

## **SYLLABUS FOR THE DEGREE OF MASTER OF SCIENCE IN ENGINEERING IN INDUSTRIAL ENGINEERING AND LOGISTICS MANAGEMENT MSC(ENG)(IELM)]**

[This syllabus is applicable to students admitted to the curriculum in the academic year 2021-22.]

### Definition and Terminology

Discipline course – any course offered by the curriculum of the MSc(Eng) in Industrial Engineering and Logistics Management (IELM).

Fundamental courses – a specific number of discipline courses in the curriculum that a student must pass.

Elective course – any course offered by the Departments of the Faculty of Engineering for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Industrial Engineering and Logistics Management that are not classified as discipline courses.

Capstone Experience – a dissertation or a project which is a compulsory and integral part of the curriculum.

### Curriculum Structure

Candidates are required to complete 72 credits of courses, as set out below.

<b>Course Category</b>	<b>Enrolment Mode</b>	
	<b>8 Courses + Dissertation</b>	<b>10 Courses + Project</b>
Discipline Courses (including at least 2 Fundamental Courses)	Not less than 36 credits	Not less than 48 credits
Elective Courses	Not more than 12 credits	
Capstone	Dissertation (24 credits)	Project (12 credits)
Total	72 credits	

Candidates are permitted to select courses in accordance with Regulations MSc4, MSc5 and MSc6. The curriculum provides two enrolment modes for candidates to choose from either (i) 8 courses plus a dissertation, or (ii) 10 courses plus a project. In choosing the enrolment mode (i), candidates must complete a 24-credit dissertation and at least 6 discipline courses (including at least 2 fundamental courses); for enrolment mode (ii), candidates must complete a 12-credit project and at least 8 discipline courses (including at least 2 fundamental courses). Candidates choosing any enrolment mode can take no more than 2 elective courses out of Taught Postgraduate level courses offered by other curricula in the Faculty of Engineering. All selection will be subjected to approval by the Course Coordinator.

The curriculum is offered in both part-time and full-time modes. For the part-time mode of study, the curriculum shall extend over not less than two and not more than three academic years of study. For the full-time mode of study, the curriculum shall extend over not less than one and not more than two academic years of study.

The curriculum provides advanced education and training in the philosophy, methods and techniques of Industrial Engineering, Logistics and Supply Chain Management and Financial Engineering, which are essential for industrial and service organizations in both the private and the public sectors.

All courses are assessed through examination and / or coursework assessment, the weightings of which are subject to approval by the Board of Examiners.

The courses are streamlined into five categories:

- Fundamental or Capstone course (coded with IMSE70xx),
- Industrial Engineering-focused course (coded with IMSE71xx),
- Logistics and Supply Chain Management-focused course (coded with IMSE72xx),
- Financial Engineering-focused course (coded with IMSE73xx), and
- Leadership-training course (coded with IMSE79xx).

It should be noted that not all of the courses listed below are offered every year:

### **List of Discipline Courses**

#### **Fundamental Courses (Students are required to choose at least 2 out of 3):**

IMSE7015 Engineering economics and finance

IMSE7020 Supply chain management

IMSE7034 Operational research

#### **Capstone Courses (Students are required to choose either one):**

IMSE7098 Project (12 credits)

IMSE7099 Dissertation (24 credits)

#### **Other Discipline Courses:**

IMSE7111 Intelligent optimization

IMSE7119 Digital enterprises and e-commerce

IMSE7128 Human factors engineering

IMSE7138 Healthcare systems engineering

IMSE7139 Cyber-physical systems

IMSE7137 Virtual reality for systems engineering

IMSE7212 Physical internet

IMSE7221 Warehousing and city logistics

IMSE7222 Global logistics and transportation systems

IMSE7251 Fundamentals of law for logistics

IMSE7310 Financial engineering

IMSE7315 Supply chain and logistics finance

IMSE7337 Operational risk management

IMSE7339 Financial technologies

IMSE7340 Asset and portfolio management

IMSE7902 Project management

IMSE7909 Quality management

IMSE7929 Frontiers in industrial engineering and logistics management

IMSE7936 Operations planning and control

## *Elective Courses*

Please consult courses offered for other MSc curricula in the Faculty of Engineering.

Calendar entries of discipline courses offered by the curriculum of MSc(Eng) in IELM

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### **IMSE7015. Engineering economics and finance (6 credits)**

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.

