Subject to approval

DATA AND SYSTEMS ENGINEERING

SYLLABUS

The syllabus applies to students admitted in the academic year 2026-27 and thereafter under the four-year curriculum.

Definition and Terminology

Each course offered by the Department of Data and 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 Data and Systems Engineering for the fulfillment of the curriculum requirements of the degree of BEng in Data and Systems Engineering 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 42 credits of introductory core courses and 42 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 Data and Systems Engineering.

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

University Requirements
Students are required to complete:

a) the non-credit bearing course "CAES1001Academic communication in English";
b) 6 credits in "CAES9545 Technical English for Data and Systems Engineering";
c) 6 credits in Chinese language enhancement course "CENG9001 Practical Chinese for engineering students";
d) 36 credits in the Common Core Curriculum, comprising at least 6 credits and not more than 12 credits from each Area of Inquiry with not more than 24 credits being selected within one academic year except where candidates are required to make up for failed credits; and
e) 6 credits of courses in artificial intelligence literacy;
f) a non-credit bearing course in national education and national security education, and any other non-credit bearing courses as may be required from time to time.

Capstone Experience
Students are required to complete the 12-credit "DASE4174 Project" to fulfill the capstone experience requirement for the degree of BEng in Data and Systems Engineering.

Internship

Students are required to complete the non-credit bearing internship "DASE3229 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 (Data and Systems Engineering) comprises 240 credits of courses with the following structure:

UG 5 Requirements (54 credits)

Course Code	Course	No. of credits
CAES1001	Academic communication in English*	0
CAES9545	Technical English for Data and Systems Engineering	6
CENG9001	Practical Chinese for engineering students	6
CC##XXXX	Common Core Course [1]	36
AILT1001	Artificial intelligence literacy I	3
AILT9018	Artificial intelligence literacy II – AI for engineers[#]	3
Non-credit bearing courses as required by the University		0
Total for UG5 Requirements		54

Notes:

[*] Students have to complete 36 credits in the Common Core Curriculum, comprising at least 6 credits and not more than 12 credits from each Area of Inquiry with not more than 24 credits being selected within one academic year except where candidates are required to make up for failed credits.

[#] Students may take AILT9019 AI Literacy for Computing and Data Science offered by the School of Computing and Data Science to replace AILT9018.

Pre-requisite (6 credits) (Treat as one of free electives)

This course aims at students without taking HKDSE Physics (or equivalent) background and provides them with fundamental knowledge of physics necessary to take up the Engineering Core courses.

Course code	Course	No. of credits
ENGG1200	Engineering Physics	6

Engineering Core Courses (42 credits)

Course Code	Course	No. of credits
DASE1001	Computing in Practice – Introduction to data and systems engineering	6
MATH1851	Calculus and ordinary differential equations	6
MATH1853	Linear algebra, probability & statistics	6
ENGG1000	Engineering fundamentals	6
ENGG1101	Engineering challenges I	6
ENGG1330	Computer programming I	6
ENGG2202	Engineering challenges II	6
Total for Engineering Core Courses		42

Discipline Core Courses (84 credits)

Introductory Courses (42 credits)

Course Code	Course	No. of credits
DASE1109	Fundamentals of engineering design	6
DASE2102	Fundamentals of logistics and operations	6
DASE2121	Engineering training	6
DASE2132	Statistical analysis	6
DASE2134	Operational research	6
DASE2135	Mathematical optimisation	6
DASE2144	Fundamentals of robotics	6
Total for Introductory Discipline Core Courses		42

Advanced Courses (42 credits)

Course Code	Course	No. of credits
DASE3102	Strategic supply chain management	6
DASE3115	Engineering economics and finance	6
DASE3126	Engineers in society	6
DASE3128	Human-machine collaboration	6
DASE3136	Operations planning and control	6
DASE3139	The internet of things	6
DASE4140	Machine learning and applications	6
Total for Advanced Discipline Core Courses		42

Capstone Experience and Internship (12 credits)

