SYLLABUS FOR THE DEGREE OF MASTER OF SCIENCE IN ENGINEERING IN SUSTAINABILITY ENGINEERING [MSC(ENG)(SE)]
(Applicable to students admitted to the curriculum in the academic year 2027-28 and thereafter)

Definition and Terminology

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

Elective Course – any course from the list of elective courses, or any 6-credit TPg courses offered by the Departments of the Faculty of Engineering, or selected courses in the subject areas of COMP, ECOM, FITE, ICOM offered by the School of Computing and Data Science, for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Sustainability Engineering that are not classified as discipline core courses.

Capstone Experience – either a 18-credit dissertation, or a 6-credit ideation project or a 6-credit internship as a compulsory and integral part of the curriculum.

Curriculum Structure

Students are required to complete 72 credits of courses as set out below, normally over one academic year of full-time study or two academic years of part-time study:

Course Category	**No. of Credits**		
	Research Track	**Entrepreneurship Track**	**Industry Track**
Discipline Core Courses (9-credit each)	54	54	54
Elective Courses (6-credit each)	-	12	12
Capstone Experience	18 (Dissertation)	6 (Ideation project)	6 (Internship)
Total	72		

Candidates shall select courses in accordance with the regulations of the degree. Candidates must complete 6 courses from List A (9-credit each). For Capstone Experience, candidates can choose either one of the following tracks: (i) Research Track: students should complete 18-credit Dissertation; (ii) Entrepreneurship Track: students should complete two 6-credit courses from List B and the 6-credit Ideation project; (iii) Industry Track: students should complete two 6-credit courses from List B and the 6-credit Internship. All course selection will be subject to approval by the Programme Director(s).

Curriculum

List A - Discipline Core Courses		
Course code	**Course**	**Credits**
SUSE7001	Green energy and sustainable energy systems	9
SUSE7002	Sustainable manufacturing and sustainability materials	9
SUSE7003	Sustainable agriculture and food sustainability	9
SUSE7004	Sustainable built and urban environments	9
SUSE7005	Environmental technologies	9
SUSE7006	Carbon technologies and appraisals	9

Students under the Industry Track or Entrepreneurship Track will be required to complete two 6-credit courses from List B.

List B - Elective Courses		
Course code	**Course**	**Credits**
SUSE7007	Climate change impacts and adaptation	6
SUSE7008	ESG integration and sustainable value	6
ELEC6095	Smart grid	6
ELEC7011	Energy internet	6
EMEE6005	Renewable energy technology I: Fundamental (fundamental)	6
EMEE6007	Energy and carbon audit	6
EMEE7013	Leadership in future energy industry	6
MEBS6016	Energy performance of buildings	6
Students may select from the above eight elective courses, or any 6-credit TPg courses offered by the Department of the Faculty of Engineering, or selected courses in the subject areas of COMP, ECOM, FITE, ICOM offered by the School of Computing and Data Science, for the fulfilment of the curriculum requirements of the degree of MSc(Eng) in Sustainability Engineering that are not classified as discipline core courses.		

Capstone Experience (select either one)		
Course code	**Course**	**Credits**
SUSE7009	Dissertation	18
SUSE7010	Ideation project	6
SUSE7011	Internship	6

COURSE DESCRIPTION

The following is a list of discipline core courses, elective courses and capstone experience. The list of courses below is not final and some courses may not be offered every year.

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

List-A Discipline Core courses

SUSE7001. Green energy and sustainable energy systems (9-credit)

This course centers on the transition from fossil fuels to practical, real-world clean energy solutions, including hydrogen and other renewable energy system. Its primary objectives are to provide students with a comprehensive understanding of regional, national, and global energy system; and to examine energy efficiency engineering, renewable energy technologies, and emerging sustainability innovations within energy system. Moving beyond simple installations like solar panels or wind turbines, the course emphasizes the design of integrated and sustainable energy systems that prioritize reliability, affordability, and equity. Students will learn promising energy solutions that support communities, industries, and transportation networks without excessive costs or marginalizing vulnerable groups. By focusing human-cantered design, the course explores emerging strategies to enhance energy resilient —such as addressing intermittency—while promoting accessibility to all. Ultimately, students will recognize sustainable energy not only as a technical challenge, but as a societal solution that empowers communities, society and economics.

