# INDUSTRIAL ENGINEERING AND LOGISTICS MANAGEMENT

## SYLLABUS

The syllabus applies to students admitted in the academic year 2023-24 and thereafter under the four-year curriculum.

Definition and Terminology

Each course offered by the Department of Industrial and Manufacturing Systems Engineering shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Industrial and Manufacturing Systems Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Industrial Engineering and Logistics Management that are not classified as discipline core course.

## Curriculum

The Curriculum comprises 240 credits of courses as follows:

Engineering Core Courses
Students are required to complete at least 42 credits of Engineering Core Courses.

Discipline Core Courses
Students are required to complete ALL discipline core courses (84 credits), comprising 36 credits of introductory core courses and 48 credits of advanced core courses.

Discipline Elective Courses
Students are required to complete at least 36 credits of discipline elective courses offered by the Department of Industrial and Manufacturing Systems Engineering.

Elective Courses
Students are required to complete 12 credits of elective course(s) offered by either the Department of Industrial and Manufacturing Systems Engineering, or other departments within or outside of the Faculty of Engineering.

University Requirements
Students are required to complete:
  a) 12 credits in English language enhancement, including 6 credits in "CAES1000 Core University English" and 6 credits in "CAES9532 Technical English for Industrial and Manufacturing Systems Engineering";
  b) 6 credits in Chinese language enhancement course "CENG9001 Practical Chinese for Engineering Students";
  c) 36 credits of courses in the Common Core Curriculum, comprising at least one and not more than two courses from each Area of Inquiry with not more than 24 credits of courses being selected within one academic year except where candidates are required to make up for failed credits; and
  d) non-credit bearing courses as required by the University.

Capstone Experience
Students are required to complete the 12-credit "IMSE4174 Project" to fulfill the capstone experience requirement for the degree of BEng in Industrial Engineering and Logistics Management.

<u>Internship</u>
Students are required to complete the non-credit bearing internship "IMSE3229 Internship", which normally takes place after their third year of study.

**Degree Classification**

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN 15 of the Regulations for the Degree of Bachelor of Engineering and UG 9 of the Regulations for First Degree Curricula.

**The details of the distribution of the above course categories are as follows:**

The curriculum of BEng (Industrial Engineering and Logistics Management) comprises 240 credits of courses with the following structure:

**UG 5 Requirements (54 credits)**

| Course Code | Course | No. of credits |
|---|---|---|
| CAES1000 | Core University English | 6 |
| CAES9532 | Technical English for Industrial and Manufacturing Systems Engineering | 6 |
| CENG9001 | Practical Chinese for Engineering Students | 6 |
| CC##XXXX | University Common Core Course (6 courses)* | 36 |
| Non-credit bearing courses as required by the University | | 0 |
| **Total for UG5 Requirements** | | 54 |

* Students have to complete 36 credits of courses in the Common Core Curriculum, comprising at least one and not more than two courses from each Area of Inquiry with not more than 24 credits of courses being selected within one academic year except where candidates are required to make up for failed credits.

**Engineering Core Courses (42 credits)**

| Course Code | Course | No. of credits |
|---|---|---|
| MATH1851 | Calculus and ordinary differential equations | 6 |
| MATH1853 | Linear Algebra, Probability & Statistics | 6 |
| ENGG1300 | Fundamental Mechanics | 6 |
| ENGG1310 | Electricity & Electronics | 6 |
| ENGG1320 | Engineers in the Modern World | 6 |
| ENGG1330 | Computer programming I | 6 |
| Choose one of the following: | | |
| ENGG1340 | Computer programming II | 6 |
| ENGG1350 | Thermofluid mechanics | 6 |
| **Total for Engineering Core Courses** | | 42 |

**Discipline Core Courses (84 credits)**

*Introductory Courses (36 credits)*

| Course Code | Course | No. of credits |
|---|---|---|
| IMSE2102 | Fundamentals of supply chain management | 6 |
| IMSE2109 | Fundamentals of engineering design | 6 |
| IMSE2121 | Engineering training | 6 |
| IMSE2132 | Statistical analysis | 6 |
| IMSE2134 | Operational research | 6 |
| IMSE2135 | Mathematical optimisation | 6 |
| **Total for Introductory Discipline Core Courses** | | 36 |

*Advanced Courses (48 credits)*

| Course Code | Course | No. of credits |
|---|---|---|
| IMSE3102 | Strategic supply chain management | 6 |
| IMSE3115 | Engineering economics and finance | 6 |
| IMSE3126 | Engineers in society | 6 |
| IMSE3134 | Innovation and entrepreneurship | 6 |
| IMSE3136 | Operations planning and control | 6 |
| IMSE4122 | Global logistics systems | 6 |
| IMSE4135 | Systems integration | 6 |
| IMSE4136 | Transportation and distribution planning | 6 |
| **Total for Advanced Discipline Core Courses** | | 48 |

