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 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)**

**General Module**

- ME5001 Mechanical Engineering Project

**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
ME5309 Aircraft Engines and Rocket Propulsion
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/EE5101 Linear Systems
ME5402/EE5106 Advanced Robotics
ME5403/EE5103 Computer Control Systems
ME5404/EE5904 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

(Not all modules listed above are necessary available in any one year.)
**TABLE 1 - SPECIALISATION IN COMPUTATION AND MODELLING**

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.

<table>
<thead>
<tr>
<th>Revised Specialisation Requirements (with effect from Semester 1, AY2016/2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 5 modules (20 MCs) from the following module list, each with a grade of at least B- :</td>
</tr>
</tbody>
</table>

**Modules for Specialisation**

- ME4291: Finite Element Analysis
- CE4257: Linear Finite Element Analysis
  *(Students can only choose either ME4291 or CE4257, which is pre-requisite for CE6006)*
- ME5300A*: Special Project in Computation and Modelling I
- ME5300B*: Special Project in Computation and Modelling II
- ME5301: Flow Systems Analysis
- ME5302: Computational Fluid Mechanics
- ME5361: Advanced Computational Fluid Dynamics
- ME5401/EE5101: Linear Systems
- ME5404/EE5904: Neural Networks
- ME6105: Continuum Mechanics
- ME6303: Advanced Fluid Dynamics
- ME6604: Modelling of Machining Processes
  *(For students in the coursework program (MSc); this module is in replace of CE5311 and the preclusion is CE6003)*
- CE6006: Advanced Finite Element Analysis

The 5 modules must include at least 3 modules from the Department of Mechanical Engineering (ME-coded modules).

*Students can choose to take either (i) ME5300A only or (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.
### Revised Specialisation Requirements (with effect from Semester 1, AY2016/2017)

At least 5 modules (20 MCs) from the following module list:

<table>
<thead>
<tr>
<th>Modules for Specialisation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME5608</td>
<td>Additive and Non-Conventional Manufacturing Processes</td>
</tr>
<tr>
<td>ME5612</td>
<td>Computer Aided Product Development</td>
</tr>
<tr>
<td>ME6505</td>
<td>Engineering Materials in Medicine</td>
</tr>
<tr>
<td>ME5402/EE5106</td>
<td>Advanced Robotics</td>
</tr>
<tr>
<td>ME5513</td>
<td>Fracture and Fatigue of Materials</td>
</tr>
<tr>
<td>ME5600A*</td>
<td>Project in Advanced Manufacturing I</td>
</tr>
<tr>
<td>ME5600B*</td>
<td>Project in Advanced Manufacturing II</td>
</tr>
<tr>
<td>ME5611</td>
<td>Sustainable Product Design &amp; Manufacturing</td>
</tr>
<tr>
<td>ME6604</td>
<td>Modelling of Machining Processes</td>
</tr>
<tr>
<td>MLE5102</td>
<td>Mechanical Behaviours of Materials</td>
</tr>
<tr>
<td>MLE5204</td>
<td>Advanced Processing of Metallic Materials</td>
</tr>
<tr>
<td>MST5001</td>
<td>Structure and Properties of Materials</td>
</tr>
<tr>
<td>MST5002</td>
<td>Materials Characterization</td>
</tr>
<tr>
<td>PR5211</td>
<td>Pharmaceutical Analysis IV</td>
</tr>
<tr>
<td>PR5216</td>
<td>Advances in Drug Delivery</td>
</tr>
<tr>
<td>ID5951B</td>
<td>Topics in Industrial Design: Interaction Design</td>
</tr>
<tr>
<td>ID5951C</td>
<td>Topics in Industrial Design: Healthcare Design</td>
</tr>
</tbody>
</table>

The 5 modules must include ME5608 and either ME5612 or ME6505.

*Students can choose to take either (i) ME5600A only or (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.

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.