate level engineering curricula. However, it is not very common to offer a course on PM in engineering technology departments. This paper has proposed an Industrial Management and Control course for a newly developed and approved M.S. in Technology Program offered at the IPFW under Purdue University system. The paper outlined the course modules and teaching modalities for both graduate and undergraduate technology programs that are typically offered in the Engineering Technology schools.

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