MASTER OF SCIENCE IN MECHANICAL ENGINEERING

MODULE SYNOPSIS

Core Modules

Master of Science Dissertation

Code: MEC6001 Credits: 12

The Master of Science Dissertation is a two-trimester module designed for students to pursue an in-depth independent study to solve complex engineering problems, thereby strengthening and deepening their technical knowledge and skills acquired in classrooms, design and capstone projects. With SIT's focus on Applied Learning and Applied Research, students are required to individually work on a technical project with strong industrial relevance and applied research content. This module also encourages students to think critically when addressing and solving complex engineering problems using various advanced techniques and tools, as well as supports the development of SIT-DNA in our graduates. During the project execution, students are required to achieve the desired objectives in the most productive ways. In the execution process, students can also develop soft skills such as project management and planning, as well as effective communication, report writing, and oral presentation. Upon completion, students are required to present their project outcomes to a wide audience with and without an engineering background.

Advanced Non-Destructive Testing

Code: MEC6006 Credits: 6

This module will focus on the advanced topics of NDT including emerging test techniques, as well as automation that can improve inspection efficiency. Principles and practice of the NDT methods considered will be studied to understand suitable applications in the industry. Emphasis will be placed on the effectiveness of test methods in detecting a range of material and structural flaws. Practical lab sessions will reinforce this understanding and allow students to learn the standards required in preparing and performing the tests, followed by analysis and documentation of the test results in inspection reports for these NDT methods. On the topic of inspection automation, students will learn the requirements and governing engineering parameters to design and control the automation process. Automation of an ultrasonic testing method in an immersion system for weld inspection will be considered as a case study. Lectures, tutorials and labs will be conducted throughout the whole trimester. There will be quizzes, lab sessions and project work during the trimester. At the end of the trimester, students will need to sit for a final examination.

Professional Practices in Mechanical Engineering

Code: MEC6100 Credits: 6

The objective of this module is to provide the extensive knowledge to students about the Professional engineering act 1991, and basics of professional mechanical services like Inbuilding transportation systems elevator & escalators and study different types of piped system, it includes pipe, fittings, valves, and other piping components, and Heating & Air Conditioning Systems, this includes theory, operation, safety factors, components, electrical and vacuum controls. Proper handling of refrigerant and antifreeze will be discussed as well as government regulations concerning their use It also provides students with the knowledge of active fire protection systems such as fire alarm, fire extinguisher, fire hose reel, wet & dry riser, automatic fire sprinkler, smoke control system and clean agent fire suppression system Gas Flooding System and Other major Mechanical systems of Boiler plant and Calorifier and Pressure vessels and pressure piping.

SUSTAINABLE BUILDING TECHNOLOGY (SBT) SPECIALISATION ELECTIVE MODULES

Construction Management using BIM

Code: MEC6003 Credits: 6

This module provides students with knowledge, understanding, and skills in construction management services. The use of the lean concept, aided by integrated digital delivery (IDD), to reduce sources of waste and enhance value delivery for all stakeholders involved in the construction process is the primary focus of this module. IDD is the digital structure that operationalises the integration of digital solutions across the lifecycle of infrastructure design, construction, management, and deconstruction. It provides the technological and organisational backbone that enables seamless data flow, collaboration, and value delivery among stakeholders. Students will also be exposed to using Autodesk Navisworks Timeliner to generate a BIM 4D construction planning schedule.

SMART FM and Asset Management

Code: MEC6010 Credits: 6

Facility management plays a vital role in the whole building life-cycle, from concept design to demolition. It is an interdisciplinary field devoted to the coordination of space, infrastructure, people and organization. As buildings are getting larger and more complex, Building Information Modelling (BIM)'s role expands beyond design, analysis, construction planning, 4D coordination and fabrication process. The information in this model can support the day-to-day operations and planning needed to ensure that the facility continues to operate reliably and at peak efficiency.

District Cooling Systems

Code: MEC6011 Credits: 6

Singapore is located in a tropical region and requires cooling throughout the year. Almost all of the buildings need cooling, and hence chiller plants are essential to provide cooling for the buildings. Despite having chiller plants in the builds for cooling, the building owners need to accommodate the chiller plant's associated maintenance and operation costs. In addition, it is vitally important to schedule the chiller plants to run at their optimal operating conditions to minimize energy wastage. A district cooling (DC) system is a central air-conditioning system that produces and distributes chilled water from a plant(s) to buildings, thus centralizing chilled water production and maximizing economy of scale. District Cooling Systems (DCS) eliminate the concern over the maintenance and operating cost associated with the local chiller plants. Furthermore, the building owners also can

save the space required for the chiller plant. Since DCS is designed to provide cooling for the district level, DCS service providers can optimize the energy usage based on the demand of the buildings.