Course Code	Course	No. of credits
DASE3229	Internship*	0
DASE4174	Project^{+}	12
Total for Capstone Experience and Internship Courses		12

*Internship
+Capstone Experience

Discipline Elective Courses (36 credits)

Course Code	Course	No. of credits
DASE2112	Engineering technology	6
DASE2113	Information systems	6
DASE2114	Product development	6
DASE3103	Advanced robotics and automation	6
DASE3106	Manufacturing technology	6
DASE3107	Systems modelling and simulation	6
DASE3109	Quality management	6
DASE3110	Supply chain finance	6
DASE3111	Data-driven optimisation	6
DASE3116	Data-driven methods for e-commerce	6
DASE3118	Industrial organisation and management	6
DASE3120	Purchasing and supply management	6
DASE3137	Virtual reality for systems engineering	6
DASE3142	Computational methods and applications	6
DASE3155	Sensors and intelligence for robotic systems	6

DASE3156	Computer vision and applications	6
DASE3158	Data structures and algorithms	6
DASE3159	Technology innovation and entrepreneurship	6
DASE4101	Intelligent manufacturing	6
DASE4102	Engineering project management	6
DASE4110	Financial engineering	6
DASE4119	Digital enterprises and e-commerce	6
DASE4121	Strategic management of business and technology	6
DASE4122	Global logistics and transportation systems	6
DASE4136	Intelligent transportation and autonomous driving	6
DASE4137	Data-driven risk analytics	6
DASE4141	Digital twin and applications	6
DASE4145	Data analytics for human-machine systems	6
DASE4146	Additive manufacturing	6
DASE4147	Mechatronic systems engineering	6
DASE4148	Research projects	6
DASE4149	Natural language processing and applications	6
DASE4157	Physical AI	6
DASE4538	Healthcare systems engineering	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 Data and 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 Data and 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 five Focuses, provided that he/she must have taken at least FOUR courses under the corresponding Focus. The maximum number of courses to be taken under each "Focus" is five.

Robotics and intelligent systems (10 courses available)
- DASE3103 Advanced robotics and automation
- DASE3128 Human-machine collaboration
- DASE3137 Virtual reality for systems engineering
- DASE3155 Sensors and intelligence for robotic systems
- DASE3156 Computer vision and applications
- DASE4136 Intelligent transportation and autonomous driving
- DASE4141 Digital twin and applications
- DASE4145 Data analytics for human-machine systems
- DASE4157 Physical AI
- DASE4538 Healthcare systems engineering

Data analytics and computing (10 courses available)
- DASE2113 Information systems
- DASE3107 Systems modelling and simulation
- DASE3111 Data-driven optimisation
- DASE3116 Data-driven methods for e-commerce
- DASE3142 Computational methods and applications
- DASE3158 Data structures and algorithms
- DASE4137 Data-driven risk analytics
- DASE4141 Digital twin and applications

- DASE4145 Data analytics for human-machine systems
- DASE4149 Natural language processing and applications

Intelligent manufacturing and automation (8 courses available)
- DASE2112 Engineering technology
- DASE2114 Product development
- DASE3106 Manufacturing technology
- DASE3107 Systems modelling and simulation
- DASE3109 Quality management
- DASE4101 Intelligent manufacturing
- DASE4146 Additive manufacturing
- DASE4147 Mechatronic systems engineering

Intelligent transportation (7 courses available)
- DASE2113 Information systems
- DASE3107 Systems modelling and simulation
- DASE3156 Computer vision and applications
- DASE4102 Engineering project management
- DASE4122 Global logistics and transportation systems
- DASE4136 Intelligent transportation and autonomous driving
- DASE4148 Research projects

Supply chain and logistics technologies (10 courses available)
- DASE3107 Systems modelling and simulation
- DASE3109 Quality management
- DASE3110 Supply chain finance
- DASE3111 Data-driven optimisation
- DASE3118 Industrial organisation and management
- DASE3137 Virtual reality for systems engineering
- DASE4110 Financial engineering
- DASE4119 Digital enterprises and e-commerce
- DASE4122 Global logistics and transportation systems
- DASE4137 Data-driven risk analytics

Remarks: In principle, double counting is not permissible. A completed elective course shall be counted towards one Focus only.

