Overview

At the undergraduate level, the Department of Materials Science & Engineering offers a four-year engineering curriculum leading to a Bachelor of Engineering degree in Materials Science and Engineering (MSE). This is a professional engineering programme, which prepares students for work as a Materials Engineer in different industries and for further study for postgraduate degrees.

This programme consists of many components – University Level Requirements, Unrestrictive Electives, Engineering Core Courses Requirements, and MSE Programme Requriemetns, in order to provide a broad education. The Common and Major Requirements are well-balanced in science, general engineering, and materials science and engineering. MSE graduates will have a solid science foundation, basic engineering background and sound knowledge in materials science and engineering.

Degree Requirements

The following are the requirements for the degree of B.Eng. (Materials Science and Engineering):

All Students

- Students should **not read more than 60 units of level 1000 courses** towards their degree requirements.
- Satisfy all other requirements as prescribed by the College of Design and Engineering or the University.
- A student must also satisfy other additional requirements that may be prescribed by the College of Design and Engineering or the University.

Table 1: Summary of MSE Course Requirements and Credits for A-Level Intake

Course Requirements	Units
COMMON CURRICULUM REQUIREMENTS [1]	**40**
Singapore Studies	4
Cultures and Connections	4
Communities and Engagement	4
Critique and Expression	4
Digital Literacy	4
Data Literacy	4
Design Thinking	4
Maker Space	4
Artificial Intelligence	4
Project Management	4
MAJOR REQUIREMENTS	**80**
Engineering Core	**20**
MA1511 Engineering Calculus	2
MA1512 Differential Equations for Engineering	2
MA1513 Linear Algebra with Differential Equations	2
CE2407A Uncertainty Analysis for Engineers	2
EG2401A Engineering Professionalism	2
EG3611A Industrial Attachment [4]	10
Major Programme	**60**
MLE1001B Materials Science & Engineering Principles & Practice I [5]	4
MLE2001A Materials Science & Engineering Principles & Practice II [5]	4
MLE2102 Thermodynamics and Renewable Energy Technologies	4
MLE2103A Materials Kinetics & Processing	2
MLE2105 Electronic Properties of Materials	4
MLE2108 Mechanical and Structural Properties of Materials	4
MLE3101A Materials Characterization	3

MLE3101 Materials Characterization Laboratory	3
MLE3103 Materials Design: Aerospace to Biomedical Applications	4
MLE3104 Polymeric and Composite Materials	4
MLE3111A Materials Properties and Processing Laboratory	2
MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3203 Engineering Materials	4
Integrated Project (MLE4101B B.Eng. Dissertation or MLE4102A Design Project) [6]	8
Two Technical Elective at any level (3000--5000) [2]	8
UNRESTRICTED ELECTIVES	**40**
Build Your Own Degree [3]	
TOTAL	**160**

[1] See Table 3

[2] See Table 4

[3] See https://www.eng.nus.edu.sg/mse/undergraduate/build-your-own-degree/.

[4] EG3611A can be replaced by:
EG3612 Vacation Industrial attachment (6 Units) + either
CFG2101 NUS Vacation Internship Programme (4 Units) or
CDE2605 Undergraduate Research Opportunities Programme (4 Units) or
CDE2605R Undergraduate Research Experience (4 Units)

[5] - Students from other Engineering majors who transfer into MSE are allowed to map the Gateway courses taken in their previous Engineering majors to the Gateway courses in MSE (MLE1001B and MLE2001A).
- One level 1000 Gateway course can be mapped to the level 1000 MSE Gateway course (MLE1001B) and one level 2000 Gateway course can be mapped to the level 2000 MSE Gateway course (MLE2001A). Exception for Environmental Engineering which has two level 2000 Gateway courses. ESE2101 can be mapped to level 1000 MSE Gateway course (MLE1001B), ESE2102 can be mapped to the level 2000 MSE Gateway course (MLE2001A).
- Students who are not taking MLE2001A due to mapping from other level 2000 Gateway course are required to take MLE2301 Introduction to Materials, which will count as a technical elective.

[6] EG4301 is a 12 Units course that forms part of the Innovation and Design Second Major. Students taking this will fulfil the Integrated Project (8 Units) and an additional 4 Units of Unrestricted Electives.

Table 2: Summary of MSE Course Requirements and Credits for Poly Intake [6]