Acoustics Engineering

Code: MEC6016 Credits: 6

This course enables students to acquire the latest knowledge on acoustics and vibration technologies and related design for buildings. Basic theories of building acoustics, noise suppression and control, and frequency analysis are covered. Particularly, calculations on dB arithmetic, radiated sound field and its prediction are important fundamentals. Acoustic measurements are the bedrock of acoustical investigations both in research and applied acoustics, for example, room acoustics and sound propagation along ducts. The analysis of real acoustical problems is realised in a reverberation room where knowledge acquired in noise control and sustainable design methodology are analytically predicted and confirmed through practical experiments, with related topics such as acoustic transmission loss and reverberation time. Airborne sound insulation/absorber or damping of walls, doors and windows for buildings are investigated with the intent to reduce the dependency of air conditioning in a building. Silencer, sound barriers and vibration isolators or other suitable passive acoustic attenuation techniques offer significant advantages in this case for a sustainable building. Acoustic criteria used in Singapore are elaborated together with other common industry standards. Some advanced topics in psychoacoustics and active noise control are addressed.

Indoor Environmental Quality Engineering

Code: MEC6017 Credits: 6

This module provides students with knowledge about indoor environmental quality, energy, and health. Students will be provided applied learning experience required to conduct indoor air quality (IAQ) and climate audits, assess the risk involved, and recommend countermeasures to improve IAQ and climate. The importance of considering other indoor environmental quality issues when solving IAQ problems will be emphasised.

Lighting Technology for Building Services

Code: MEC6018 Credits: 6

Student will understand the fundamental lighting principals in the context of performance-based building design and diagnostics. Student will acquire detail knowledge on relevant aspects of lighting physics that affect the physiological and psychological experience of buildings, performance metrics, design and benchmarking methodologies, and contemporary simulation tools. Also, the first-hand case studies in lighting design, technologies will be delivered by the experienced experts in the lighting industry. The students will apply the knowledge they acquire to their lighting design project assignment.

Structure Vibration and Control

Code: MEC6021 Credits: 6

All mechanical structures are designed to resist vibrational disturbances. With the advancements in technology, the number of vibrations affecting system performance can be significantly reduced. As such, it is important to comprehend, model, analyse, and control these vibrations. This module aims to provide students with the concept of vibration phenomenon and its effects, vibration isolation applications, practical considerations, and commonly used vibration reduction techniques and control of vibration in physical systems. Using real world examples, various mathematical models, characteristics, performance, and stability of feedback control systems will also be discussed and evaluated.

SUSTAINABLE LAND TRANSPORT (SLT) SPECIALISATION ELECTIVE MODULES

Railway Safety Standards/ Legislations/ Best Practices

Code: MEC6009 Credits: 6

This module covers various safety standards, legislation, and best practices that govern the design, manufacturing, testing, maintenance and operation of railway systems. Specifically, it includes historical and current perspectives on how safety standards, legislation, and best practices evolve with railway developments in local and international contexts; as well as comprehension and applications of different safety standards, legislation, and best practices for local and international railways.

Systems Engineering for Urban Railway Systems

Code: MEC6012 Credits: 6

The first half of the module focuses on topics including: introduction to systems engineering for management of complex system projects. The topics covered include systems engineering work processes using the Vee-model; life cycle management processes with emphasis placed on the technical, technical management, agreement and organizational project-enabling processes; an overview of systems engineering applications in large scale system-of-systems projects and case studies. The second half of the module focuses on railway systems engineering covering topics on: Singapore's long term railway transport plans; introduction to railway systems; railway systems integration; railway engineering asset management and maintenance engineering; and technology applications in support of railway systems engineering and case studies.

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Remanufacturing Systems Management

Code: MEC6023 Credits: 6

This specialist module will introduce the key remanufacturing concepts and the various manufacturing technologies and processes related to remanufacturing. It familiarises the student with techniques to assess a component for remanufacturability, as well as to create components with design features to facilitate remanufacturing. It equips the student with the fundamentals and applicable knowledge to address technical and management issues commonly faced in modern remanufacturing systems and operations. The student would be encouraged to explore remanufacturing design, processes, and systems management through lectures, laboratory sessions, on-line activities and projects. Assessment of learning will be through continual assessments, evaluation of group projects and the student's individual performance in a summative assessment.

Asset Management and Maintenance Engineering

Code: MEC6109 Credits: 6

The module aims to impart knowledge and develop skills necessary for the students to draw up risk and reliability-based asset management strategies, formulate and implement aligned maintenance policies and plans, and to conduct asset performance assessment and improvement for realising optimised asset values over the asset life cycle. The module also looks specifically at maintenance engineering in the use of sensors and IoT 4.0 technologies to aid in risk mitigation and predictive maintenance, planning and management of maintenance functions, spares provisioning and inventory control, asset life cycle project management, as well as risk and safety assessment methodologies for safe operation of the assets. In line with SIT's applied learning pedagogy, the students will be required to apply what they have learned from the modules to specific asset management and maintenance related complex engineering problems. These will be carried out in the form of individual and group projects to be assessed as part of the module requirements.