3.2.8.1 Overview

The Department of Industrial Systems Engineering and Management (ISEM) was established in the Faculty of Engineering in 1972. It offers an undergraduate BEng (Industrial & Systems Engineering) degree programme and graduate programmes leading to the MSc (Industrial & Systems Engineering), MEng and PhD degrees.

The domain knowledge of ISE is derived from combinations of engineering, mathematics, statistics, computing and social sciences. The ISE discipline calls for the adoption of a holistic view in resolving problems encountered and developing opportunities presented, coupled with a strong emphasis on efficiency and productivity improvement. Such a perspective provides the decision makers with the capacity for the identification, analysis and design of complex productive systems through an integrated approach. This will lead to effective systems in both the industrial and service sectors.

ISE is unique among the engineering disciplines in that the application of its techniques is not restricted to only specific technological or industrial problems. Its application can be found in a wide range of areas. Versatility is a trait of ISE graduates. Some examples are:

- Manufacturing and engineering industries: process optimisation, systems integration, quality and reliability engineering, human factors engineering, factory physics, just in time, etc.
- Logistics industry: third party logistics, vendor managed inventory, integrators, transportation and distribution networks optimisation, order fulfilment process, etc.
- Defence industry in relation to support of military operations.
- Service industry: management consultancy, risk management, service quality, information systems, project management, banking service strategy, etc.

Programme Educational Objectives

The Programme Educational Objectives of BEng (Industrial & Systems Engineering)'s curriculum strive to equip graduates with the following attributes:

1. Apply fundamental knowledge and skill sets required in the Industrial and Systems Engineering profession.
2. Adopt a systems approach to design, develop, implement and innovate integrated systems that include people, technology, information, energy and resources taking into account global, societal, environmental and economic contexts.
3. Work and communicate effectively with multi-disciplinary team members and different types of stakeholders.
4. Recognize the need and continue to develop skills and knowledge to embrace changes in society and the profession.

To achieve these educational objectives, the curriculum offers students the flexibility of customising their modules for both breadth and depth. The breadth comes in the form of Unrestricted Elective Modules (UEMs), reading other approved engineering, computer science and science modules not covered in the curriculum, enhancement programmes and other international academic exchange programmes. The depth comes from the provision of focused sets of modules, projects and other activities to equip students with the necessary expertise to operate effectively within particular domains in the field.

Student Learning Outcomes

The Student Learning Outcomes of BEng (Industrial & Systems Engineering)'s curriculum strive to equip graduates with the following attributes:

a. Engineering Knowledge: Apply the knowledge of mathematics, science, and engineering to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, research through relevant literature review, and analyze complex engineering problems to reach substantiated conclusions using mathematics, natural sciences, and engineering sciences.
c. System Design and Development: Design and develop solutions for complex engineering problems including systems, components and/or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
d. Investigation: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create/select and apply appropriate techniques, resources, and modern engineering and IT tools to complex engineering activities with an understanding of the limitations.
f. The engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of professional engineering solutions in a societal and environmental context and to demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and economic decision-making, and apply them to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Rapid globalisation forces firms to spread their operations across a greater range and diversity of locations than ever before. The demand for effective integration of these far-flung operations has become the focus of logistics and supply chain management. Furthermore, the easy availability of information raises the expectations of consumers on the quality of products and services offered, which translates into the demand for skills in quality engineering and management. Singapore's economy has also entered a phase where competitiveness of its industry in the global market has to be linked to capability in design and this would require designers with skills which combine the art of design and science of engineering. The depth and breadth of the curriculum will equip students with the necessary skills and knowledge to address specific challenges in complex integrated multidisciplinary systems and to meet the demands of the Singapore economy.

In summary, we see that the global trend has created the condition of increasing system complexity in which the need for integrative skills becomes more important. We believe that the ISE curriculum can provide the students with the requisite skills to add value in such a world. They will be the ones who will be able to create new opportunities in bringing diverse elements together on account of their systems mind-set.