

## MASTER OF SCIENCE (MECHANICAL ENGINEERING)

The programme is intended to provide students with an advanced knowledge and understanding of the 'state-of-the-art' in one or more of the many areas of mechanical engineering. Its unique balance of rigorous fundamentals and engaging real-world applications in the M.Sc. (Mechanical Engineering) programme train the students to be analytical thinkers who will successfully integrate and synthesize the theory and new knowledge. The combination of expertise in research and in engineering consultancy in the Department of Mechanical Engineering helps to give this M.Sc. (Mechanical Engineering) course its unique features. The success of this M.Sc. (Mechanical Engineering) course can be measured by the large proportion of its graduates who find appropriate and challenging posts in industry at home and abroad.

To graduate, a student needs to accumulate a total of no less than 40 Modular Credits (MCs) and obtain a minimum Cumulative Average Point (CAP) of 3.0 (equivalent to the Grade of B-) for the best modules equivalent of 40 MCs (inclusive of foundation/core modules, where required). Each graduate module of 39 lecture hours is usually assigned 4 MCs. Hence, in general, a student needs to complete 10 modules chosen from the list of modules. **(A maximum of 2 approved external modules are usually allowed.)**

A candidate may read for a M.Sc. in Mechanical Engineering with or without a major or area of specialisation. Currently, students must complete at least 5 modules from the core module list for the specialization in order to graduate with the specialisation.

The Specialisations *currently* available are as follows:

1. Computation and Modelling
2. Manufacturing Technology & Automation

**Starting Semester 1, AY2016/2017, the Specialisations available are as follows:**

**1. Computation and Modelling (Table 1)**

*(At least 5 modules (20MCs) from the revised module list, each with a grade of at least B-. This will be applicable to new students matriculating in Semester 1, AY2016/2017 onwards only.)*

**2. Advanced Manufacturing (Table 2)**

*(At least 5 modules (20MCs) from the revised module list)*

The following graduate modules are offered by the Department of Mechanical Engineering:

### GRADUATE MODULES (Module Descriptions)

#### Applied Mechanics

ME5103	Plates and Shells
ME5106	Engineering Acoustics
ME5161	Optical Techniques in Experimental Stress Analysis
ME6105	Continuum Mechanics

#### Energy & Bio-thermal Systems

ME5204	Air Conditioning and Building Automation
ME5205	Energy Engineering
ME5207	Solar Energy Systems
ME6204	Convective Heat Transfer
ME6205	Advanced Topics in Heat and Mass Transfer

**Fluid Mechanics**

ME5301	Flow Systems Analysis
ME5302	Computational Fluid Mechanics
ME5303	Industrial Aerodynamics
ME5304	Experimental Fluid Mechanics
ME5305	Fundamentals of Aeroelasticity
ME5361	Advanced Computational Fluid Dynamics
ME6303	Advanced Fluid Dynamics
OT5102	Oil and Gas Technology
OT5301	Subsea Systems Engineering
OT5302	Flow Assurance
OT5303	Subsea Control
OT5304	Subsea Construction & Operational Support
OT5305	Pressures Surges in Oil & Gas Flow Systems

**Control & Mechatronics**

ME5401/EE5101R	Linear Systems
ME5402/EE5106R	Advanced Robotics
ME5403/EE5103R	Computer Control Systems
ME5404/EE5904R	Neural Networks
ME5405	Machine Vision
ME6405	Autonomous Mobile Robotics
ME6406	Optimization Techniques for Dynamical Systems

**Materials**

ME5506	Corrosion of Materials
ME5513	Fracture and Fatigue of Materials
ME5516	Emerging Energy Conversion and Storage Technologies
ME6504	Defects and Dislocations in Solids
ME6505	Engineering Materials in Medicine

**Manufacturing**

ME5608	Additive and Non-Conventional Manufacturing Processes
ME5611	Sustainable Product Design & Manufacturing
ME5612	Computer Aided Product Development
ME6604	Modelling of Machining Processes

**ETM Modules**

MT5002	Management of Industrial R & D
MT5006	Strategic and New Product Development
MT5007	Management of Technological Innovation
SDM5001	Systems Architecture
SDM5002	Systems Engineering

(Not all modules listed above are necessary available in any one year.)

## **TABLE 1 - SPECIALISATION IN COMPUTATION AND MODELLING**

The **revised** module list for the specialisation in Computation and Modelling will be applicable to existing students as well as new students matriculating in Semester 1, AY2016/2017 onwards. Existing students may option to join the specialization if they have more than 1 year candidature.

Students must obtain at least a **minimum grade of B-** for each of the modules (from the revised module list for the specialisation) in order to graduate with the specialisation. **This will be applicable to new students matriculating in Semester 1, AY2016/2017 onwards only.**