Course Requirements	Units
COMMON CURRICULUM REQUIREMENTS [1]	**32**
Singapore Studies	4
Cultures and Connections	4
Communities and Engagement	4
Critique and Expression	4
Digital Literacy	4
Data Literacy	4
Artificial Intelligence	4
Project Management	4
MAJOR REQUIREMENTS	**70**
Engineering Core	**10**
MA1511 Engineering Calculus	2
MA1512 Differential Equations for Engineering	2
MA1513 Linear Algebra with Differential Equations	2
CE2407A Uncertainty Analysis for Engineers	2
EG2401A Engineering Professionalism	2
Major Programme	**60**
MLE1001B Materials Science & Engineering Principles & Practice I [4]	4
MLE2001A Materials Science & Engineering Principles & Practice II [4]	4
MLE2102 Thermodynamics and Renewable Energy Technologies	4
MLE2103A Materials Kinetics & Processing	2
MLE2105 Electronic Properties of Materials	4
MLE2108 Mechanical and Structural Properties of Materials	4
MLE3101A Materials Characterization	3
MLE3101 Materials Characterization Laboratory	3
MLE3103 Materials Design: Aerospace to Biomedical Applications	4
MLE3104 Polymeric and Composite Materials	4
MLE3111A Materials Properties and Processing Laboratory	2
MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3203 Engineering Materials	4
Integrated Project (MLE4101B B.Eng. Dissertation or MLE4102A Design Project) [5]	8
Two Technical Elective at any level (3000--5000) [2]	8
UNRESTRICTED ELECTIVES	**20**
Build Your Own Degree	
TOTAL	**122**

[1] See Table 3

[2] See Table 4

[3] See https://www.eng.nus.edu.sg/mse/undergraduate/build-your-own-degree/.

[4] - Students from other Engineering majors who transfer into MSE are allowed to map the Gateway courses taken in their previous Engineering majors to the Gateway courses in MSE (MLE1001B and MLE2001A).
- One level 1000 Gateway course can be mapped to the level 1000 MSE Gateway course (MLE1001B) and one level 2000 Gateway course can be mapped to the level 2000 MSE Gateway course (MLE2001A). Exception for Environmental Engineering which has two level 2000 Gateway courses. ESE2101 can be mapped to level 1000 MSE Gateway course (MLE1001B), ESE2102 can be mapped to the level 2000 MSE Gateway course (MLE2001A).

- Students who are not taking MLE2001A due to mapping from other level 2000 Gateway course are required to take MLE2301 Introduction to Materials, which will count as a technical elective.

[5] EG4301 is a 12 Units course that forms part of the Innovation and Design Second Major. Students taking this will fulfil the Integrated Project (8 Units) and an additional 4 Units of Unrestricted Electives.

[6] Based on those **granted 38 Units of Advanced Placement Credits (APC)**: UE (20 Units), Industrial Attachment (10 Units), EG1311 (4 Units), DTK1234 (4 Units). **Requirements vary depending on the APC granted.**

Table 3: Catalogue of Courses in Common Curriculum

Common Curriculum Pillar	Basket of Courses [1]
Singapore Studies	CDE2501 Liveable Cities
Cultures and Connections	Students may read any course from the curated list of courses as approved by the NUS General Education Committee for this pillar (GEC).
Communities and Engagement	Students may read any course from the curated list of courses as approved by the NUS General Education Committee for this pillar (GEN).
Critique and Expression	ES2631 Critique and Communication of Thinking and Design
Digital Literacy	CS1010E Programming Methodology
Data Literacy	GEA1000 Quantitative Reasoning with Data
Design Thinking	DTK1234 Design Thinking
Maker Space	EG1311/EG1311BE Design and Make
Artificial Intelligence	EE2211 Introduction to Machine Learning or EE2213 Introduction to Artificial Intelligence
Project Management	PF1101A Project Management & Finance

[1] The listing of courses is expected to grow and evolve over time, to suit curricular needs

Table 4: List of Technical Elective Courses

List of Technical Elective Courses
MLE2301 Introduction to Materials Science & Engineering **(not applicable to those who take MLE1001B, MLE2001A)**
MLE3102 Degradation and Failure of Materials / MLE4224 Degradation and Failure of Materials **(MLE3102 recoded to MLE4224 wef AY25/26 Sem 2)**
MLE3105 Dielectric and Magnetic Materials
MLE3202 Materials for Biointerfaces / MLE4239 Materials for Biointerfaces **(MLE3202 recoded to MLE4239 wef AY26/27 Sem 1)**
MLE4201 Advanced Materials Characterisation
MLE4202 Selected advanced Topics on Polymers
MLE4203 Polymeric Biomedical Materials
MLE4204 Synthesis and Growth of Nanostructures
MLE4205 Theory & Modelling of Material Properties
MLE4206 Current topics on Nanomaterials
MLE4207 Microfabrication Process and Technology
MLE4208 Photovoltaic Materials
MLE4210 Materials for Energy Storage and Conversion
MLE4211 Nanoelectronics and information technology
MLE4212 Advanced Structural Materials
MLE4213 Innovation & Product Development for Material Engineers
MLE4217 Application of Big Data in Materials Science
MLE4218 AI for Biomaterials Discovery
MLE4219 Materials for Optics: from Quantum Light to Nanodevices
MLE4220 Two-Dimensional Materials
MLE4221 Emerging materials for renewable fuels and clean water
MLE4222 Electron transport in novel quantum materials
MLE4225 Electro-active Materials for Sustainability
MLE4227 Sustainable Water Harvesting Technologies
MLE4228 Robotics Materials
MLE4230 Current Topics in Materials AI
MLE4231 Optoelectronics with Organics and Nanocrystals
MLE5215 Atomistic Modelling of Molecules and Materials **(open to those with level 4 standing and minimum GPA of 3.5)**
MLE5220 Finite element method in materials: basic concepts and problem solving **(open to those with level 4 standing and minimum GPA of 3.5)**
MLE5223 Rational Materials Design for Sustainability **(open to those with level 4 standing and minimum GPA of 3.5)**
MLE5245 Materials for CO2 Renewal **(open to those with level 4 standing and minimum GPA of 3.5)**