**Capstone Experience and Internship (12 credits)**

| Course Code | Course | No. of credits |
|---|---|---|
| IMSE3229 | Internship* | 0 |
| IMSE4174 | Project+ | 12 |
| **Total for Capstone Experience and Internship Courses** | | 12 |

*Internship
+Capstone Experience

**Discipline Elective Courses (36 credits)**

| Course Code | Course | No. of credits |
|---|---|---|
| IMSE2112 | Engineering technology | 6 |
| IMSE2113 | Information systems | 6 |
| IMSE2114 | Product development | 6 |
| IMSE3103 | Systems automation | 6 |
| IMSE3106 | Manufacturing technology | 6 |
| IMSE3107 | Systems modelling and simulation | 6 |
| IMSE3109 | Quality management | 6 |
| IMSE3110 | Supply chain finance | 6 |
| IMSE3111 | Intelligent optimisation | 6 |
| IMSE3116 | Internet technology for e-commerce | 6 |
| IMSE3118 | Industrial organisation and management | 6 |
| IMSE3120 | Purchasing and supply management | 6 |
| IMSE3128 | Human factors engineering | 6 |
| IMSE3137 | Virtual reality for systems engineering | 6 |
| IMSE3138 | Warehousing and terminal operations | 6 |

| IMSE3139 | Cyber-physical systems | 6 |
|---|---|---|
| IMSE3142 | Computational methods for industrial engineering | 6 |
| IMSE3155 | Integrative studies | 6 |
| IMSE4101 | Computer integrated manufacturing | 6 |
| IMSE4102 | Engineering project management | 6 |
| IMSE4110 | Financial engineering | 6 |
| IMSE4119 | Digital enterprises and e-commerce | 6 |
| IMSE4121 | Strategic management of business and technology | 6 |
| IMSE4137 | Operational risk management | 6 |
| IMSE4138 | Asset and portfolio management | 6 |
| IMSE4140 | Machine learning for industrial engineering | 6 |
| IMSE4141 | Digital twin technologies | 6 |
| IMSE4143 | The internet of things | 6 |
| **Complete six discipline elective courses for a total of 36 credits** | | 36 |

**Elective Courses (12 credits)**

At least 12 credits of courses offered by either the Department of Industrial and Manufacturing Systems Engineering, or other departments within or outside of the Faculty of Engineering. Students may take up to two 6-credit MSc(Eng) courses offered by the Department of Industrial and Manufacturing Systems Engineering as elective courses, subject to the approval of the Head of Department.

**Focus**

A student may choose to claim any of the following three Focuses, provided that he/she must have taken at least FOUR courses under the corresponding Focus.

*Logistics Engineering (9 courses available)*
- IMSE2113 Information systems
- IMSE3106 Manufacturing technology
- IMSE3107 Systems modelling and simulation
- IMSE3109 Quality management
- IMSE3110 Supply chain finance
- IMSE3120 Purchasing and supply management
- IMSE3138 Warehousing and terminal operations
- IMSE4101 Computer integrated manufacturing
- IMSE4102 Engineering project management

*Smart Transport and Logistics\* (5 courses available)*
- CIVL2111 Transportation engineering
- CIVL3119 Traffic engineering
- CIVL3120 Transportation infrastructure engineering
- IMSE3107 Systems modelling and simulation
- IMSE3111 Intelligent optimisation

*Systems Analytics (14 courses available)*
- IMSE2112 Engineering technology
- IMSE3103 Systems automation
- IMSE3107 Systems modelling and simulation
- IMSE3111 Intelligent optimisation
- IMSE3128 Human factors engineering
- IMSE3137 Virtual reality for systems engineering
- IMSE3139 Cyber-physical systems
- IMSE3142 Computational methods for industrial engineering
- IMSE4110 Financial engineering

- IMSE4119 Digital enterprises and e-commerce
- IMSE4137 Operational risk management
- IMSE4140 Machine learning for industrial engineering
- IMSE4141 Digital twin technologies
- IMSE4143 The internet of things

\* A student who claims the focus on *Smart Transport and Logistics* is required to complete at least one course from CIVL2111/3119/3120 and at least one course from IMSE3107/3111.