Summary of curriculum structure of BEng in Data and Systems Engineering

Course Categories	No. of credits
UG5 Requirements	54
Engineering Core Courses	42
Discipline Core Courses (Introductory)	42
Discipline Core Courses (Advanced)	42
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 (36 credits)

DASE1001	Computing in Practice – Introduction to data and systems engineering	6
ENGG1000	Engineering fundamentals	6
ENGG1101	Engineering challenges	6
ENGG1330	Computer programming I	6
MATH1851	Calculus and ordinary differential equations	6
MATH1853	Linear algebra, probability & statistics	6

Introductory Discipline Core Courses (6 credits)

DASE1109	Fundamentals of engineering design	6

University Requirements (UG5) (15 credits)

CAES1001	Academic communication in English	0
CC##XXXX	Common Core Courses	12
AILT1001	Artificial intelligence literacy I	3

SECOND YEAR

Engineering Core Courses (6 credits)

ENGG2202	Engineering challenges II	6

Introductory Discipline Core Courses (36 credits)

DASE2102	Fundamentals of logistics and operations	6
DASE2121	Engineering training	6
DASE2132	Statistical analysis	6
DASE2134	Operational research	6
DASE2135	Mathematical optimisation	6
DASE2144	Fundamentals of robotics	6

University Requirements (UG5) (21 credits)

CC##XXXX	Common Core Courses	18
AILT9018	Artificial intelligence literacy II – AI for engineers	3

THIRD YEAR

Advanced Discipline Core Courses (30 credits)

DASE3102	Strategic supply chain management	6
DASE3115	Engineering economics and finance	6
DASE3126	Engineers in society	6
DASE3128	Human-machine collaboration	6
DASE3136	Operations planning and control	6

University Requirements (UG5) (12 credits)

CENG9001	Practical Chinese for engineering students (This course should be enrolled in the third year)	6
CC##XXXX	Common Core Courses	6

Discipline Elective Courses (18 Credits) 18

Internship (0 credit)

DASE3229	Internship	0

FOURTH YEAR

Advanced Discipline Core Courses (12 credits)		
DASE3139	The internet of things	6
DASE4140	Machine learning and applications	6
University Requirements (UG5) (6 credits)		
CAES9545	Technical English for Data and Systems engineering	6
Discipline Elective Courses (18 Credits)		18
Capstone Experience (12 credits)		
DASE4174	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.

Minor in Data and Systems Engineering
[not eligible for BEng in Data and Systems Engineering students]

Candidates who are interested in pursuing minor in Data and Systems Engineering 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		
DASE2102	Fundamentals of logistics and operations	6
DASE2144	Fundamentals of robotics	6
(ii) 24 credits of elective courses selected from the following:		
DASE2132	Statistical analysis	6
DASE2134	Operational research	6
DASE3102	Strategic supply chain management	6
DASE3107	Systems modelling and simulation	6
DASE3111	Data-driven optimisation	6
DASE3116	Data-driven methods for e-commerce	6
DASE3136	Operations planning and control	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

DASE1001	Computing in Practice – Introduction to data and systems engineering (6 credits)
ENGG1000	Engineering fundamentals (6 credits)
ENGG1101	Engineering challenges I (6 credits)
ENGG1330	Computer programming I (6 credits)
ENGG2202	Engineering challenges II (6 credits)
MATH1851	Calculus and ordinary differential equations (6 credits)
MATH1853	Linear algebra, probability & statistics (6 credits)

DASE1001. Computing in Practice -- Introduction to data and systems engineering (6 credits)

This course provides an introduction to data and systems engineering, covering fundamental concepts and techniques. Students will learn essential skills in fundamental principles, hardware, software, and system implementation. The course will involve utilizing sensors and mathematical tools to collect data on environmental conditions like temperature, humidity, and CO2 levels, as well as computer vision for data processing, modeling, and applications. Students will also acquire knowledge in data processing techniques such as data cleansing and manipulation, designing relational and non-relational databases, data analysis, and visualization using basic mathematics, and utilizing cloud-based AI data analytics tools. Machine learning and decision-making methods will also be covered. Intelligent and automated systems, powered by robotics, will be illustrated. Real-world case studies from industries including manufacturing, transportation, logistics, healthcare, and energy will be presented to provide practical insights.

