

## **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
- 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.

The curriculum also features an enhanced breadth component comprising Breadth modules, General Education Modules (GEMs) and Unrestricted Elective Modules (UEMs). These are intended to broaden the outlook of the students and develop broad based skills that complement the professional training of the programme. At the same time, they also offered students greater scope and flexibility to tailor their learning to suit their individual needs for depth and breadth, and even to pursue their personal interest beyond the confines of their chosen major.

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 here [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 161 MCs with a CAP  $\geq 2.0$ .
- Pass the modules in accordance with Table 3.2.10a.
- Pass at least 20 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 (12MCs) 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 AY2013/14)**

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 LEVEL REQUIREMENTS</b>	<b>20</b>
General Education Modules (GEM) (at least one from Group B: Humanities and Social Sciences)	8
Singapore Studies (SS) Module	4
Breadth: Modules Outside Student's Faculty	8
<b>UNRESTRICTED ELECTIVES MODULES</b>	<b>20</b>
<b>PROGRAMME REQUIREMENTS</b>	
<b>Faculty Requirements</b>	<b>10</b>
ES1531 Critical Thinking and Writing	4
HR2002 Human Capital in Organizations	3
EG2401 Engineering Professionalism	3
ES2331 Communicating Engineering (can be counted as Breadth or UEM)	4
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

MODULAR REQUIREMENTS	MCs
<b>Mechanical Engineering Major Requirements</b>	
<b>ME Core Subjects:</b>	<b>41</b>
ME2113 Mechanics of Materials I	3
ME2114 Mechanics of Materials II	3
ME2121 Engineering Thermodynamics	3
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>27</b>
ME2101 Fundamentals of Mechanical Design	4
ME2103 Engineering Visualisation and Modelling	3
ME3101 Mechanical Systems Design I	4
ME3102 Mechanical Systems Design II	4
ME4101 B.Eng. Dissertation (Over 2 semesters)	12
<b>ME Electives:</b>	
<b>Technical Electives (from Table 3.2.10b)</b>	<b>20</b>
Total	161

\*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>◇</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<sup>◇</sup> 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<sup>◇</sup> Corrosion of Materials

<sup>◇</sup> 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.