**Summary of curriculum structure of BEng (programme)**

| Course Categories | No. of credits |
|---|---|
| UG5 Requirements | 54 |
| Engineering Core Courses | 42 |
| Discipline Core Courses (Introductory) | 36 |
| Discipline Core Courses (Advanced) | 48 |
| Capstone Experience and Internship | 12 |
| Discipline Elective Courses | 36 |
| Elective Courses | 12 |
| **Total** | **240** |

A suggested study plan is given as follows:

**FIRST YEAR**

**Engineering Core Courses (42 credits)**

| | | |
|---|---|---|
| MATH1851 | Calculus and ordinary differential equations | 6 |
| MATH1853 | Linear algebra, probability & statistics | 6 |
| ENGG1300 | Fundamental Mechanics | 6 |
| ENGG1310 | Electricity & Electronics | 6 |
| ENGG1320 | Engineers in the Modern World | 6 |
| ENGG1330 | Computer programming I | 6 |

Choose one of the following:

| | | |
|---|---|---|
| ENGG1340 | Computer programming II | 6 |
| ENGG1350 | Thermofluid mechanics | 6 |

**University Requirements (UG5) (18 credits)**

| | | |
|---|---|---|
| CAES1000 | Core University English | 6 |
| CC##XXXX | Two Common Core Courses | 12 |

**SECOND YEAR**

**Introductory Discipline Core Courses (36 credits)**

| | | |
|---|---|---|
| IMSE2102 | Fundamentals of supply chain management | 6 |
| IMSE2109 | Fundamentals of engineering design | 6 |
| IMSE2121 | Engineering training | 6 |
| IMSE2132 | Statistical analysis | 6 |
| IMSE2134 | Operational research | 6 |
| IMSE2135 | Mathematical optimisation | 6 |

**University Requirements (UG5) (18 credits)**

| | | |
|---|---|---|
| CC##XXXX | Three Common Core Courses | 18 |

**Discipline Elective Courses (6 Credits)**          6

**THIRD YEAR**

**Advanced Discipline Core Courses (30 credits)**

| | | |
|---|---|---|
| IMSE3102 | Strategic supply chain management | 6 |
| IMSE3115 | Engineering economics and finance | 6 |
| IMSE3126 | Engineers in society | 6 |
| IMSE3134 | Innovation and entrepreneurship | 6 |
| IMSE3136 | Operations planning and control | 6 |

**University Requirements (UG5) (18 credits)**

| | | |
|---|---|---|
| CENG9001 | Practical Chinese for engineering students (This course should be enrolled in the third year) | 6 |
| CAES9532 | Technical English for Industrial and Manufacturing Systems Engineering | 6 |
| CC##XXXX | One Common Core Courses | 6 |

**Discipline Elective Courses (12 Credits)**      12

**Internship (0 credit)**

| | | |
|---|---|---|
| IMSE3229 | Internship | 0 |

**FOURTH YEAR**

**Advanced Discipline Core Courses (18 credits)**

| | | |
|---|---|---|
| IMSE4122 | Global logistics systems | 6 |
| IMSE4135 | Systems integration | 6 |
| IMSE4136 | Transportation and distribution planning | 6 |

**Discipline Elective Courses (18 Credits)**      18

**Capstone Experience (12 credits)**

| | | |
|---|---|---|
| IMSE4174 | Project | 12 |

**Elective Courses (12 credits)**      12

**Non-credit bearing courses as required by the University**
Students will have the flexibility to take the courses in any semester throughout the period of studies.

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**Minor in Industrial Engineering and Logistics Management**
**[not eligible for BEng(IELM) students]**

Candidates who are interested in pursuing minor in Industrial Engineering and Logistics Management must satisfy the following prerequisite:

•      Level 4 or above in Mathematics in the Hong Kong Diploma in Secondary Education (HKDSE) Examination, or equivalent

Candidates are required to complete a total of 36 credits of courses in the following manner:

| Course Code | Course | Credits |
|---|---|---|
| *(i) 12 credits of core courses* | | |
| IMSE2102 | Fundamentals of supply chain management | 6 |
| IMSE4136 | Transportation and distribution planning | 6 |

*(ii) 24 credits of elective courses selected from the following:*

| | | |
|---|---|---|
| IMSE2132 | Statistical analysis | 6 |
| IMSE2134 | Operational research | 6 |
| IMSE3102 | Strategic supply chain management | 6 |
| IMSE3115 | Engineering economics and finance | 6 |
| IMSE3106 | Manufacturing technology | 6 |
| IMSE3107 | Systems modelling and simulation | 6 |
| IMSE4119 | Digital enterprises and e-commerce | 6 |

## COURSE DESCRIPTIONS

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

## Engineering Core Courses

| | |
|---|---|
| MATH1851 | Calculus and ordinary differential equations (6 credits) |
| MATH1853 | Linear algebra, probability & statistics (6 credits) |
| ENGG1300 | Fundamental Mechanics (6 credits) |
| ENGG1310 | Electricity & Electronics (6 credits) |
| ENGG1320 | Engineers in the Modern World (6 credits) |
| ENGG1330 | Computer programming I (6 credits) |
| ENGG1340 | Computer programming II (6 credits) |
| ENGG1350 | Thermofluid mechanics (6 credits) |

Please refer to the Engineering Core Courses in the syllabus for the degree of BEng for details.