Assessment: 100% continuous assessment

ENGG1000. Engineering fundamentals (6 credits)

This course provides first-year engineering students with a unified foundation in mechanics, electricity, microelectronics, and computing, preparing them for studies in their respective engineering disciplines. It begins with an introductory overview of key concepts, offering students a broad understanding of statics, dynamic mechanics, electricity, microelectronics, and computer systems. This foundational knowledge equips students with the necessary tools to analyze and model basic engineering systems while connecting theory to practical applications.

Building on this foundation, students deepen their understanding through focused modules tailored to their field of study. Students specializing in mechanics explore topics such as force systems, stress-strain behavior, kinematics, dynamics, and structural analysis. Those focusing on electricity and computing delve into microelectronics, computer systems, programming, digital logic, and networking. By combining a broad conceptual introduction with discipline-aligned depth, the course prepares students for future coursework and applied problem-solving in their chosen engineering fields.

Assessment: 40% continuous assessment, 60% examination

ENGG1101. Engineering challenges I (6 credits)

This course provides a hands-on, project-based experience for first-year engineering students. Students will work collaboratively in teams, engaging in designing, building, and testing solutions for an engineering challenge. Through seminars and hands-on workshops, students will understand fundamental concepts of engineering and innovation, as well as the challenges and opportunities for engineering professionals.

In the first semester, students delve into the design stage, where they learn to define a problem, design solutions, evaluate and select a viable solution, and create an implementation plan.

Moving on to the second semester, students tackle the build and test stage, where they transform their solution plans from concept to reality. Throughout this stage, they have opportunities to iterate, enhance, and showcase their innovations.

Assessment: 100% continuous assessment

ENGG1200. Engineering physics (6 credits)

This course aims at students without taking HKDSE Physics (or equivalent) background and provides them with fundamental knowledge of physics necessary to take up the Engineering Core courses in mechanics and electricity. Course contents include the basic principles of mechanics, motion of particles and systems through concepts of momentum and energy; specific heat capacities, latent heat and modes of heat transfer (conduction, convection and radiation); the modes of wave propagation through the science and applications of light (optics) and sound (acoustics); and electric circuits through current and voltage (Ohm's law), and the ideas of capacitor, inductor, and electromagnetic induction.

Not for the following students: (a) with level 3 or above in HKDSE Physics or Combined Science with Physics component; and (b) have passed in PHYS1050.

Assessment: 40% continuous assessment, 60% examination

ENGG1330. Computer programming I (6 credits)

This is an introductory course designed for first-year engineering students to learn about computer programming. Students will acquire basic Python programming skills, including syntax, identifiers, control statements, functions, recursions, strings, lists, dictionaries, tuples and filed. Searching and sorting algorithms, such as sequential search, binary search, bubble sort, insertion sort and selection sort, will also be covered. Mutually exclusive with: COMP1117 or ENGG1111 or IIMT2602

Assessment: 50% continuous assessment, 50% examination

ENGG2202. Engineering challenge II (6 credits)

This is a project-based course that emphasizes active learning, where students collaborate in multidisciplinary teams to solve engineering challenges. Each academic year, the course introduces a variety of engineering challenge topics tailored to students' skill levels, requiring them to integrate foundational engineering skills acquired from ENGG1101 Engineering Challenge I and core subjects such as programming, mechanics, mechatronics, electrical and electronic fundamentals, mathematics, statistics, and artificial intelligence (AI).

