

THE UNIVERSITY OF HONG KONG



Department of Industrial and Manufacturing Systems Engineering

MSc (IELM) List of course offered 2024-2025

(The below list is NOT finalized.)

IMSE7015. Engineering economics and finance

Engineering economics fundamentals: cost concepts, money-time relationships, comparing alternatives, depreciation and income taxes, cost estimation, price changes and exchange rates, replacement analysis, effects of uncertainties; financial statements, ratio analysis, financial performance, financial planning and growth; capital budgeting: investment criteria, project analysis and evaluation, project cash flow; cost of capital, long-term financial policy, financial leverage and capital structure policy. (Students who have passed “IELM7016 Engineering economics and finance” are not allowed to take this course.)

IMSE7020. Supply chain management*

Supply chain characterisation; operation objectives; distribution channels; channel design considerations; logistics network design. Inventory management; risk pooling; distribution strategies. Strategic alliances; international issues in supply chain management; coordinating product and supply chain design; customer value. Information technology; decision support systems; the value of information in supply chains. Case studies and contemporary topics on supply chain management; the beer game. (Students who have passed “IELM6044 Supply chain management” are not allowed to take this course.)

IMSE7034. Operational research*

The philosophy and methodology of Operational Research: problem analysis, model building, and implementation of solutions. Mathematical programming and its applications in logistics and supplies: vehicle scheduling, transportation and transshipments problems. Replacement models for capital equipment and preventive replacement for components of low capital value. Risk analysis for capital expenditure proposals. Queuing theory and event simulation with applications in serial and parallel supply chains. (Students who have passed “IELM6034 Operational research techniques” are not allowed to take this course.)

IMSE7098. Project

A group of students will work on a supervised project that relates to major research and/or industrial projects and initiatives that supervisors have recently carried out. Groups are expected to generate project deliverables of a variety of forms including patents, software copyrights, research papers, proof-of-the-concept solutions and products, consultancy reports / whitepapers, etc. This course will provide students with a range of opportunities to engage in academic research, industrial innovation and entrepreneurship development. (Students who have passed “IELM7023 Systems integration and analytics” are not allowed to take this course.)

IMSE7099. Dissertation

Student individuals will undertake a supervised project which will be assessed. The dissertation module must relate to the subject matter and be agreed by the Department of Industrial and Manufacturing Systems Engineering. The

Dissertation can be related to research projects within the department or industry-related projects. (Students who have passed “IELM7045 Dissertation” are not allowed to take this course.)

IMSE7111. Data-driven optimization

Overview of data-driven optimization and intelligent analytics; Genetic algorithms; Simulated annealing algorithm; Tabu search algorithm; Particle swarm optimization; Ant colony optimization; Predatory search strategy; Computational techniques and intelligent optimization strategies for dynamic systems; Data mining, decision analytics; Applications in multiple objective optimization; Applications in constraint problems; Multiple level optimization; Case studies in supply chain, logistics, manufacturing and service applications.

IMSE7119. Digital enterprises and e-commerce

Overview and development of e-business; e-business technologies and solutions: appraisal and selection, implementation and adoption; Enterprise information and knowledge portals, virtual enterprises; Roles of e-business in enterprise development and integration; corporate social accountability and responsibility standards; digital technologies for product design and development; cryptographic algorithms for corporate data and IP protection; mobile technology and electronic payment, smart cards, RFID and NFC. (Students who have passed “IELM6047 Digital enterprises” or “IELM7013 Digital enterprises and e-commerce” are not allowed to take this course.)

IMSE7137. Virtual reality for systems engineering

Fundamental of virtual reality, concepts of virtual, augmented and mixed reality (VR, AR and MR), visualization and interacting with complex information and systems with virtual reality, applications of virtual reality technology in engineering systems design and analysis, immersive and interactive virtual environments; innovation and consciousness with virtual reality system development and deployment, ethical issues and social impacts of adopting virtual reality in system development. Designing and building virtual systems with immersive virtual reality systems including CAVE-like environment and VR headsets.

IMSE7138. Healthcare systems engineering*

Introduction to healthcare delivery systems; healthcare technology-human integration; human factors in healthcare; crew resource management; quality of care; economic analysis in healthcare; healthcare logistics; healthcare system test and evaluation; analysis and design for patient safety.

IMSE7139. Cyber-physical systems

This course mainly consists of lectures and projects. The topics include introduction to cyber-physical systems (CPS), sensors and sensor networks, robotics and automation, communications for CPS, data analytics in CPS, digital twins, cloud computing for CPS, and system integrations. By completion of the projects, the topics will be discussed in the related lectures and hands-on experiments. The outcomes of the each individual projects will be integrated at the end to address CPS from system point of view as well in applications related settings. (Students who have passed “IELM7022 Advanced cyber-physical systems” are not allowed to take this course.)