## University Requirements on Language Enhancement Courses

**CAES1000.   Core University English (6 credits)**
**CENG9001.   Practical Chinese for engineering students (6 credits)**

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

**CAES9532.   Technical English for Industrial and Manufacturing Systems Engineering (6 credits)**

This 6-credit English-in-the-Discipline course will introduce IMSE students to professional and technical communication through report writing and oral presentation with a focus on the former. The course will provide an intensive English environment and engage students in activities which help them prepare for the completion of the assessments required by the disciplinary project-based courses as nominated by the Department of Industrial and Manufacturing Systems Engineering. Assessment is wholly by coursework.

Co-requisite:   IMSE3134 Innovation and entrepreneurship [for BEng(IELM) students only]
                IMSE4175 Project [for BEng(EngSc) Systems Analytics students only]
Assessment:    100% continuous assessment

## University Common Core Curriculum

Successful completion of 36 credits of courses in the Common Core Curriculum, comprising at least one and not more than two courses from each Area of Inquiry with not more than 24 credits of courses being selected within one academic year except where candidates are required to make up for failed credits:

- Science, Technology and Big Data
- Arts and Humanities
- Global Issues
- China: Culture, State and Society

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### IMSE2102.  Fundamentals of supply chain management (6 credits)

Definition, importance and objectives of logistics; the roles of logistics in supply chain management; business of production; business environment; transport fundamentals and transport decisions; storage and handling systems and decisions; inventory policies; forecasting logistics requirements; facility location analysis; network planning process; purchasing scope and objectives; purchasing structure and organisation; purchasing variables – price, time and quality; buying commodities; buying capital goods; buying services; purchasing systems.

Assessment:    20% continuous assessment, 80% examination

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### IMSE2109.  Fundamentals of engineering design (6 credits)

Visualization of technical information; application of CAD software to prepare product design models and drawings; principles of engineering graphics: orthographic projections, isometric views, auxiliary views, sectioning, dimensioning and tolerancing; assembly modelling and drawing; design of components; general principles of product and tool design.

Assessment:    100% continuous assessment

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### IMSE2112.  Engineering technology (6 credits)

Kinematics and dynamics of rigid bodies, centre of percussion, design for reduction of impact stress; analysis, simulation and applications of 4-bar mechanisms, velocity diagram and instantaneous centre of rotation; Geneva mechanism, gear train and motion transmission; analysis and applications of simple harmonic motion, damping of vibrations; fundamental electrical circuit analysis; alternating current electricity, AC circuits and phasors.

Assessment:    20% continuous assessment, 80% examination

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### IMSE2113.  Information systems (6 credits)

Information systems; the strategic role of information technology; data communications and networking; online databases and their applications; development and implementation of information systems.

Prerequisite:    ENGG1330 Computer Programming I
Assessment:    100% continuous assessment

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**IMSE2114.**     **Product development (6 credits)**

Organisation and management, performance measurement; market research, product design specification, product safety, product and the environment, concept generation and selection, design review and improvements; product appraisal from functional, ergonomic and aesthetic, manufacturing and economical aspects; design theory and methodology, information / literature search.

Assessment:     40% continuous assessment, 60% examination

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**IMSE2121.**     **Engineering training (6 credits)**

Metal work, manufacturing practice, practical networking, computing practice, design practice, plastic processing, metrology, CNC programming and CAD/CAM, electronics, work study.

Assessment:     100% practical work

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**IMSE2132.**     **Statistical analysis (6 credits)**

Statistics – probability distributions, mathematical expectation, random sampling, point estimation of parameters, confidence interval, hypothesis testing, analysis of variance, regression analysis. Analytics – data visualization, time series forecasting, decision-making under uncertainty. Introduction to data analytics software. Application of statistics and analytics on engineering problems.