Assessment: 50% coursework, 50% examination.

SUSE7002. Sustainable manufacturing and sustainability materials (9-credit)

This course focuses on the shift from traditional, energy- and emission-intensive production and manufacturing methods towards green, sustainable, and circular approaches that reduce environmental impact and conserve resources. It will cover the development of emerging sustainable materials including recyclable products. The course discusses strategies for the efficient use of energy, water, and raw materials, as well as integrating renewable energy sources while minimizing emissions and waste. Through case studies, students will analyze the entire lifecycle of products—from raw material sourcing to end-of-life recycling—gaining a comprehensive understanding of sustainable product design. Students will also examine why many modern products—such as plastics to textiles—end up in landfills or oceans, and will learn how to redesign systems to enable materials to be reused, repaired, or repurposed indefinitely. Emphasising practical transitions to sustainable manufacturing, the course highlights how leading businesses are already benefiting from waste-free, circular manufacturing models.

Assessment: 40% coursework, 60% examination.

SUSE7003. Sustainable agriculture and food sustainability (9-credit)

Agriculture plays a vital role in global resource consumption and greenhouse gas emissions, accounting for approximately 70% of total water withdrawals, nearly 40% of the Earth's land surface, and contributing over 10-12% of human-induced greenhouse gases. Meanwhile, global crop production is projected to decline by 15% over the next 30 years, highlighting the urgent need for innovative engineering strategies and transformative technologies in agriculture and food systems. This course will explore these complex challenges by examining the principles and practices of sustainable agriculture. Students will engage in experiential learning activities connected to the local food system, including

field trips and practical exercises at the Kadoorie Centre. Topics will also include climate-resilient farming methods and their role in stabilizing food supplies amid climate change. The course will also cover cutting-edge technologies like precision farming, vertical agriculture, and emerging food innovations such as superfood. Beyond technical concepts and engineering principles, discussions will incorporate the social, economic, and ecological dimensions of sustainable agriculture, emphasizing how engineering solutions can support resilient, equitable, and environmentally friendly food systems.

Assessment: 60% coursework, 40% examination.

SUSE7004. Sustainable built and urban environments (9-credit)

This course teaches the design of buildings and cities that are efficient, liveable, equitable, and environmentally resilient. Moving beyond the realm of futuristic gadgets, it emphasizes human-cantered design principles that prioritize well-being and sustainability. Topics include integrated greenery to mitigate flooding and regulate urban temperatures, developing energy-efficient buildings and building systems, and creating low-pollution transit networks. Students will examine innovations across urban planning, recyclable building envelopes, and sustainable infrastructure, transforming cities into hubs of health and resilience. Throughout the course, students will analyze both local (Hong Kong) and global/regional urban environments, exploring how innovative engineering solutions can lead to sustainable outcomes. Emphasis will be placed on transformative approaches that leverage emerging technologies and design strategies. Students are encouraged to think creatively and critically about how intentional, human-centered design can generate "green" outcomes through policy, planning, and engineering practices rather than relying solely on technology. This course aims to equip engineering students with the knowledge and skills to develop sustainable, resilient, and equitable built environments that respond effectively to climate challenges and urbanization pressures.

Assessment: 30% coursework, 70% examination.

SUSE7005. Environmental technologies (9-credit)

This course offers an overview of environmental and ecological systems, transitioning from traditional environmental management approaches to cutting-edge technologies and innovations aimed at conserving, monitoring, improving, and, in certain cases, remediating natural resources. Topics include water harvesting and purification, waste management, and beyond. Students will learn to utilize multi-source datasets—from satellite imagery to distributed sensor networks—and explore emerging AI models such as generative adversarial networks and reinforcement learning to perform systematic analysis and inform decision-making. The course also delves into the technical principles underlying these innovative environmental technologies, with in-depth discussions on why these tools and advancements have become essential, particularly in addressing the bottlenecks to achieving a sustainable environment.

Assessment: 50% coursework, 50% examination.