Student teams will work on one of the challenges, embracing the essence of active learning, which focuses on self-directed exploration, navigating various options, experimenting with ideas, making mistakes, and reflecting on their processes. This approach encourages students to take ownership of their learning by identifying what they need to learn and determining how to acquire the necessary skills. The course is structured over two semesters with bi-weekly activities, allowing students sufficient time to develop these skills through continuous exploration. Faculty instructors will provide supervision through project meetings and technical guidance through hands-on workshops, supporting students throughout their learning journey and exploration.

Through the course, students develop essential active learning skills such as problem-solving brainstorming (Think-Pair-Share), real-world exploration, prototyping and testing, progress reflection, and collaborative peer learning. These skills equip students with the competencies required for the successful completion of engineering projects and prepare them to address advanced challenges in their respective fields of study.

Assessment: 100% continuous assessment

MATH1851. Calculus and ordinary differential equations (6 credits)

In this course, students will be introduced to fundamental concepts of calculus and ordinary differential equations with a view on applications in different engineering fields. A concrete foundation of mathematics that underpins the various engineering subjects will be built. Mathematical concepts and principles, as well as some typical engineering applications, would be emphasized so that students could enhance their mathematical skills in solving engineering problems, and be well prepared in learning a higher level of applied mathematics required in different engineering disciplines.

Pre-requisite: Level 2 or above in Module 1, or Module 2 of HKDSE Mathematics or equivalent, or Pass in MATH1011. (This course is exclusively for Engineering students.)

Assessment: 30% continuous assessment, 70% examination

MATH1853. Linear algebra, probability & statistics (6 credits)

As the complementary course of MATH1851, students will be introduced to more topics of mathematics commonly applied in engineering so that students could be further enhanced with a concrete skill in mathematics underpinned for different engineering subjects. The course emphasizes mathematical concepts, principles, analysis, and their relationship to the modelling of engineering systems. Students could be furnished with the essential mathematical skills to analytically tackle some typical engineering problems to prepare for all the engineering subjects.

Pre-requisite: Level 2 or above in Module 1, or Module 2 of HKDSE Mathematics or equivalent, or Pass in MATH1011, or take MATH1011 and MATH1853 concurrently in the same semester. (This course is exclusively for Engineering students.)

Assessment: 20% continuous assessment, 80% examination

Language Enhancement Courses

CAES1001. Academic communication in English (0 credit)

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.

CAES9545. Technical English for Data and Systems Engineering (6 credits)

This 6-credit English-in-the-Discipline course will introduce BEng in Data and Systems Engineering 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 Data and Systems Engineering. Assessment is wholly by coursework.

Co-requisite: DASE4174 Project [for BEng in Data and Systems Engineering students only]
DASE4175 Project [for BEng(EngSc) Systems Analytics students only]
Assessment: 100% continuous assessment

Common Core Curriculum

Successful completion of 36 credits in the Common Core Curriculum, comprising at least 6 credits and not more than 12 credits from each Area of Inquiry with not more than 24 credits being selected within one academic year except where candidates are required to make up for failed credits:

- Scientific and Technological Literacy
- Arts and Humanities
- Global Issues
- China: Culture, State and Society
- Artificial Intelligence

Artificial Intelligence Literacy

AILT1001. Artificial Intelligence Literacy I (3 credits)

Artificial Intelligence (AI) literacy is essential for navigating our modern society effectively and responsibly. This course provides students with the skills and knowledge needed to understand AI concepts, interact with AI systems, and critically evaluate their impact. Through lectures, online learning activities and a practical project, students will explore the ethical, social, and technological dimensions of AI, preparing them to make informed decisions in a world that is increasingly AI-driven.