Prerequisite:     MATH1851 Calculus and ordinary differential equations or
                       MATH1853 Linear algebra, probability & statistics
Assessment:     40% continuous assessment, 60% examination

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**IMSE2134.**     **Operational research (6 credits)**

Formulation of linear programming; Geometry of linear programming; Simplex method; Sensitivity analysis; Duality theory; Formulation of integer programming; Branch-and-bound; Network flow; Application of queueing models; Poisson process; Birth-and-death process; M/M/1 queue; M/M/k queue

Prerequisite:     MATH1851 Calculus and ordinary differential equations or
                       MATH1853 Linear algebra, probability & statistics
Assessment:     30% continuous assessment and 70% examination

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**IMSE2135.**     **Mathematical optimisation (6 credits)**

Multivariable functions, partial derivatives and multiple integrals; multivariable unconstrained optimisation; optimisation problems with equality and inequality constraints; nonlinear optimization; gradient methods and Newton-Raphson method; industrial applications of optimisation techniques.

Prerequisite:     MATH1851 Calculus and ordinary differential equations
Assessment:     30% continuous assessment, 70% examination

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**IMSE3102.**     **Strategic supply chain management (6 credits)**

Supply chain overview; operating objectives; barriers to internal integration; supply chain performance cycles; logistics positioning; supply chain environmental assessment; time-based supply chains; information flow; alternative supply chain strategies; supply chain integration theory; logistics location

structure; warehouse location patterns; transportation economies; inventory economies; least total cost design; formulating supply chain strategy; planning and design supply chain methodology; supply chain administration and dimensions of change management.

Prerequisite:    IMSE2102 Fundamentals of supply chain management
Assessment:    20% continuous assessment, 80% examination

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### IMSE3103.    Systems automation (6 credits)

Introduction to robotics and automation, fundamental of robotics; basic components of robotic systems; robot applications including industrial robots, services robots, space robots, and medical robots; robot intelligence, integration of robotics systems for automation, applications of automation in manufacturing, logistics, and smart city; Global trend and development in robotics and systems automation. The course includes lectures and laboratory experiments.

Prerequisite:    MATH1851 Calculus and ordinary differential equations
Assessment:    70% continuous assessment, 30% examination

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### IMSE3106.    Manufacturing technology (6 credits)

Introduction to manufacturing, safety in manufacturing, manufacturing and the environment; metrology, measuring standards, limits and fits, geometrical tolerances, limit gauging, surface texture; casting processes, pattern and gating, permanent and non-permanent moulds; forming processes, principles of bulk deformation and sheet metal working; joining processes, fastening, liquid and solid states welding, powder metallurgy; machining processes, cutting and grinding operations, non-traditional machining, cutting conditions; plastics materials and processing.

Assessment:    40% continuous assessment and 60% examination

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### IMSE3107.    Systems modelling and simulation (6 credits)

Basic concepts of modelling and simulation; discrete-event simulation techniques; introduction to computer-aided simulation and the use of simulation packages; methodology of simulation study of industrial systems; model development for industrial systems, analysis of systems; model validation and verification; analysis of simulation results, case studies of industrial and manufacturing systems using discrete event simulations.

Assessment:    60% continuous assessment, 40% examination

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### IMSE3109.    Quality management (6 credits)

Total quality management; management tools for quality; benchmarking; ISO9000 series and ISO14000 series; national quality awards; design of industrial experiments; statistical process control; control charts; acceptance sampling; business process reengineering; customer services quality; Six Sigma; DMAIC process; Poka-yoke; failure mode and effect analysis; reliability engineering.

Assessment:    30% continuous assessment, 70% examination

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### IMSE3110.    Supply chain finance (6 credits)

Financial markets; derivatives for risk transfer in supply chain, forward, futures, options, swap; binomial model and Black-Scholes model for evaluating options; risk measures, value-at-risk (VaR), returns and

utility functions. Managing supply chain risks: financial and nonfinancial risks; uncertain customer demand, material price, exchange rates; logistics financing and risks; development of risk hedging models: price models, demand models, optimal hedging policies. Strengthening of financial and risk protection capabilities of supply chain members: financing for optimising members' working capital.

Assessment:     40% continuous assessment and 60% examination

## IMSE3111.     Intelligent optimisation (6 credits)

Evolutionary computation – overview, genetic algorithms, greedy algorithms, and ant colony optimisation; Data warehousing and mining – overview, probabilistic approaches to compression, and mining with big data; Fuzzy information and systems – modeling, optimisation, and evaluation; Decision table – overview, structure, and limited-entry.

Assessment:     50% continuous assessment and 50% examination

## IMSE3115.     Engineering economics and finance (6 credits)

Cost accounting - procedures; direct costs, absorption costing; marginal costing. Planning and control – activity-based costing systems; standard costing systems; capital expenditure and investment; health, safety and environmental aspects of company activities; contemporary issues in management accounting; financial accounting - accounting rules; basic financial accounts; manufacturing accounts; company account; financial performance – ratio analysis; interpretation of accounting data.