<b><u>Current</u> Specialisation Requirements</b>	<b><u>Revised</u> Specialisation Requirements (with effect from Semester 1, AY2016/2017)</b>
In general, a student needs to complete 10 modules with at least five (5) selected from the core list.	At least <u>5</u> modules (20 MCs) from the following module list, each with a grade of at least B- :
<b><u>Core Modules</u></b>	<b><u>Modules for Specialisation</u></b>
ME5302 Computational Fluid Mechanics	ME4291 Finite Element Analysis
ME5361 Advanced Computational Fluid Dynamics	CE4257 Linear Finite Element Analysis
ME5362 Advanced Fluid Transients Computation and Modelling	<i>(Students can only choose either ME4291 or CE4257, which is pre-requisite for CE6006)</i>
ME5404/EE5904R Neural Networks	ME5300A* Special Project in Computation and Modelling I
ME5701 Mathematics for Engineering Research	ME5300B* Special Project in Computation and Modelling II
ME6301 Research Topics in Fluid Dynamics	ME5301 Flow Systems Analysis
ME6302 Topics in Fluid Dynamics	ME5302 Computational Fluid Mechanics
ME6303 Advanced Fluid Dynamics	ME5361 Advanced Computational Fluid Dynamics
ME6304 Turbulence in Fluid Flows	ME5401/EE5101R Linear Systems
	ME5404/EE5904R Neural Networks
	ME6105 Continuum Mechanics
	ME6303 Advanced Fluid Dynamics
	ME6604 Modelling of Machining Processes
	CE5377 Numerical Methods in Mechanics & Envr. Flows
	<i>(for students in the coursework program (MSc); this module is in replace of CE5311 and the preclusion is CE6003)</i>
	CE6006 Advanced Finite Element Analysis
	 <u>The 5 modules must include at least 3 modules from the Department of Mechanical Engineering (ME-coded modules).</u>
	 *Students can choose to take either (i) ME5300A only <u>or</u> (ii) both ME5300A and ME5300B to be counted towards the specialisation requirements. The projects can be offered either by staff in the Department of Mechanical Engineering or by industry.
	 The remaining 5 modules (20 MCs) to satisfy the degree requirements may be selected from the Level 5000 and 6000 modules listed in the module listing for the M.Sc. (Mechanical Engineering) programme.

Updated on 22 August 2017

**TABLE 2 - SPECIALISATION IN MANUFACTURING TECHNOLOGY AND AUTOMATION**  
**SPECIALISATION IN ADVANCED MANUFACTURING**

The students in Specialization in Manufacturing Technology and Automation may option to transfer to the Specialization in Advanced Manufacturing. For the students transfer to new specialization, they have to select the modules from the revised module list. For the students not transferred, they should still select the module from current list.

<b>Specialisation in Manufacturing Technology and Automation</b>	<b>Specialisation in Advanced Manufacturing</b>
<b><u>Current</u> Specialisation Requirements</b>	<b><u>Revised</u> Specialisation Requirements (with effect from Semester 1, AY2016/2017)</b>
<p>In general, a student needs to complete 10 modules with at least five (5) selected from the core list.</p> <p><b><u>Core Modules</u></b></p> <p>ME5402/ Advanced Robotics            EE5106R            ME5403/ Computer Control Systems            EE5103R            ME5405 Machine Vision            ME5609 Rapid Response Manufacturing            ME5610 Product Development            ME5611 Sustainable Product Design &amp; Manufacturing            ME5613 Optimal Design of Multi-Functional Structures            ME6602 Topics in Manufacturing            ME6604 Modelling of Machining Processes            ME6605 Additive and Non-Conventional Manufacturing Processes            ME6606 Computer Aided Product Development</p> <p><b><u>Current students</u></b> in the existing specialisation in Manufacturing Technology and Automation may choose to remain in the existing specialisation, or opt for the specialisation in Advanced Manufacturing.</p> <p>If students choose to remain in the existing specialisation in Manufacturing Technology and Automation, they need to obtain 5 modules (20 MCs) from the current module list for the specialisation (above).</p> <p>If they choose to opt for the specialisation in Advanced Manufacturing, they will need to obtain 5 modules (20 MCs) from the revised module list for the specialisation.</p>	<p>At least <u>5</u> modules (20 MCs) from the following module list :</p> <p><b><u>Modules for Specialisation</u></b></p> <p>ME5608 Additive and Non-Conventional Manufacturing Processes            ME5612 Computer Aided Product Development            ME6505 Engineering Materials in Medicine            ME5402/ Advanced Robotics            EE5106R            ME5513 Fracture and Fatigue of Materials            ME5600A* Project in Advanced Manufacturing I            ME5600B* Project in Advanced Manufacturing II            ME5611 Sustainable Product Design &amp; Manufacturing            ME6604 Modelling of Machining Processes MLE5102 Mechanical Behaviours of Materials            MLE5204 Advanced Processing of Metallic Materials            MST5001 Structure and Properties of Materials            MST5002 Materials Characterization            PR5211 Pharmaceutical Analysis IV            PR5216 Advances in Drug Delivery            ID5951B Topics in Industrial Design: Interaction Design            ID5951C Topics in Industrial Design: Healthcare Design</p> <p>The 5 modules must include <u>ME5608 and either ME5612 or ME6505</u>. *Students can choose to take either (i) ME5600A only <u>or</u> (ii) both ME5600A and ME5600B to be counted towards the specialisation requirements. The industry or internal projects related to 3DP technologies and applications will be offered by hospitals, NUS staff or biomedical companies.</p> <p>The remaining 5 modules (20 MCs) to satisfy the degree requirements may be selected from the Level 5000 and 6000 modules listed in the module listing for the M.Sc. (Mechanical Engineering) programme.</p>

**SPECIALISATION IN OFFSHORE OIL AND GAS TECHNOLOGY**

This specialization is offered in Semester 1 of AY 2011/ 2012 by Department of Civil & Environment Engineering, under M.Sc. (Offshore Technology).