Assessment: 100% continuous assessment

AILT9018. Artificial intelligence literacy II – AI for engineers (3 credits)

AI for Engineers introduces students to artificial intelligence (AI) in engineering contexts. Through two modular learning units, students progress from 1) adopting AI tools for engineering literacy, to 2) hands-on development, and finally to 3) problem-focused application, while emphasizing ethical and responsible AI use. The course prepares students to apply core AI technologies to diverse engineering challenges and to develop fundamental skills for learning and applying AI in engineering.
While students are expected to have basic programming knowledge from prior coursework, the necessary coding skills will be further developed and applied within this course**.**

Assessment: 100% continuous assessment

AILT9019. AI Literacy for Computing and Data Science (3 credits)

This project-based course empowers students to apply AI technologies to real-world challenges across diverse domains. Building on foundational AI literacy, students will engage in hands-on learning through online modules, develop and implement AI-driven solutions for domain-specific problems, and showcase their innovations to the broader community. The course emphasizes practical applications,

ethical considerations, and collaboration, preparing students to become responsible AI practitioners and innovators.

Assessment: 100% continuous assessment

DASE1109. 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

DASE2102. Fundamentals of logistics and operations (6 credits)

Definition, importance and objectives of operations; modelling operational processes; 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; network planning process; sustainable logistics; purchasing scope and objectives.

Assessment: 20% continuous assessment, 80% examination

DASE2112. 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

DASE2113. 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

DASE2114. 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

DASE2121. 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

DASE2132. 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

DASE2134. 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

DASE2135. Mathematical optimisation (6 credits)

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

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

DASE2144. Fundamentals of robotics (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;
MATH1853 Linear algebra, probability & statistics
Assessment: 50% continuous assessment, 50% examination

DASE3102. 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: DASE2102 Fundamentals of logistics and operations
Assessment: 20% continuous assessment, 80% examination

DASE3103. Advanced robotics and automation (6 credits)

Discussing robot kinematics and dynamics modelling; introducing basic robot control and motion planning methods, sensing systems, and applications. The topics also include robot force control, teleoperations and the integration of robots with automation systems. The application examples include manufacturing automation and services. The course includes lectures and laboratory experiments. The course includes lectures and laboratory experiments.

Prerequisite: DASE2144 Fundamentals of robotics
Assessment: 70% continuous assessment, 30% examination

DASE3106. 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

DASE3107. 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

DASE3109. 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

DASE3110. 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

DASE3111. Data-driven 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 data and systems – modeling, optimisation, and evaluation; Decision table and tree – overview, structure, and limited-entry.

Assessment: 50% continuous assessment and 50% examination

DASE3115. 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

DASE3116. Data-driven methods for e-commerce (6 credits)

Overview of e-business and e-commerce; Electronic Business Solutions (EBS) and e-commerce infrastructure; roles and applications of e-commerce solutions; design and development of e-commerce systems: internet programming, web-based system development, online database design and implementation; data acquisition, processing and analytics for e-commerce.

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

DASE3118. 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: DASE2102 Fundamentals of logistics and operations
Assessment: 40% continuous assessment, 60% examination

DASE3120. 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

DASE3126. 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; innovation and technology; 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

DASE3128. Human-machine collaboration (6 credits)

Fundamentals of human-machine collaboration; human-centric theories and methods; design and evaluation of interactive systems through user studies; trust, safety, and health in human-machine collaboration; human sensation, perception, and cognition; information processing; heuristics, biases, and mental models in human decision making; human factors and ergonomics; UX and UI design.

Assessment: 40% continuous assessment, 60% examination

DASE3136. Operations planning and control (6 credits)

The use of operations planning and control systems in forecasting, scheduling and inventory control; facility location; 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; network optimisation; information reporting and processing; distribution operations planning and control.

Prerequisite: DASE2134 Operational research
Assessment: 20% continuous assessment, 80% examination

DASE3137. 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

DASE3139. The internet of things (6 credits)

Introduction to the Internet-of-Things (IoT); IoT network architecture; sensors and devices; IoT communication techniques; wireless sensor networks; edge computing; embedded systems; cloud computing; data analytics; distributed computing; control and signal processing; integration and interaction between cyber systems and physical systems; design, analysis, optimisation of CPSs; security and privacy techniques for CPSs and IoTs; CPS and IoT applications in smart manufacturing, smart supply chains, and smart healthcare.

