

## **Bachelor of Engineering (Mechanical Engineering)**

### **Overview**

The undergraduate mechanical engineering curriculum has evolved over the years to meet the challenges of technological development and industry. It emphasizes the fundamentals of the engineering sciences as well as applications relevant to the prevailing industries. The students undergo a rigorous course of training in science and mathematics in their first year with the Faculty. In the four semesters following that, the students are given a strong foundation in all the principal areas of mechanical engineering sciences, namely: Applied Mechanics, Control, Electrical Engineering, Fluids Engineering, Manufacturing, Materials and Thermodynamics and Heat Transfer. Engineers exercise their creativity through the innovative products that they design. Design is hence an integral part of the mechanical engineering curriculum. In addition to the teaching of mechanical design principles, students are also taught computer-aided design and analysis (CAD/CAM) with the aid of state-of-the-art computer software and hardware. In the fifth and sixth semesters, students are given a design-and-build project on a group basis. The project provides learning opportunities for the students in integrative skills, and develops innovation, teamwork and communication skills. From the sixth semester onwards, the students are offered a wide-range of technical electives. They may choose a combination of elective modules to suit their individual interests or they may apply to the Department to enrol in one of the following specialisations:

- Aeronautical Engineering
- Automotive Engineering
- Energy and Sustainability
- Offshore Oil & Gas Technology

Enrolment in a specialisation is subjected to approval of the Head of Department. The students are also required to undertake a research-based project leading to a B.Eng. Dissertation in the last two semesters. The project enhances the capacity of the students for critical thinking and self-motivated learning, and trains them in research methodology. The independent study elective modules provide further opportunities for interested students to be engaged on project and research-based work.

In addition to the aforementioned specialisations, which may be read as part of the B.Eng. programme, students may also apply to read a minor in conjunction with the main degree. This will require the students to offer additional modules as stipulated by the requirements of the minor programme. The available minor programmes are listed at [http://www.eng.nus.edu.sg/ugrad/SP\\_minors.html](http://www.eng.nus.edu.sg/ugrad/SP_minors.html).

The Mechanical Engineering programme at NUS prepares its graduates well for challenging and rewarding careers in all phases of productive industrial activity extending from research to design, development and manufacturing. Our graduates are much sought after in a broad spectrum of industry covering:

- General Manufacturing
- Advanced Materials

- Aerospace
- Automation and Control
- Defence
- Precision Engineering
- Semiconductor Manufacturing and Testing
- Thermal and Power Engineering
- Design, Testing and Consulting services

The B.Eng. (Mechanical Engineering) degree is accredited by the Engineering Accreditation Board (EAB) in Singapore and is recognised by the signatories of the Washington Accord (<http://www.washingtonaccord.org/>). The B.Eng. (Mechanical Engineering) degree is also internationally recognised for admission to graduate studies in all the major universities around the world.

### **Degree Requirements**

Students in the Bachelor of Engineering (Mechanical Engineering) programme are required to satisfy the following requirements to graduate from the course:

- Complete a minimum of 160 MCs with a CAP  $\geq 2.0$ .
- Pass the modules in accordance with Table 3.2.10a.
- Pass at least 12 MCs equivalent of technical elective modules as listed in Table 3.2.10b. Students may, subject to approval of the Head of Department, offer up to two ME5-Level technical modules in lieu of two of the technical electives
- Subject to approval of the Head of Department, students may enrol in one of the following specialisations when they have completed a minimum of 100 MCs of the programme requirements:
  - Aeronautical Engineering
  - Automotive Engineering
  - Energy and Sustainability
  - Offshore Oil & Gas Technology
- To qualify for a specialisation, a student must pass at least four modules from the chosen area of specialisation and any other requirements as given in Table 3.2.10c. Students in a specialisation programme are required to do their final-year dissertation (8MCs) in an area related to the specialisation. For updated information on Specialisation programmes, please refer <http://www.me.nus.edu.sg/current-students/program-overview/specialisations/specialisations-from-2013>

Students should not read more than 60 MCs of Level-1000 modules towards their degree requirements.