Assessment:     30% continuous assessment, 70% examination

## IMSE3116.     Internet technology for e-commerce (6 credits)

Overview of e-Business and e-Commerce; Electronic Business Solutions (EBS) and technology; roles and applications of e-business solutions; design and development of e-business systems: adoption and implementation: internet programming, web-based system development, online database design and implementation.

Prerequisite:   ENGG1330 Computer programming I
Assessment:     60% continuous assessment and 40% examination

## IMSE3118.     Industrial organisation and management (6 credits)

Managing and managers; evolution of management theory; planning - decision making; strategic management; strategy implementation, strategic management; organising - organisational design and structure; power and the distribution of authority; managing organisational change and innovation; leading – motivation, leadership, teams and teamwork; controlling, principles of effective control, operations control.

Prerequisite:   IMSE2102 Fundamentals of supply chain management
Assessment:     40% continuous assessment, 60% examination

**IMSE3120.    Purchasing and supply management (6 credits)**

Introduction of purchasing function/process; quality management for goods and service; sourcing and market analysis; make-or-buy decisions and subcontracting ; negotiation; controlling price and costs; vendor selection; commodity buying; service buying; capital buying; strategic purchasing; e-procurement and public procurement

Assessment:    40% continuous assessment, 60% examination

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**IMSE3126.    Engineers in society (6 credits)**

Responsibilities of professional engineers in society; role of ethics in engineering; engineering health and safety; accident prevention and management; environmental considerations; the fundamentals of the Hong Kong legal system; legal issues and the laws relevant to engineering practice; meeting with professionals from industry for sharing knowledge about engineering ethics and responsibility.

Assessment:    30% continuous assessment, 70% examination

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**IMSE3128.    Human factors engineering (6 credits)**

Human-organization interaction; human-technology interface usability and design; workplace safety and health; applied anthropometry and biomechanics; physical work and manual material handling; time and motion study; workplace and environmental design, illumination, noise, thermal; information processing; display and control; skills and learning; job design and shift work.

Assessment:    40% continuous assessment, 60% examination

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**IMSE3229.    Internship (0 credit)**

An internship in an appropriate industry six to twelve weeks duration. All Year 3 students must undergo a 6 to 12-week Internship in the summer immediately after the second semester of Level 3 studies ends. Most students undergo Internships in services or manufacturing companies in Hong Kong or China. The content of such on-the-job training may include engineering design and modification, installation, repairing, computation, programming, site inspection, measurement, quality assurance, warehouse management, etc. In some companies, the training programmes are project-orientated and often predetermined. The Internship is an important part of this 4-year BEng programme, as it gives students an opportunity to gain practical experience in industry and to develop their professional skills.

At the end of the training period, all the sponsoring organisations will complete an appraisal form on the trainees' performance. Students must submit a report after the training, and assessments are based on both the training logbook and performance appraisal.

Prerequisite:    IMSE2121 Engineering Training
Assessment:    100% practical work

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**IMSE3134.    Innovation and entrepreneurship (6 credits)**

The course is designed to apply industrial engineering principles and methodologies in an integrated manner for formulating strategies for innovation and entrepreneurship. The main element of the course is a group project on developing a conceptual product, or a service, or a system with innovative ideas and designing a start-up business plan. This project serves as a vehicle for integrated applications of

various topics, including product and system design methodologies, project management, product life-cycle management, manufacturing and business logistics, cost accounting, scheduling, process planning and workflow, human factors, distribution and marketing.

The students will learn about entrepreneurship in the new world economy, general characteristics of entrepreneurs, marketing of products and services, business plan, venture capital, environmental and contingency factors, time management, communication, systematic problem solving, group work, negotiating and assertiveness, coping with pressure, and leadership.

Pre-requisite:     IMSE2109 Fundamentals of engineering design
Co-requisite:     CAES9532 Technical English for Industrial and Manufacturing Systems Engineering
Assessment:     100% continuous assessment

### IMSE3136.     Operations planning and control (6 credits)

The use of operations planning and control systems in forecasting, scheduling and inventory control; functions and organisation of production and inventory control systems; demand forecasting; deterministic and stochastic inventory control problems; aggregate production planning; master production scheduling; requirements and capacity planning systems; operations scheduling and control of production systems; Just-In-Time techniques; balancing of assembly lines; information reporting and processing; supply chain management.

