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 2019-20 and thereafter.]

Definition and Terminology

Discipline course – any course on a list of courses in the discipline of curriculum which a candidate must pass at least a certain number of credits as specified in the Regulations.

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 24-credit dissertation 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, normally over one academic year of full-time study or two academic years of part-time study:

Course Category	No. of Credits
Discipline Courses (including at least 2 Fundamental Courses)	Not less than 36
Elective Courses	Not more than 12
Capstone (Dissertation)	24
Total	72

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. It provides advanced education and training in the philosophy, methods and techniques of Industrial Engineering and Industrial / Logistics Management which are appropriate to industrial and service organizations in both the private and the public sectors.

Candidates are permitted to select courses in accordance with Regulations MSc4, MSc5 and MSc6. Candidates must complete the following categories of courses: (i) at least 6 discipline courses (including at least 2 fundamental courses); (ii) 24 credits of capstone course and (iii) no more than 2 elective courses. He / she can select no more than two Taught Postgraduate level courses offered by other curricula in the Faculty of Engineering as electives. All selection will be subjected to approval by the Course Coordinator.

The following is a list of discipline courses offered by the Department of Industrial and Manufacturing Systems Engineering. The list below is not final and some courses may not be offered every year.

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

List of Discipline Courses

Fundamental Courses (Students are required to choose at least 2 out of 3):
IELM6034 Operational Research Techniques (fundamental course)
IELM6044 Supply Chain Management (fundamental course)
IELM7016 Engineering Economics and Finance (fundamental course)

IELM6001 Concurrent Engineering
IELM6002 Operations Management
IELM6004 Industrial Project Management
IELM6028 Enterprise Logistics and Facilities Design
IELM6030 Ergonomics
IELM6037 Costing and Finance
IELM6042 Quality Management
IELM6046 Supply Management
IELM6048 Terminal and Warehousing Operations
IELM6050 Industrial Applications of Radio Frequency Identification
IELM6051 Fundamentals of Law for Logistics
IELM7002 Frontiers in Industrial Engineering and Logistics Management
IELM7011 Supply Chain and Logistics Finance
IELM7012 Physical Internet
IELM7013 Digital Enterprises and E-Commerce
IELM7014 Organisation Management and Strategy
IELM7015 Global Logistics
IELM7017 Operational Risk Management
IELM7018 Financial Engineering
IELM7019 Financial Technologies
IELM7020 Asset and Portfolio Management
IELM7021 Computational Optimization and Intelligent Analytics
IELM7022 Advanced Cyber-Physical Systems
IELM7023 Systems Integration and Analytics

Capstone (Dissertation)
IELM7045 Dissertation

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IELM6001. Concurrent engineering (6 credits)

Product development process analysis and reengineering: performance measurement, organisation and management issues and extended enterprises. Formal methods and techniques, "Design for X", arc conjoint analysis. Product management, product variety, and engineering changes. Collaborative product commerce: information/task sharing, customer/supplier involvement and e-commerce/e-business applications. Case studies in logistics, service and manufacturing industries.

IELM6002. Operations management (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.

IELM6004. Industrial 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.

IELM6028. Enterprise logistics and facilities design (6 credits)

Enterprise logistics: materials handling systems, storage and warehousing operations, competitive manufacturing, modelling and analysis of enterprise logistics systems; location analysis; methodologies for facilities planning: systematic layout planning approaches (SLP); manufacturing strategies; layout planning algorithms.

IELM6030. Ergonomics (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.

IELM6034.   Operational research techniques (6 credits) (fundamental course)

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 transhipments 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.

IELM6037.   Costing and finance (6 credits)

Cost terms and purposes, allocation and absorption of overheads, cost volume analysis, product costing, activity-based costing, budgetary control and standard costing, variance analysis, cost for decision making. Capital investment appraisal including discount cash flow, net present value and internal rate of return, risk analysis. Interpretation of financial statements, ratio analysis, fund flow statement, sources of funds, management of working capital.

IELM6042.   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.

IELM6044.   Supply chain management (6 credits) (fundamental course)

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.

IELM6046.   Supply management (6 credits)

Purchasing in the supply chain, strategic purchasing, implementation and evaluation of strategy; purchasing organisation in a corporation, impact of e-procurement; out-sourcing, supplier selection, partnership with suppliers; pricing agreement, price analysis; global sourcing.

IELM6048.   Terminal and warehousing operations (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.

IELM6050.   Industrial applications of radio frequency identification technologies (6 credits)

Introduction to radio frequency identification (RFID); features and characteristics of readers and tags, typical frequencies, materials and orientations, middleware, standards for electronic product coding, and physical markup language. Design, development and implementation of RFID solutions; business process analysis, technology and vendor selection, deployment of readers and tags, infrastructure architecture, integration with enterprise application systems, and cost-benefits and constraints. RFID case studies and applications in object identification and tracking, asset management, warehouse management, supply chain integration, and manufacturing automation.

IELM6051.   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.

IELM7002.   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.

IELM7011.   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.

IELM7012.   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.

IELM7013.   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.

(Students who have passed "IELM6047 Digital enterprises" are not allowed to take this course.)

IELM7014.   Organisation management and strategy (6 credits)

The role of the manager, teams and task design, team based systems, team leadership, measuring the performance of teams. Theories of motivation with case studies from industry. Theories of organisation design, socio-technical theory, contingency and markets and clans theory. Behavioural control and change issues, organisation dynamics. Understanding organisational structures. Classifying types of system, Mintzberg typologies and configurations. The Global Business: Strategic decisions in the global business, global culture, leadership, vision, ethics and corporate social responsibility. The design of organisations. The systems view of organisations. Global business issues. Specify appropriate organisation structures to match market needs. Explain cultural implications for global organisations. The fundamentals of strategic management.

(Students who have passed "IELM6027 Organisation theory and behavioural science" are not allowed to take this course.)

IELM7015.   Global logistics (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.

(Students who have passed "IELM6045 Global operations and logistics" are not allowed to take this course.)

IELM7016.   Engineering economics and finance (6 credits) (fundamental course)

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.

IELM7017.   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.

(Students who have passed "IELM6052 Operational risk management practices" are not allowed to take this course.)

IELM7018.   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.

IELM7019.   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.

IELM7020.   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.

IELM7021.   Computational Optimization and Intelligent Analytics (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.

IELM7022.   Advanced 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.

IELM7023.   Systems Integration and Analytics (6 credits)

This course is mainly based on group projects enhanced by a series of invited guest lectures. Project topics are related 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.

Capstone courses

IELM7045.   Dissertation (24 credits)

Student individuals or groups 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.