**Table 3.2.10a: Summary of ME Modular Requirements and Credits (For student intakes from AY2014/15 onwards)**

Students are advised to refer to Department of Mechanical Engineering website at <http://www.me.nus.edu.sg> for latest updated information on B.Eng.(ME) Curriculum.

| <b>MODULAR REQUIREMENTS</b>   | <b>MCs</b>      |
|---|-----------------|
| <b>University Requirements</b>  | <b>20</b>       |
| General Education Modules (GEM)<br>Group A: GEK1549 Critical Thinking and Writing<br>One from Group B: Humanities and Social Sciences | 8<br>(4)<br>(4) |
| Singapore Studies (SS) Module   | 4               |
| Breadth: Modules Outside Student's Faculty  | 8               |
| <b>Unrestricted Electives**</b>   | <b>20</b>       |
| <b>Programme Requirements</b>   |                 |
| <b>Faculty Requirements</b>   | <b>10</b>       |
| ES2331 Communicating Engineering  | 4               |
| HR2002 Human Capital in Organizations   | 3               |
| EG2401 Engineering Professionalism  | 3               |
| ES1xxx English*   | -               |
| <b>Foundation Requirements</b>  | <b>23</b>       |
| MA1505 Mathematics I  | 4               |
| MA1506 Mathematics II   | 4               |
| EG1108 Electrical Engineering   | 3               |
| EG1109 Statics and Mechanics of Materials   | 4               |
| PC1431 Physics IE   | 4               |
| CS1010E Programming Methodology   | 4               |
| <b>Mechanical Engineering Major Requirements</b>  |                 |

| <b>MODULAR REQUIREMENTS</b>                           | <b>MCs</b> |
|---|------------|
| <b>ME Core Subjects</b>                               | <b>42</b>  |
| ME2113 Mechanics of Materials I                       | 3          |
| ME2114 Mechanics of Materials II                      | 3          |
| ME2121 Engineering Thermodynamics                     | 4          |
| ME2134 Fluid Mechanics I                              | 4          |
| ME2135 Fluid Mechanics II                             | 4          |
| ME2142 Feedback Control Systems                       | 4          |
| ME2143 Sensors and Actuators                          | 4          |
| ME2151 Principles of Mechanical Engineering Materials | 4          |
| ME3112 Mechanics of Machines                          | 4          |
| ME3122 Heat Transfer                                  | 4          |
| ME3162 Manufacturing Processes                        | 4          |
| <b>ME Design and Project Modules</b>                  | <b>33</b>  |
| ME2101 Fundamentals of Mechanical Design              | 4          |
| ME2103 Engineering Visualisation and Modelling        | 3          |
| ME3103 Mechanical Systems Design                      | 6          |
| ME4101A B.Eng. Dissertation (Over 2 semesters)        | 8          |
| <b>EG3601 Industrial Attachment Programme</b>         | <b>12</b>  |
| <b>ME Electives</b>                                   |            |
| <b>Technical Electives (from Table 3.2.10b)</b>       | <b>12</b>  |
| <b>Total</b>  | <b>160</b> |

\* Students who have not passed or been exempted from the Qualifying English Test at the time of admission to the Faculty will have to read ES1000 and/or ES1102. This will be decided by CELC.

**Table 3.2.10b: ME Technical Electives Modules**

**Applied Mechanics**

|        |                                   |
|--------|-----------------------------------|
| ME3211 | Mechanics of Solids               |
| ME4211 | Applied Mechanics                 |
| ME4212 | Aircraft Structures               |
| ME4213 | Vibration Theory and Applications |
| ME4214 | Vehicle Dynamics                  |

**Control and Mechatronics**

|                     |   |
|---------------------|---|
| ME3241              | Microprocessor Applications                 |
| ME3242              | Industrial Automation                       |
| ME4241              | Aircraft Performance, Stability and Control |
| ME4245              | Robot Kinematics, Dynamics and Control      |
| ME4246              | Linear Systems                              |
| ME5405 <sup>o</sup> | Machine Vision                              |
| EE4305              | Introduction to Fuzzy/Neural Systems        |

**Fluid Mechanics**

|        |  |
|--------|--|
| ME3232 | Compressible Flow                        |
| ME3233 | Unsteady Flow in Fluid Systems           |
| ME4231 | Aerodynamics and Propulsion              |
| ME4233 | Computational Methods in Fluid Mechanics |
| ME4234 | Experimental Methods in Fluid Mechanics  |
| ME4235 | Introduction to Aeroelasticity           |

**Manufacturing**

|        |   |
|--------|---|
| ME3261 | Computer aided Design and Manufacturing |
| ME3263 | Design for Manufacturing and Assembly   |
| ME4261 | Tool Engineering                        |
| ME4262 | Automation in Manufacturing             |
| ME4263 | Fundamentals of Product Development     |
| ME4264 | Automobile Design and Engineering       |
| ME4265 | Automotive Body and Chassis Engineering |

**Materials Science**

|        |                                  |
|--------|----------------------------------|
| ME3251 | Materials for Engineers          |
| ME4251 | Thermal Engineering of Materials |
| ME4253 | Biomaterials Engineering         |
| ME4254 | Materials in Engineering Design  |
| ME4255 | Materials Failure                |

