

# IE Capstone Design Experience: From Theory to Practice

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**Abstract** -This paper describes the working relationship between the Genesee Economic Growth Alliance and GMI Engineering & Management Institute's Industrial Engineering program to provide operational improvement technical assistance to area businesses. This paper discusses the unique working relationship between the Manufacturing Innovation Council, GMI's Industrial Engineering Capstone Design Program, and the Genesee County business community. In addition to the working relationship, the paper describes how students are taught to develop a work plan for an unstructured and open-ended problem using a project problem solving process. Finally, a project completed during the summer and fall semesters is reviewed.

GMI Engineering and Management Institute's Industrial Engineering program implemented a new senior level capstone design course in cooperation with the Genesee Economic Growth Alliance's Manufacturing Innovation Council in Genesee County. The purpose of this course is to prepare the student to handle unstructured and open-ended problems encountered during the design and operation of a discrete part manufacturing plant or service organization. The projects provide a design/re-design experience, which challenges students to integrate and apply their course work and co-op work experiences in a work environment to problems such as:

- Identifying and eliminating non-valued added activities.
- Implementing quality assurance procedures such as statistical quality control.
- Designing plant layouts and operating plans for new or existing facilities to meet future production volumes and cost targets.
- Determining material handling and unit load container requirements to achieve throughput and minimize indirect costs.
- Generating feasible solutions to reduce the cost of a manufacturing or service process.
- Redesigning a manufacturing or service system to achieve a reduced lead time or cycle time.
- Applying traditional methods and work measurement techniques to standardize work.
- Developing action plans to implement lean/JIT manufacturing operating principles.

Candidate MIC member projects are solicited through periodic mailings and announcements through the office of the Executive Vice President of the Genesee Economic Growth Alliance. Periodically, GMI's Industrial Engineering Capstone Design Course Coordinator and the Executive Vice President meet to discuss which candidate projects are suitable for the student based project teams. Ideally, the project should be driven by a real need, within the skill base of senior level industrial engineering students, and structured such that meaningful results can be obtained within an 8 to 10 week time period. Once a candidate project has satisfied the screening criteria, a meeting is schedule at the MIC members' facility to discuss the candidate project in more detail.

At the conclusion of the on-site meetings, a decision is reached on suitability of the project. If the candidate project is accepted, the roles and responsibilities of the MIC member project liaison are mutually agreed upon in writing. Also, the course operation and general time line of events are discussed. Finally, a proposal is submitted that describes the general project objectives, overall project scope, and contractual terms and conditions. Acceptance of the MIC GMI proposal constitutes a viable project for the student-based project teams to investigate.

The students form their project teams and are given a set of milestones and deliverables to complete over the 12-week semester. Lectures are given approximately once per week during the first half of the semester on basic project management and problem solving skills. A project problem solving process is discussed which gives each student project team a systematic way of organizing the project team, collect and analyzing information relative the statement of need, and a framework for structuring the evaluation of alternatives, and presenting recommendations.

Although lectures are given, the role of the Capstone Course Coordinator is a nontraditional one. The coordinator primarily serves as a consultant to guide students in their projects and point them in the right direction, resolves project team conflicts, and provides some resources so the project teams complete their project in a timely manner. Evaluation of the project teams work is a shared responsibility with the MIC member company.