Assessment: 50% continuous assessment, 50% examination

DASE3142. Computational methods and applications (6 credits)

Solution of non-linear equations; Numerical calculus and optimisation; 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: DASE2132 Statistical analysis and DASE2135 Mathematical optimisation
Assessment: 50% continuous assessment, 50% examination

DASE3155. Sensors and intelligence for robotic systems (6 credits)

Introducing sensors and sensing system for robotic systems and operations; discussing methodologies for decision making in robotic operations including model-based as well as data-driven approaches; focusing on applications in manufacturing automation, services, and smart constructions. The course is a combination of discussions of theoretical knowledge and application examples. It consists of lectures and laboratory experiments.

Pre-requisite: DASE2144 Fundamentals of robotics
Assessment: 70% continuous assessment, 30% examination

DASE3156. Computer vision and applications (6 credits)

Fundamental principle of computer vision including imaging hardware systems, image processing methods, and pattern recognition; applications of computer vision including image based recognition and visual servo; application examples including industrial inspection, autonomous driving, and robot navigation.

Prerequisite: ENGG1330 Computer programming I or DASE2113 Information systems
Assessment: 60% continuous assessment, 40% examination.

DASE3158. Data structures and algorithms (6 credits)

This course will introduce the essential components for data structures. Basic concepts, definitions, and examples for data structure are included such as array, string, matrix/grid, stack, queue, hash, tree, and graph. Typical algorithms for data analytics will be covered, including searching and sorting algorithms, divide and conquer algorithms, graph algorithm, geometric algorithms, bitwise algorithms, and randomized algorithms.

Prerequisite: ENGG1330 Computer programming I
Assessment: 50% continuous assessment, 50% examination

DASE3159. Technology innovation and entrepreneurship

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.

Assessment: 100% continuous assessment

DASE3229. 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. Alternatively, students are given the option of joining a one-year integrated Study-Work Programme on a full-time basis to work in the industry between their third and final year of studies. 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: DASE2121 Engineering training
Assessment: 100% practical work

DASE4101. Intelligent manufacturing (6 credits)

Overview of Computer Integrated Manufacturing (CIM) and Intelligent Manufacturing (IM); CAD/CAM functions; CNC applications in CAM; intelligent design and machining; intelligent monitoring and control; computer aided process planning, automated process planning; rapid prototyping (3D printing) and virtual manufacturing; digital technologies integration for IM.

Prerequisite: DASE2109 Fundamentals of engineering design
Assessment: 40% continuous assessment, 60% examination

DASE4102. 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

DASE4110. 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: DASE3115 Engineering economics and finance
Assessment: 30% continuous assessment, 70% examination

DASE4119. 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: DASE2113 Information systems or ENGG1330 Computer programming I
Assessment: 50% continuous assessment, 50% examination

DASE4121. 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: DASE2102 Fundamentals of logistics and operations
Assessment: 30% continuous assessment, 70% examination

DASE4122. Global logistics and transportation systems (6 credits)

Global logistics and transportation strategies; the role of logistics in global operations and marketing strategies; intermodal transportation; logistics and transportation infrastructure operations; transportation network modelling and analysis; traffic management; transportation mode choice; shipment planning; transhipment and consolidation; transportation demand and supply; transportation

cost; fleet development and management; vehicle routing problem; scheduling problem; level of service; terminal operations.

Prerequisite: DASE2134 Operational research
Assessment: 40% continuous assessment, 60% examination

DASE4136. Intelligent transportation and autonomous driving (6 credits)

Introduction to the Intelligent Transportation System (ITS) framework and autonomous driving systems; sensor and data collection in ITS; traffic flow theory and mathematical models; traffic control and operation; architecture of connected autonomous vehicles; localization and state estimation; perception in modern autonomous driving, neural network and deep learning; decision making and planning for autonomous driving; kinematic model and vehicle control; safety, reliability and social aspects of ITS and autonomous driving.