**Micro Systems Technology**

|        |                                      |
|--------|--------------------------------------|
| ME3281 | Microsystems Design and Applications |
| ME4283 | Micro Fabrication Processes          |
| ME4284 | Micro Sensors and Micro Actuators    |

**Thermodynamics**

|        |                                   |
|--------|-----------------------------------|
| ME3221 | Energy Conversion Processes       |
| ME4223 | Thermal Environmental Engineering |

|        |                                     |
|--------|-------------------------------------|
| ME4225 | Industrial Heat Transfer            |
| ME4226 | Energy and Thermal Systems Analysis |
| ME4227 | Internal Combustion Engine          |

### **Multidisciplinary**

|        |                                  |
|--------|----------------------------------|
| ME3291 | Numerical Methods in Engineering |
| ME4291 | Finite Elements Analysis         |
| ME4293 | Microelectronics Packaging       |

### **Others**

|        |   |
|--------|---|
| ME3000 | Independent Study 1                                   |
| ME3001 | Independent Study 2                                   |
| ME4105 | Specialisation Study Module (for OOGT Specialisation) |

### **Table 3.2.10c: Technical Electives Modules for ME Specialisations**

Students are advised to refer to Department of Mechanical Engineering website at <http://www.me.nus.edu.sg/current-students/program-overview/specialisations> for latest updated information related to specialisation.

### **Aeronautical Engineering**

Students taking Aeronautical Engineering Specialisation are required to select TWO modules from Group A and TWO modules from Group B and present their FYP in a poster session.

#### Group A

|        |   |
|--------|---|
| ME3232 | Compressible Flow                           |
| ME4231 | Aerodynamics and Propulsion                 |
| ME4235 | Introduction to Aeroelasticity              |
| ME4241 | Aircraft Performance, Stability and Control |

#### Group B

|        |   |
|--------|---|
| ME4212 | Aircraft Structures                       |
| ME4233 | Computational Methods in Fluids Mechanics |
| ME4234 | Experimental Methods in Fluid Mechanics   |
| ME4291 | Finite Element Analysis                   |

### **Automotive Engineering**

Students taking Automotive Engineering Specialisation are required to select at least THREE modules from Group A and another ONE from either Groups.

#### Group A

|        |   |
|--------|---|
| ME4214 | Vehicle Dynamics                        |
| ME4227 | Internal Combustion Engine              |
| ME4264 | Automobile Design and Engineering       |
| ME4265 | Automotive Body and Chassis Engineering |

### Group B

|        |   |
|--------|---|
| ME3251 | Materials for Engineers                 |
| ME3261 | Computer aided Design and Manufacturing |
| ME3263 | Design for Manufacturing and Assembly   |
| ME4213 | Vibration Theory and Application        |
| ME4254 | Materials in Engineering Design         |
| ME4255 | Materials Failure                       |
| ME4262 | Automation in Manufacturing             |

### **Energy and Sustainability**

Students taking Energy and Sustainability specialisation are required to take at least FOUR modules from the list below and present their FYP in a poster session

|         |                                       |
|---------|---------------------------------------|
| ME3221  | Energy Conversion Processes           |
| ME4223  | Thermal Environmental Engineering     |
| ME4225  | Industrial Heat Transfer              |
| ME4226  | Energy and Thermal Systems Analysis   |
| ME4227  | Internal Combustion Engines           |
| ME5207◇ | Solar Energy Systems                  |
| ESP3401 | Photovoltaic Devices & Systems        |
| ESP4402 | Transport Phenomena in Energy Systems |

### **Offshore Oil and Gas Technology**

Students taking Offshore Oil and Gas Technology are required to take ALL modules in Group A and at least another TWO modules from Group B.

### Group A

|        |  |
|--------|--|
| GE3244 | Fundamentals in Petroleum Geoscience (Fulfil Breadth/UEM requirements) |
| ME4105 | Offshore Oil and Gas Technology  |

### Group B

|         |  |
|---------|--|
| ME3211  | Mechanics of Solids                    |
| ME3233  | Unsteady Flow in Fluid Systems         |
| ME4213  | Vibration Theory and Applications      |
| ME4245  | Robot Kinematics, Dynamics and Control |
| ME4254  | Materials in Engineering Design        |
| ME4261  | Tool Engineering                       |
| ME5506◇ | Corrosion of Materials                 |

◇ Stage 4 status and a CAP of more than 3.5 are needed in order to read Level-5000 modules.

## **Sample Semester Schedule**

Students may refer to Department of Mechanical Engineering website at <http://www.me.nus.edu.sg/current-students/program-overview/sample-schedules> for the updated copy of the sample semester schedule for their reference. The scheduling of the modules is a reference guide and may be subject to changes without prior notice.