SUSE7006. Carbon technologies and appraisals (9-credit)

This course centres on the fundamentalprinciples and emerging technologies related to carbon capture, utilization, and storage. It explores current and innovative methods transforming natural gas and petroleum into low-emission energy sources. Additionally, the course introduces the concept of carbon appraisal, a process that assesses the greenhouse gas impacts of projects, policies, or organizations by monetizing them to their environmental effects, thereby evaluating their economic and climate implications. Students will master technical mechanisms—including chemical absorption/physical adsorption for capture, geological storage technologies and assessment, and industrial emission

modulation, for example, analysing cutting-edge advancements like direct air capture and bioenergy with carbon capture and storage. Furthermore, the course emphasizes tools like carbon appraisals and life cycle analysis to evaluate the efficiency, cost-effectiveness, and environmental benefits of various technologies. By monetizing impacts and analysing deployment scenarios, students will learn to identify implementation challenges and develop the concept of low-carbon technology roadmaps to support sustainable transitions.

Assessment: 60% coursework, 40% examination.

List B - Elective Courses

SUSE7007. Climate change impacts and adaptation (6-credit)

This course introduces the fundamental concepts of climate change impacts and adaptation strategies. Building upon basic climate science knowledge, students will explore how climate change affects natural and human systems across different regions. The course covers key vulnerability concepts and practical adaptation approaches relevant to engineering solutions. Students will learn basic frameworks for assessing climate vulnerability and developing appropriate adaptation measures. The curriculum examines both technological adaptations (such as resilient infrastructure design, water management systems, and cooling technologies) and nature-based solutions (including green infrastructure, ecosystem restoration, and sustainable land management).

Assessment: 50% coursework, 50% examination.

SUSE7008. ESG integration and sustainable value (6-credit)

This course bridges engineering expertise with environmental, social, and governance (ESG) frameworks and sustainable finance mechanisms. Moving beyond basic ESG reporting, students will develop technical competencies to quantify and validate ESG metrics across complex engineering projects and operations. The curriculum explores the technical foundations of sustainability standards, materiality assessments, and third-party verification protocols. Students will master methods for translating engineering decisions into financial and risk metrics through comprehensive cost-benefit analyses that account for externalities, natural capital valuation, and social return on investment. This course prepares engineers to effectively communicate sustainability performance to financial stakeholders and to leverage sustainable finance tools to accelerate the deployment of engineering solutions for climate mitigation and adaptation.

Assessment: 50% coursework, 50% examination.

ELEC6095. Smart grid (6-credit)

This course aims at providing fundamental knowledge of various smart grid technologies. The challenges of the future electric power grid, renewable energy integration, energy utilization, energy storage system, automation and communication technologies in smart grid will be covered. Topics on the smart devices/appliances and energy saving control are included.

Mutually exclusive with: ELEC6096 and MEBS6018

Assessment: 40% continuous assessment, 60% examination.

ELEC7011. Energy internet (6-credit)

The aim of this course is to provide basic knowledge on the emerging energy technologies in Energy Internet, which offer innovative solutions to accommodate renewable energy and achieve carbon neutrality goals. This calls for an interdisciplinary understanding of aspects such as electrical engineering, thermal engineering, information technology, data science, management science, and economics. This course will showcase the advances by combining these aspects and introduce the layered structure of the Energy Internet with rich illustrative examples of the key concepts, components, and technologies. The latest technical developments and industrial demonstrations will be covered as well.

Assessment: 40% practical work, 60% continuous assessment.

EMEE6005. Renewable energy technology I: Fundamental (fundamental) (6-credit)

This course focuses mainly on different renewable energy technologies including hydro power, wind power, bioenergy, solar thermal, solar PV, energy storage, and energy usage. The specific course objectives are: (1) to have a deep understanding of the important role played by renewable energy in our energy supply; and (2) to grasp the fundamentals of different energy resources; (3) to understand energy storage and its important role in solving intermittency and other issues; and (4) to understand how to use energy more efficiently with solid state lighting and other energy saving technologies Topics include: renewable energy in a big picture; hydro power; wind power; solar thermal; solar PV; bioenergy; energy storage: energy usage.

Students who have taken and passed MECH 6042 will not be allowed to take EMEE6005.

Assessment: 30% in-course assessment, 70% examination.

