

# 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 emphasises 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
- 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 read 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). 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 15 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
  - 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 to
  - <http://me.nus.edu.sg/current-students/b-eng-me-programme/specialisations-for-2015/>

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 AY2016/17 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>
General Education Modules (GE) (5 Modules, each of 4MCs) <ul style="list-style-type: none"> <li>• Human Cultures (GEH)</li> <li>• Quantitative Reasoning (GER)</li> <li>• Thinking and Expression (GET)</li> <li>• Singapore Studies (GES)</li> <li>• Asking Questions (GEQ)</li> </ul>	20
<b>Unrestricted Electives**</b>	<b>20</b>
<b>Programme Requirements</b>	
<b>Faculty Requirements</b>	<b>11</b>
( ES1531 or equivalent) Critical Thinking & Writing <sup>1</sup>	4
ES2331 Communicating Engineering	4
EG2401 Engineering Professionalism	3
ES1xxx English <sup>2</sup>	-
<b>Foundation Requirements</b>	<b>28</b>
MA1505 Mathematics I	4
MA1506 Mathematics II	4
PC1431 Physics IE	4
CS1010E Programming Methodology	4
EG1111 Engineering Principles & Practice I	6
EG1112 Engineering Principles & Practice II	6

<b>MODULAR REQUIREMENTS</b>	<b>MCs</b>
<b>Mechanical Engineering Major Requirements</b>	
<b>ME Core Subjects</b>	<b>36</b>
ME2112 Strength of Materials	4
ME2121 Engineering Thermodynamics	4
ME2134 Fluid Mechanics I	4
ME2142 Feedback Control Systems	4
ME2151 Principles of Mechanical Engineering Materials	4
ME3112 Mechanics of Machines	4
ME3162 Manufacturing Processes	4
Professional Development (Students in iRP pathway will read 2 Level-5000 modules)	8
<b>ME Design and Project Modules</b>	<b>18</b>
ME2102 Engineering Innovation and Modelling	4
ME3103 Mechanical Systems Design	6
ME4101A B.Eng. Dissertation (Over 2 semesters)	8
<b>EG3601 Industrial Attachment Programme<sup>3</sup></b>	<b>12</b>
<b>ME Electives</b>	

<b>MODULAR REQUIREMENTS</b>	<b>MCs</b>
Technical Electives (from Table 3.2.10b)	15
<b>Total</b>	<b>160</b>

<sup>1</sup> BEng students are required to read a Critical Thinking & Writing module (ES1531) and a Communications module (ES2331). Alternatively, students can read ES1501X Academic Expository Writing in place of both ES1531 and ES2331.

USP/UTRP/RVRC students should refer to their respective programmes for USP/UTRP/RVRC modules to be read in place of ES1531 and/or ES2331.

<sup>2</sup> 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 ES1103. This will be decided by CELC.

<sup>3</sup> For BEng students who are from direct poly intake and in the following special programmes: DDPs, CDPs, GEP & CSP, internship / industrial-attachment is optional and the modular credits for the internship/industrial-attachment will become 'Free Electives' i.e., Unrestricted Electives (UE).

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

#### Applied Mechanics

ME2114 Mechanics of Materials

ME3211 Mechanics of Solids

ME4212 Aircraft Structures

ME4213 Vibration Theory and Applications

ESP3206 Continuum Mechanics

#### Control and Mechatronics

ME2143 Sensor and Actuators

ME3241 Microprocessor Applications

ME3242 Automation

ME4241 Aircraft Performance and Stability

ME4245 Robot Mechanics and Control

ME4246 Modern Control System

ME5405<sup>◊</sup> Machine Vision

#### Fluid Mechanics

ME2135 Fluid Mechanics II

ME3232 Compressible Flow

ME3233 Unsteady Flow in Fluid Systems

ME4231 Aerodynamics and Propulsion

ME4233 Computational Methods in Fluid Mechanics

ME5304<sup>◊</sup> Experimental Fluid Mechanics

ME5305<sup>◊</sup> Fundamentals of 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

Materials Science

ME3251 Materials for Engineers  
ME4253 Biomaterials Engineering  
ME4255 Materials Failure  
ME4256 Functional Materials and Devices

Micro Systems Technology

ME3281 Microsystems Design and Applications

Thermodynamics

ME3122 Heat Transfer  
ME3221 Sustainable Energy Conversion  
ESP3401 Photovoltaic Devices & Systems  
ME4223 Thermal Environmental Engineering  
ME4225 Applied Heat Transfer  
ME4226 Energy and Thermal Systems  
ME4227 Internal Combustion Engine  
ESP4401 Optimization of Energy Systems

Multidisciplinary

ME3291 Numerical Methods in Engineering  
ME4291 Finite Elements Analysis

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

Students are advised to refer to Department of Mechanical Engineering website at

- <http://me.nus.edu.sg/current-students/b-eng-me-programme/specialisations-for-2015/>

for latest updated information related to specialisations.

**Aeronautical Engineering**

Students taking the Aeronautical Engineering Specialisation must read ME2135 Fluid Mechanics II, select TWO modules from Group A and TWO modules from Group B and present their FYP in a poster session.

**Compulsory**

ME2135 Fluid Mechanics II

**Group A**

ME3232 Compressible Flow  
ME4231 Aerodynamics and Propulsion  
ME4241 Aircraft Performance and Stability  
ME5305<sup>o</sup> Fundamentals of Aeroelasticity

**Group B**

ME4212 Aircraft Structures

ME4233 Computational Methods in Fluids Mechanics  
ME4291 Finite Element Analysis  
ME5304<sup>◇</sup> Experimental Fluid Mechanics

### **Energy and Sustainability**

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

ME3221 Sustainable Energy Conversion  
ME4223 Thermal Environmental Engineering  
ME4225 Applied Heat Transfer  
ME4226 Energy and Thermal Systems  
ME4227 Internal Combustion Engines  
ME5205<sup>◇</sup> Energy Engineering  
ME5207<sup>◇</sup> Solar Energy Systems  
ME5516<sup>◇</sup> Emerging Energy Conversion and Storage Technologies  
ESP3401 Photovoltaic Devices & Systems  
ESP4401 Optimization of Energy Systems  
ESP4402 Transport Phenomena in Energy Systems

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

Students taking the Offshore Oil and Gas Technology specialisation must read ME2135 Fluid Mechanics II, take all the modules from Group A and select at least TWO modules from Group B.

#### **Group A**

GE3244 Fundamentals in Petroleum Geoscience (Fulfil UEM requirements)  
ME2135 Fluid Mechanics II  
ME4105 Specialisation Study Module (Offshore Oil and Gas Technology)

#### **Group B**

ME3211 Mechanics of Solids  
ME3233 Unsteady Flow in Fluid Systems  
ME4213 Vibration Theory and Applications  
ME4245 Robot Mechanics and Control  
ME4254 Materials in Engineering Design  
ME4261 Tool Engineering  
ME5506<sup>◇</sup> Corrosion of Materials

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

## **3.2.10.3 Sample Semester Schedule**

Students may refer to Department of Mechanical Engineering website at <http://me.nus.edu.sg/current-students/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 subject to changes without prior notice.