“Industrial engineers are expected to have employment growth of 20 percent over the projections decade, faster than the average for all occupations. As firms look for new ways to reduce costs and raise productivity, they increasingly will turn to industrial engineers to develop more efficient processes and reduce costs, delays, and waste.”

What is Industrial Engineering and Operations Research?

Industrial Engineering and Operations Research (IE/OR) is an accredited engineering degree program at the University of Massachusetts in Amherst, Massachusetts. It is one of five engineering degree programs at the University. There is also a Masters and Ph.D. program in IE/OR.

Industrial engineering is a branch of engineering that concerns the development, improvement, implementation and evaluation of integrated systems of people, materials, processes, knowledge, information, equipment, and energy. It draws upon the specialized knowledge and skill in the mathematical, physical and social sciences together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results to be obtained from such systems [adapted from IIE].

Operations research or operational research (OR) is an interdisciplinary science which uses scientific methods such as mathematical modeling, statistics, and algorithms to help with decision making in complex real-world problems which are concerned with coordination and execution of the operations within an organization. The organization can be either a manufacturing or service sector activity. The eventual intention behind using this science is to elicit a best possible solution to a problem scientifically, which improves or optimizes the performance of the organization.

Figure 1 illustrates a large hospital campus located in Eastern Massachusetts, that was subject of a patient, staff, and visitor flow study.

Operations research also closely relates to Industrial engineering. Industrial engineering takes more of an engineering point of view, and industrial engineers typically consider OR techniques to be a major part of their tool set. Some of the primary tools used by operations researchers are statistics, optimization, stochastic processes, queueing theory, game theory, graph theory, decision analysis, and simulation. Because of the computational nature of these fields, OR also has ties to computer science, and operations researchers regularly use custom-written or off-the-shelf software.

Figure 2: Hospital Network Flow Planning

Operations research is distinguished by its ability to look at and improve an entire system, rather than concentrating only on specific elements (though this is often done as well). An operations researcher faced with a new problem is expected to determine which techniques are most appropriate given the nature of the system, the goals for improvement, and constraints on time and computing power. For this and other reasons, the human element of OR is vital. Like any other tools, OR techniques cannot solve problems by themselves. Figure 2 illustrates the network components and routes of the patients, staff, and visitors through the hospital campus.

What Can IE/OR Do for You?

There are a myriad of companies and agencies interested in IE/OR graduates. Because of your skills, you may work in industrial manufacturing facilities or service companies, government, and private sector companies.
What do IEORs DO?

As a management engineer in a hospital, you may help doctors and nurses make the best use of their time in treating patients. You may also design procedures for optimum use of medical facilities to help bring the cost of health care down.

As an ergonomist in a television manufacturing plant, you may change the tools workers use to assemble televisions to reduce the risk of repetitive stress injuries.

As an operations analyst for an airline, you may design a bar coding system for identifying and transporting passengers’ luggage to ensure that it does not get lost.

As a quality engineer for a public gas and electric company, you may improve customer satisfaction by designing a process to schedule service calls around the availability of the customer.

Sample Projects of IEORs

☞ Designing the admissions procedure at a hospital
☞ Discovering a new way to assemble a product that will prevent worker injury
☞ Converting a major production line to JIT and kanban system
☞ Representing a company in the design and construction of a new manufacturing plant
☞ Performing motion and time studies
☞ Developing prototype units for the cellular phone car adapter market
☞ Simulation modeling
☞ Developing a hardware protection program for spacecraft
☞ Developing a supplier quality program
☞ Implementing lean manufacturing concepts
☞ Developing and launching a complete material handling system for a new automobile
☞ Developing the conceptual layout of a dockyard and ship repair maintenance facility
☞ Working on a design project to make a medical device to treat sleep apnea
☞ Representing manufacturing and purchasing issues on a design team

Core Classes

➀ Probability and Statistics
➂ Engineering Economy
➃ Facility Layout and Simulation Modeling
➄ Operations Research
➅ Human Factors
➆ Quality Control
➇ Production Planning & Control
**How Do IEORS Benefit Society and Business?**

Industrial engineering and Operations Research has provided a systematic approach to streamline and improve productivity and efficiency. Benefits that can be linked directly to the work of industrial engineers include:

- Leaner, more energy efficient and more profitable business practices while increasing customer service and quality.
- Improved efficiency. This improves competitiveness, profitability, and reduces resource requirements.
- The idea of setting labor or time standards. The original production lines in the 1920s were successful because of IEORS. The IEOR profession is timeless and can be molded to fit the times and the place.
- Good organization and improving productivity - these improvements eliminate or reduce some of the frustrations of life and are essential to the long term health of business.
- Increased ability to do more with less.
- Making work safer, faster, easier, and more rewarding.
- Providing a method by which businesses can analyze their processes and try to make improvements to them. It is focused on optimization - doing more with less - and helps to reduce waste in society.
- Increased cycle time and throughput thus helping more people get their product quicker.
- Assistance in guiding society and business to care more for their workforce while improving the bottom-line.
- Showing ways to improve the working environment, improving efficiencies, and teaching people about ergonomics.
- Making the world safer through better designed and easier to use products.
- Reducing costs associated with new technologies.

**Where Do IEORS Work?**

Manufacturing firms and service industries hire a significant number of IEORS. Today, more and more businesses hire IEORS in areas like sales and marketing, finance, information systems, and personnel. Other industries employing IEORS are hospitals, airlines, banks, railroads, and social services.

- Amazon.com, Chief Engineer
- American Greetings Corp., Vice President of Manufacturing
- Andersen Consulting, LLP, Senior Manager, Capacity Modeling and Simulation
- Anheuser-Busch Co., Manager of Corporate Financial Planning
- Boston Globe, Vice President of Production
- Bristol-Myers Squibb Co., Director of Strategic Planning
- Clairol Inc., Director of Worldwide Operations
- Coca-Cola Enterprises Inc., Director of Planning & Logistics
- FedEx, Manager of Process Engineering
- Hewlett-Packard, Facilities Planning Engineer
- Intel Corp., Corporate Ergonomic Program Manager
- Reebok International Ltd., Director of Engineering
- The Gap Inc., Director of Operations and Engineering
- The Home Depot, Chief System Engineer
- UPS, Ergonomics Program Director
- Wal-Mart Stores Inc., Logistics Planning Manager
- Walt Disney World, Manager of Procurement Services