Prerequisite:     IMSE2134 Operational research
Assessment:     20% continuous assessment, 80% examination

### IMSE3137.     Virtual reality for systems engineering (6 credits)

Fundamental of virtual reality, concepts of virtual, augmented and mixed reality, 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.

Assessment:     60% continuous assessment, 40% examination

### IMSE3138.     Warehousing and terminal operations (6 credits)

Introduction to warehousing; material handling technologies, MH principles, container and unitizing equipment, storage and retrieval equipment, AS/RS, material transport equipment, automatic data collection and communication equipment, packaging; warehouse management system, receiving, cycle counting, order processing, picking, replenishment, shipping; warehouse planning and design: simulation model and software; design procedures.

Introduction to container terminal and air cargo terminal, basic operation flow at ship, quay, container yard, gate and CFS, container handling equipment and operation modes organization structure of a terminal and it various functions, container ship structure and generations, terminal management system, terminal planning and design methodology and analysis tools.

Prerequisite:     IMSE2102 Fundamentals of supply chain management
Assessment:     30% continuous assessment, 70% examination

**IMSE3139.      Cyber-physical systems (6 credits)**

Cyber systems: integration of computation, communication and control; Physical systems: natural and man-made systems governed by the laws of physics; Concept and characteristics of cyber-physical systems (CPSs): integration of cyber systems and physical systems; Architecture of CPSs: integration of cyber components with physical processes, interfaces, converters and networks in CPSs; Technologies of CPSs: distributed computing and networking, internet-of-things (IoT), sensing and smart identification, embedded technologies, data collection, control and signal processing, and location tracking; Applications of CPSs: smart manufacturing, smart supply chains, healthcare and medical services; smart buildings and smart cities; Trends of CPSs: challenges, research and development of software, hardware and applications. The course includes lectures and projects.

Assessment:      100% continuous assessment

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**IMSE3142 Computational methods for industrial engineering (6 credits)**

Solution of non-linear equations; Numerical calculus and optimization; Convex programming; Sample size estimation; Variance reduction methods; Parameter estimation techniques; Maximum likelihood estimation; Monte Carlo method; Markov chain Monte Carlo; Generalized additive models; Kernal density estimation; Statistical computing; Applications of computational methods in industry.

Prerequisite: IMSE2132 Statistical analysis and IMSE2135 Mathematical optimisation
Assessment: 50% continuous assessment, 50% examination

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**IMSE3155.      Integrative studies (6 credits)**

To apply industrial and systems engineering principles and methodologies in an integrated manner. The major element of the course is a group project on product or system design and development, which serves as the vehicle for integrating the applications of various topics including: product and system design methodologies; project management; product life-cycle management; manufacturing and business logistics; cost accounting; scheduling; process planning and workflow; human factors; distribution and marketing. The course will also develop students in the areas of technical literature survey, analysis and assimilation of materials, skills of written and oral presentation, composition and implementation of ideas, communication and interactive skills through student-centred activities, interactive and project-based learning.

Pre-requisite: IMSE2109 Fundamentals of engineering design
Assessment: 100% continuous assessment

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**IMSE4101.      Computer integrated manufacturing (6 credits)**

Overview of Computer Integrated Manufacturing (CIM) system and CAD/CAM functions; geometric modelling in CAD - principles of surface and solid modelling; CNC applications in CAM; computer aided process planning, automated process planning; rapid prototyping (3D printing) and virtual manufacturing; CAD and CAM integration.

Prerequisite:      IMSE2109 Fundamentals of engineering design
Assessment:      40% continuous assessment, 60% examination

**IMSE4102.      Engineering project management (6 credits)**

Fundamentals of engineering project management; project environment; project evaluation; risk management process; project selection and proposal preparation; project scheduling and contingency setting and control; control of variation and claims; project management methodologies and techniques, change management; multi-criteria decision making process; analytic hierarchy process; PERT/GANTT techniques for project control and resources allocation; simulation of critical paths; case studies.

Assessment:      30% continuous assessment, 70% examination

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**IMSE4110.      Financial engineering (6 credits)**

Financial markets and financial securities, portfolio management and investment strategies; international finance, foreign exchange markets; project evaluation and financing, present value, cost of capital, cost-benefit ratio and internal rates of return; financial instruments, forwards, futures; swaps, options and hedging strategies; foreign trade and investment in China.