Prerequisite: IMSE/DASE2132 Statistical analysis
Assessment: 40% continuous assessment, 60% examination

DASE4137. Data-driven risk analytics (6 credits)

Basics of risk management, risk and return, lifecycle of risk management, operational risk management components; risk identification: risk type, risk identification tools, risk map; Risk assessment: parametric loss size models, non-parametric loss size models, loss number models, aggregated loss, jumbo loss, dependent loss, risk model calibration, risk model selection, risk prediction methodology, Bayesian Prediction, Markovian Models for risk prediction; Risk management: decision-making tools, single-stage decision tree, decision matrix, multi-stage decision tree, multi-objective decision tree..

Assessment: 30% continuous assessment, 70% examination

DASE4140. Machine learning and applications (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; Neural networks; Dimensionality reduction; Feature selection; Machine learning applications in industry.

Prerequisite: DASE2132 Statistical analysis and DASE2135 Mathematical optimisation
Assessment: 50% continuous assessment, 50% examination

DASE4141. Digital twin and applications (6 credits)

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

Assessment: 50% continuous assessment, 50% examination

DASE4145. Data analytics for human-machine systems (6 credits)

Fundamentals of human-machine systems; data-driven decision-making and statistical modelling in human-machine interaction; analysis and prediction for human-machine system performance and safety; data visualization for human-machine systems; image processing and analysis for human-machine interaction

Assessment: 40% continuous assessment, 60% examination

DASE4146. Additive manufacturing (6 credits)

Concept, principle, applications, and scope of additive manufacturing (AM); AM fabrication processes: classification, materials, and characteristics; AM workflow: object modelling, material selection, process planning, object fabrication, post-processing, and quality inspection; Design considerations for AM: object geometry, geometry fidelity, surface finish, and mechanical strength; Current limitations and further development of AM.

Prerequisites: DASE2109 Fundamentals of engineering design
Assessment: 50% continuous assessment, 50% examination

DASE4147. Mechatronic systems engineering (6 credits)

Principles of mechatronics; System integration and design; Sensors and transducers; Circuits and electronics; Embedded systems and microcontrollers; Actuators and drives; Mechanisms and mechanical components; Control systems and PID controllers; Programmable motion control; Artificial intelligence in mechatronics.

Prerequisites: ENGG1310 Electricity & Electronics and ENGG1330 Computer programming I
Assessment: 40% continuous assessment and 60% examination

DASE4148. Research projects (6 credits)

The course emphasizes student-centered learning on systems analysis, design, and integration. The course is based on research and development tasks in experiential learning environments. Students are expected to develop their analytical and implementation skills in industrial systems, such as engineering infrastructure design, data collection and processing, systems modelling and simulation, systems analysis and decision process, and systems monitoring and control.

Assessment: 100% continuous assessment

DASE4149. Natural language processing and applications (6 credits)

This course introduces the principles and techniques for natural language processing from a machine learning perspective. We will cover the topics including word vectors and language models, neural networks, recurrent neural networks, Transformer, Pretraining and Post-training, BERT, and MultiBERT, which are the key techniques for natural language processing. We will discuss implementation of these techniques and their applications in practice such as syntactic parsing, information extraction, machine translation, dialogue systems, and summarization in the industrial engineering context.

Prerequisites: DASE4140 Machine learning and applications
Assessment: 50% continuous assessment, 50% examination

DASE4157. Physical AI (6 credits)

Introduction to Physical AI and the coupling of machine intelligence with the physical world; foundations of embodied AI, including robot perception, manipulation, locomotion, vision-language-action models, and sim-to-real transfer; AI for autonomous driving, including multi-sensor perception, prediction, planning, end-to-end driving, and world models; AI for cyber-physical systems (CPS), including edge inference, time-series foundation models, federated learning, and anomaly detection; safety and verification of learning-enabled control; applications in humanoid robotics, intelligent transportation, smart manufacturing, and smart healthcare.

Assessment: 50% continuous assessment, 50% examination

DASE4174. Project (12 credits)

A 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.

Co-requisite: CAES9545 Technical English for Data and Systems Engineering
Assessment: 100% continuous assessment

DASE4538. 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.

Assessment: 40% continuous assessment, 60% examination