EMEE6007. Energy and carbon audit (6-credit)

This course aims to: (1) provide students with the fundamental principles, skills and guidelines needed to carry out effective energy and carbon audits for the commercial and industrial sectors; (2) enable students to identify energy saving and carbon reduction measures and perform quantitative analysis to predict the energy savings and carbon reduction, environmental and economic benefits; and (3) enable students to verify the performance of implemented energy saving and carbon reduction measures. Topics include: greenhouse gas emission; global warming; energy benchmarking; electrical distribution system; power quality and power factor; energy efficient lighting; motor; HVAC energy audit; refrigeration cycle; passive cooling; heating appliances; energy consumptions in compressors and pumps; energy saving measurements; local and international guidelines in energy and carbon audit; carbon footprint calculator.

Students who have taken and passed MECH 6044 will not be allowed to take EMEE6007.

Assessment: 40% continuous assessment, 60% examination.

EMEE7013. Leadership in future energy industry (6-credit)

Climate Change, together with other technical and non-technical factors, is reshaping the fossil fuel based energy industry in the last two decades and, for sure, in the foreseeable future. Business as usual is no longer a viable option for existing and emerging energy players. Visionary leadership and ability to embrace future energy technologies are two essential elements to stay competitive in the future energy sector. The course, by integrating the engineering knowledge on future energy technologies and business knowledge on leadership and management of utility of the future, shall enable the students to develop a holistic view on energy industry to date and tomorrow, understand major business trend and transition in the energy industry, and build up basic knowledge and skill to evaluate and analyze different emerging energy technologies that may become the mainstream energy in the future for achieving the net carbon zero target.

At the end of this course, students who fulfill the requirements of this course will be able to:
1. describe the challenges and trends in the energy industry
2. appreciate the role of leadership and management in the evolving energy industry
3. understand the working principle of the fossil fuel-based energy technologies and their impact on climate change and other environmental/sustainable issues.
4. understand the working principle of the emerging no/low carbon energy technologies and their contribution in mitigating climate change and other environmental/sustainable issues.

Assessment: 40% continuous assessment, 60% examination.

MEBS6016. Energy performance of buildings (6-credit)

Energy terms and concepts; energy use in buildings; energy efficient building design and operation; energy efficient technologies; building energy standards and codes; building energy analysis techniques; energy auditing of building; economic and financial analyses.

Assessment: 30% coursework, 70% examination.

Capstone Experience

SUSE7009. Dissertation (18-credit)

Dissertation is offered to students who takes the Research Track. It provides students with the opportunity to apply their knowledge to real-world sustainability challenges. Students may work individually or in small groups (with advisor approval), with clearly defined project objectives tailored to their interests and academic goals, under the guidance of a qualified Faculty supervisor. The aim of the dissertation is to synthesize and demonstrate the students' comprehensive understanding of course concepts by addressing practical design problems related to sustainable development. Students are encouraged to propose their own research topics, subject to approval by their advisors, or to select from ideas suggested by Faculty members. The project involves collaborating closely with advisors to refine research objectives, gather and analyse relevant data, and produce a detailed, well-structured report. A formal presentation of the research findings will be delivered during the second semester of the programme. The dissertation requires substantial effort in data collection and analysis to showcase mastery of research methodologies and expertise in the subject area. Beyond technical proficiency, students are expected to demonstrate strong English communication skills, effective technical writing, and the ability to articulate their research clearly and professionally.

Assessment: 100% coursework.

SUSE7010. Ideation project (6-credit)

Ideation project is offered to students who take the Entrepreneurship Track. Students may work individually or in small groups (with advisor approval), with clearly defined project objectives tailored to their interests and academic goals, under the guidance of a qualified Faculty supervisor. With the support from the Faculty supervisor, the students are encouraged to form their own innovative ideas and/or concepts for sustainability development. Solid analysis of the proposed ideas are mandatory and proof-of-principle demonstrations are welcome but not necessary.

Assessment: 100% coursework.

SUSE7011. Internship (6-credit)

Internship is offered to students who takes the Industry Track. It provides students with the opportunity to participate in an internship focused on sustainability technology and development, with placements available at universities, companies, and NGOs. The internship shall be supervised by an experienced industrial advisor and supported a course coordinator from the university. Throughout the internship, students must conduct a desktop study on a topic related to their job duties, which must be approved by the university's course coordinator. A comprehensive written report is to be submitted, including a fully referenced desktop study, as well as reflections and sharing of their internship experiences.

Assessment: 100% coursework.