Prerequisite:     IMSE3115 Engineering economics and finance
Assessment:      30% continuous assessment, 70% examination

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**IMSE4119.      Digital enterprises and e-commerce (6 credits)**

Enterprise resource management; EDI applications; data mining and warehousing; virtual enterprises; advanced Internet and web applications in product development, industrial applications of virtual reality; digital design and manufacturing technology: 3D printing, virtual prototyping and virtual manufacturing; electronic product and component cataloguing; cryptographic systems and digital watermarking; capability maturity model; social accountability and responsibility standards; E-commerce business models; technological, business planning and social issues of E-commerce; order taking and processing; mobile technology and electronic payment systems, smart cards, RFID and NFC.

Prerequisite:     IMSE2113 Information systems or
                  ENGG1330 Computer programming I
Assessment:      50% continuous assessment, 50% examination

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**IMSE4121.      Strategic management of business and technology (6 credits)**

Analysis of the external environment and industry clusters for local industries – threats and opportunities from government policies as well as the legal, economic, social and technological environment; competitive forces from industry rivals, customers and other sources; analysis of internal weaknesses and strengths – resources, competences and success factors; mission and strategic intent; strategic directions and methods – conditions and implications; implementing and evaluating strategic changes; management for technology innovation.

Prerequisite:     IMSE2102 Fundamentals of supply chain management
Assessment:      30% continuous assessment, 70% examination

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**IMSE4122.      Global logistics systems (6 credits)**

Global operations and logistics strategies, strategic changes required by globalisation, the strategic framework for integrating 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, foreign exchange risk management in global operations; operations analysis of global supply chains, information management for global logistics, performance measurement and evaluation in global logistics.

Prerequisite: IMSE2102 Fundamentals of supply chain management
Assessment: 40% continuous assessment, 60% examination

### IMSE4135. Systems integration (6 credits)

Student-centred learning on industrial systems analysis, design and integration. The course is based on case studies and capstone projects in experiential learning environments. Students are expected to develop their industrial systems integration skills in systems modelling and simulation, systems analysis and decision process, systems integration requirement analysis, systems integration strategies and planning, implementation and organizational issues for systems integration. The course involves industrial systems analysts and practitioners from manufacturing, logistics and service sectors to share best practices for systems integration at different levels such as supply chain, enterprise, information, infrastructure, process and decision.

Assessment: 100% continuous assessment

### IMSE4136. Transportation and distribution planning (6 credits)

The evolution of transportation and distribution; traffic management; transportation alternatives and technologies; transportation infrastructure; transportation and distribution performance analysis; total distribution cost analysis; fleet development and management; fleet performance indicators; routing and scheduling; shipment planning; containerisation-alternatives and selection criteria; mode selection criteria; distribution management and information systems requirements; international transportation and distribution strategies; distribution centre; warehousing and terminal operations; implementation organisational issues.

Prerequisite: IMSE2134 Operational research
Assessment: 30% continuous assessment, 70% examination

### IMSE4137. 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.

Assessment: 30% continuous assessment, 70% examination

### IMSE4138. 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.

Assessment:     30% continuous assessment, 70% examination

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**IMSE4140 Machine learning for industrial engineering (6 credits)**

Introduction to machine learning; Supervised and unsupervised learning; Predictive and classification performance evaluation; Model training, testing, selection, and validation; Regularization and stability; Linear predictors; Boosting; Stochastic gradient descent; Support vector machines; Kernel methods; Decision trees; clustering; Nearest neighbor; Neural networks; Dimensionality reduction; Feature selection; Data augmentation; Machine learning applications in industry.

Prerequisite: IMSE2132 Statistical analysis and IMSE2135 Mathematical optimisation
Assessment: 50% continuous assessment, 50% examination

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**IMSE4141 Digital twin technologies (6 credits)**

Introduction to basic concepts and fundaments of digital twin (DT) technologies; Building blocks of DT; DT infrastructures and systems; Sensing technologies; Data twining and cloning; DT modelling; DT-enabled system integration, testing, and maintenance; DT for process monitoring; Simulation; Automation; DT applications in manufacturing, construction, supply chain management, logistics, transportation, and healthcare.

Assessment: 50% continuous assessment, 50% examination

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**IMSE4143 The internet of things (6 credits)**

Introduction to the Internet of Things (IoT); IoT network architecture; Sensors and devices; Physical transmission media; Wireless sensor networks; Data transmission; IoT information systems; Ubiquitous computing; Edge computing; Embedded systems; Cloud computing; Control systems; Privacy and security; Smart technologies; Ambient intelligence; Data analytics; IoT applications in manufacturing, construction, healthcare, logistics and supply chain management.

Assessment: 50% continuous assessment, 50% examination

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**IMSE4174.     Project (12 credits)**

A dissertation or report on a topic consisting of design, experimental or analytical investigation in the field of industrial engineering and technology management; logistics engineering and supply chain management.

Assessment:     100% continuous assessment

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