IMSE7140. Machine learning and applications

Overall view of machine learning methods. Supervised learning, unsupervised learning, reinforcement learning. Support-vector machines, linear regression, decision trees, k-nearest neighbor algorithm, neural networks. Active learning, classification and regression. Model training, testing, selection, and validation. Performance evaluation. Industrial applications in forecasting, ranking, recommendation systems, information extraction, object recognition in computer vision, and pattern recognition.

IMSE7142. Computational methods for industrial engineering

This course teaches fundamental computational methods and the applications to engineering problems in the context of industrial engineering. Analytical models, algorithms, and simulation methods will be discussed. Variability and uncertainty in engineering problems. Foundations of probability, sampling distributions, confidence intervals. Interpolation and regression. Numerical solution of linear and non-linear equations, numerical differentiation and integration, boundary value problems, initial value problems and partial differential equations. Monte Carlo method.

IMSE7143. The internet of things

Theory and fundamentals of internet of things (IoT). Methods to create abstractions, formalisms and semantics at IoT layer. Artificial intelligence of things, machine learning for IoT, edge computing. IoT challenges in security, reliability and privacy. Device software development, IoT in cloud-to-thing-continuum. IoT software development, test beds and quality assurance. Sensors and actuators, remote operations and control. IoT applications in manufacturing, construction, healthcare, logistics and supply chain management.

IMSE7150. Frontiers in industrial engineering and logistics management A

This course is part of the series “Frontiers in industrial engineering and logistics management”. The aim of this series is to provide students with a deeper understanding of the advanced topics under the five areas of focus of this programme, namely, fundamentals of industrial engineering, advanced engineering technology, logistics and supply chain management, financial engineering, and leadership development. This course focuses on the fundamental theories and advanced engineering technologies in industrial engineering. Through this course, students are expected to have a holistic view of the fundamental theories and technologies in industrial engineering. This course mainly consists of lectures and projects.

IMSE7151. Frontiers in industrial engineering and logistics management B

This course is part of the series “Frontiers in industrial engineering and logistics management”. The aim of this series is to provide students with a deeper understanding of the advanced topics under the five areas of focus of this programme, namely, fundamentals of industrial engineering, advanced engineering technology, logistics and supply chain management, financial engineering, and leadership development. This course focuses on the advanced theories and data analytics methods in logistics and supply chain management. Case studies and industrial applications in the logistics and supply chain management field will be discussed. This course mainly consists of lectures and projects.

IMSE7152. Frontiers in industrial engineering and logistics management C

This course is part of the series “Frontiers in industrial engineering and logistics management”. The aim of this series is to provide students with a deeper understanding of the advanced topics under the five areas of focus of this programme, namely, fundamentals of industrial engineering, advanced engineering technology, logistics and supply chain management, financial engineering, and leadership development. This course focuses on the emerging engineering technologies and applications in the industry. Through this course, students are expected to have a holistic view of the technology development in industrial engineering. This course mainly consists of lectures and projects.

IMSE7153. Frontiers in industrial engineering and logistics management D

This course is part of the series “Frontiers in industrial engineering and logistics management”. The aim of this series is to provide students with a deeper understanding of the advanced topics under the five areas of focus of this programme, namely, fundamentals of industrial engineering, advanced engineering technology, logistics and supply chain management, financial engineering, and leadership development. This course focuses on the engineering practices and leadership training in industrial engineering. Case studies of various industrial applications will be discussed. This course mainly consists of lectures and projects.

IMSE7154. Intelligent technologies for industrial engineering A

This course is part of the series “Intelligent technologies for industrial engineering”. This series of courses are designed to introduce students to critical technologies with applications in intelligent engineering systems. The course will cover essential topics about the intelligent technologies with an emphasis on their augmentation in data engineering and analytics. Students will learn the fundamental theories and knowledge related to the technologies, and how to leverage such technologies to enhance various aspects of industrial engineering. This course mainly consists of lectures and projects.

IMSE7212. Physical internet

Logistics network history and topology, organisation and performance, logistics networks sustainability, asset utilization. Interconnection principles; Digital Internet, Physical Internet, Internet of Things. Physical Internet components: containerisation diversity, modularity, handling and sorting. Logistics information capture, publication, EPCglobal standards. Flow routing and assets management in open-loop supply networks. Collaborative logistics business models, small scale cooperative game with transferable utility, Shapley value and

core solution, big scale collaboration models, mechanism design, combinatorial optimisation. Case studies, web search, serious game. (Students who have passed “IELM7012 Physical internet” are not allowed to take this course.)