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### **IMSE7020. Supply chain management (6 credits)**

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.

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### **IMSE7034. Operational research (6 credits)**

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.

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### **IMSE7098. Project (12 credits)**

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.

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### **IMSE7099. Dissertation (24 credits)**

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.

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**IMSE7111. Intelligent optimization (6 credits)**

Overview of intelligent 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.

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**IMSE7119. Digital enterprises and e-commerce (6 credits)**

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.

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**IMSE7128. Human factors engineering (6 credits)**

Ergonomics and systems design. Physical ergonomics, anthropometry, biomechanics. Human information processing, person-machine interface design, displays and controls. The visual environment and visual performance. Thermal environment and effects on performance, indices of comfort. Noise; noise measurement, effects of noise, control of noise. Vibration and acceleration; human tolerance.

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**IMSE7137. Virtual reality for systems engineering (6 credits)**

Fundamental concept of virtual reality, augmented and mixed reality; human perception and virtual reality; system components of modern virtual reality systems; 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.

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**IMSE7138. Healthcare systems engineering (6 credits)**

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.

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**IMSE7139. Cyber-physical systems (6 credits)**

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.

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**IMSE7212. Physical internet (6 credits)**

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.

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**IMSE7221. Warehousing and city logistics (6 credits)**

Materials handling systems, automated storage and distribution systems, hardware and software, routing. Case studies from cargo terminals. Warehouse management systems, missions, functions, receiving and shipping operations planning, dock design, storage space, layout and location planning, order picking. Cost and performance analysis in logistics and warehouse management. Material handling principles, system design, selection of handling equipment, unit load design. Automation of warehouse and material handling systems, costing and audits. Applications of modelling and simulation for warehouse design and optimisation. Logistics security, logistics park and third party logistics service providers.

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**IMSE7222. Global logistics and transportation systems (6 credits)**

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.

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**IMSE7251. Fundamentals of law for logistics (6 credits)**

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.

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**IMSE7310. Financial engineering (6 credits)**

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.

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**IMSE7315. Supply chain and logistics finance (6 credits)**

Basics of financial markets; sources and channels for supply chain and logistics finance; financing conditions. Financial derivatives for managing risks; risk measures; theories and methods of financial hedging. Supply chain risks arising from global manufacturing, trading and logistics activities: uncertain price, demand and exchange rates; financing of logistics businesses and risks; development of risk hedging models: price models, demand models, optimal hedging policies.

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**IMSE7337. Operational risk management (6 credits)**

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.

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**IMSE7339. Financial technologies (6 credits)**

Applications of the state-of-the-art technologies that drive the rapid growth and disruptive innovations in the financial services sector: big data analytics and predictive modelling, mobility, payments and transactions, infrastructure and operational technologies for financial investments, P2P lending and crowdfunding, and cybersecurity. Understanding on how the financial technology innovations are disrupting traditional established business models and reshaping the way financial services are structured, provisioned and consumed.

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**IMSE7340. Asset and portfolio management (6 credits)**

Statistics of asset and portfolio management: univariate statistics, multivariate statistics, modelling the market; portfolio selection theories: mean-variance analysis, asset pricing theory; factor model: arbitrage pricing theory, factor model estimation, principal component analysis; asset price dynamics; portfolio management strategies: tracking error, information ratio, passive and active strategies; portfolio monitor and adjustment; rebalancing; basic machine learning algorithms.

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**IMSE7902. Project management (6 credits)**

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.

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**IMSE7909. Quality management (6 credits)**

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.

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**IMSE7929. Frontiers in industrial engineering and logistics management (6 credits)**

Advanced Industrial Engineering Technology refers to the four Research and Development Areas of focus in the Department of Industrial and Manufacturing Systems Engineering, namely, Industrial/ Service Engineering, Systems Engineering, Intelligent Systems and Digital Enterprise Technology.

The general aim of this course is to provide students with a deeper understanding of those advance topics under the four research and development focuses. Through the course, graduate students are expected to have a holistic view of the scope of these research focuses.

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**IMSE7936. Operations planning and control (6 credits)**

Elements of operations strategies; quantitative forecasting models; strategic decisions; planning products, processes, technologies, and facilities; selection and management of production technology; capacity planning and facility location; production planning systems; aggregate planning; master production scheduling; inventory systems; material requirement planning; shop floor planning and control; Just-In-Time manufacturing.

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