IMSE7222. Global logistics and transportation systems*

Global operations and logistics strategies, strategic changes required by globalization, the strategic framework for global operations, the role of logistics in global operations and marketing strategies; global operations and logistics planning, supplier network development, physical distribution, global logistics network design, global supply chain management, risk management in global operations; management of global operations and logistics, operations analysis of global supply chains, information management for global logistics, performance measurement and evaluation in global logistics. (Students who have passed “IELM6045 Global operations and logistics” or “IELM7015 Global logistics” are not allowed to take this course.)

IMSE7251. Fundamentals of law for logistics*

The course focuses on five areas of law essential to industrial and logistics managers: contracts, agency, shipping law, negligence and dispute resolution; overview of sources of law and legal structure of businesses; elements of a binding contract; duties of an agent, including common carriers, employees and professionals; claims arising in international shipment of goods, arbitration, mediation or litigation and venue for dispute resolution. (Students who have passed “IELM6051 Fundamentals of law for logistics” are not allowed to take this course.)

IMSE7310. Financial engineering*

Basics of financial markets; cash flow analysis; capital asset pricing model (CAPM); portfolio optimisation; arbitrage and fundamental theorem of asset pricing; types of derivatives including forward, futures and options for various underlying assets; returns, value-at-risk (VaR), utility functions; pricing and hedging of derivative securities; numerical studies. (Students who have passed “IELM7018 Financial engineering” are not allowed to take this course.)

IMSE7337. Operational risk management*

Basics of risk management, risk and return, lifecycle of risk management, operational risk management (ORM) components; risk management framework: standards, management environment, management processes; operational risk assessment: assessment, identification, scale of assessment; risk reporting: risk indicators, risk map. Risk management strategies: risk avoidance, mitigation, transfer and acceptance; applications: supply chain management, product development, environment, health and safety risks; crisis management. (Students who have passed “IELM6052 Operational risk management practices” or “IELM7017 Operational risk management” are not allowed to take this course.)

IMSE7505. Intelligent transportation and autonomous driving

This course will introduce students to the field of autonomous mobile robotics. Topics will focus on definition and applications of mobile robots; mobile robot components and architecture; kinematics and dynamics of mobile robots; sensors for mobile robots; planning and navigation for mobile robot; simultaneous localization and mapping; mobile manipulators; applications. The assignments of this course will involve building and testing autonomous mobile robots using simulation software and physical robots.

IMSE7506. Advanced machine learning methods

This course provides a detailed examination of various advanced topics in machine learning for industrial engineering, including five main directions: generative models, inference algorithms, predictive models, discovery models, and action-related models. It will cover not only the popular models, such as diffusion models, generative adversarial networks (GANs), and reinforcement learning models, but also significant classical algorithms in depth, such as Kalman filter, Markov Chain Monte Carlo (MCMC), Principal Component Analysis (PCA), and Independent Component Analysis (ICA). As the sequel to the course IMSE 7140 Machine Learning for Industrial Engineering, this course requires skills in Python programming, an understanding of core machine learning concepts, and knowledge of calculus, linear algebra, probability, and statistics—at an elementary level. IMSE 7140 covers the first two prerequisites, so completing IMSE 7140 is recommended but not required for enrolling in this course.

IMSE7902. Project management*

Fundamental of project management; PMBOK's project management framework; Project initiating, planning, executing, monitoring and controlling, and closing; Project integration management; Project scope management; CPM/PERT techniques for project time management, resource allocation and cost management; Earned value analysis for project tracking; Application of techniques such as EMV, decision tree analysis, and Monte Carlo simulation in project risk management, human resource management, communication, procurement and quality management for industrial projects; Project change control and management; Project team-building; Case studies in logistics and manufacturing industries. (Students who have passed "IELM6004 Industrial project management" are not allowed to take this course.)

IMSE7909. Quality management*

The principals of Total Quality Management and BS 7850. Basic tools of quality management, the Japanese approaches to quality management, 5S and Kaizen. Deming's approach to quality management. International quality assurance management system -- the ISO 9000 series, quality documentation, quality audit. Zero defects and Six Sigma. The American Malcolm Baldrige quality award. Quality Function Deployment. The Taguchi Methods. (Students who have passed "IELM6042 Quality management" are not allowed to take this course.)

* Approved for reimbursement from the Continuing Education Fund (CEF)

August 1, 2024