Specialization in NANOSTRUCTURED MATERIALS & NANOTECHNOLOGY (minimum 20 Units)

FYP in related area

Select electives courses from list below

MLE4201	Advanced Materials Characterisation
MLE4204	Synthesis and Growth of Nanostructures
MLE4205	Theory & Modelling of Material Properties
MLE4206	Current topics on Nanomaterials
MLE4207	Microfabrication Process and Technology
MLE4208	Photovoltaics Materials
MLE4210	Materials for Energy Storage and Conversion
MLE4211	Nanoelectronics and information technology
MLE4220	Two-Dimensional Materials
PC4253	Thin Film Technology
CN4223R	Microelectronic Thin Films

Specialization in ARTIFICIAL INTELLIGENCE IN MSE (minimum 20 Units)

EE2211 Introduction to Machine Learning

Select electives courses from list below

MLE4101B	B.Eng. Dissertation in related area (only 4 Units will count towards the specialization)
MLE4217	Application of Big Data in Materials Science
MLE4218	AI for Biomaterials Discovery
MLE4230	Current Topics in Materials AI
MLE5215	Atomistic Modelling of Molecules and Materials **(open to those with level 4 standing and minimum GPA of 3.5)**
MLE5223	Rational Materials Design for Sustainability **(open to those with level 4 standing and minimum GPA of 3.5)**

Specialization in BIOMEDICAL MATERIALS (minimum 20 Units)

Select electives courses from list below

MLE3202/ MLE4239	Materials for Biointerfaces **(MLE3202 recoded to MLE4239 wef AY26/27 Sem 1)**
MLE4203	Polymeric Biomedical Materials
MLE4201	Advanced Materials Characterisation
BN3301	Introduction to Biomaterials
BN4404	Bioelectromechanical Systems – Biomems
BN5201	Advanced Biomaterials
BN2001	Independent Study [Footnote 1]
CDE2605	Undergraduate Research Opportunities Programme (UROP) [Footnote1]
BN4101	B.Eng. Dissertation in related area (8 Units) or MLE4101B B.Eng. Dissertation in related area (8 Units) or MLE4101 B.Eng. Dissertation in related area (only 8 Units will count towards the specialization)

[Footnote1]
The projects involved in this course must be approved by the Head (or Deputy Head or Specialisation Coordinator) of the student's home Department to be in the area of biomedical materials in order to count towards the specialisation.

* Prerequisites of MLE courses can be waived for Non-MSE students. They are recommended to take MLE2301 Introduction to Materials Science & Engineering

Specialization in MATERIALS FOR RENEWABLE ENERGY AND SUSTAINABILITY (minimum 20 Units)

MLE2102 Thermodynamics and Renewable Energy Technologies

Select electives courses from list below

MLE3102/ MLE4224	Degradation and Failure of Materials **(MLE3102 recoded to MLE4224 wef AY25/26 Sem 2)**
MLE4208	Photovoltaic Materials
MLE4210	Materials for Energy Storage and Conversion
MLE4221	Emerging materials for renewable fuels and clean water
MLE4225	Electro-active Materials for Sustainability
MLE4227	Sustainable Water Harvesting Technologies
MLE4101B	B.Eng Dissertation in related area or an equivalent two semester research project in a related area as approved by the Head of Department, Materials Science & Engineering (only 4 Units from the project will count towards the specialization)
MLE5245	Materials for CO_2 Removal **(open to those with level 4 standing and minimum GPA of 3.5)**

Specialization in ROBOTICS (minimum 20 Units)

You spend the first two years building a solid foundation in engineering. Specialisation starts from Stage 3, when you read related technical electives as shown below. In Stage 4, you select a Final Year Project (FYP) that is related to robotics.

Must complete

(1) 12 Units from basket of courses AND complete a Final Year Project (8 Units) in the area of Robotics
OR
(2) 20 Units from basket of courses

Basket of courses:

BN4203 Robotics in Rehabilitation
BN4207 Microbotics
BN4601 Intelligent Medical Robotics
EE4115 Remote Sensing & Analysis with Deep Learning Techniques
EE4308 Autonomous Robot Systems
EE4309 Robot Perception
EE4311 Fuzzy Logic and Neuro Fuzzy Systems
EE4312 Artificial Neural Networks
EE4314 Eyes from above: Guidance, Navigation and Control
EE4705 Human-Robot Interaction
ME4242 Soft Robotics
ME3243/EE3305 Robotic System Design
ME4245 Robot Mechanics and Control
ME5406* Deep Learning for Robotics
MLE4228 Robotic Materials
RB4301 Robot Learning

* Only Stage 4 students with GPA >= 3.5 are allowed to read level 5000 courses.

To guide students in choosing the elective courses in a focused manner, the elective courses are arranged in three tracks. Students are encouraged to choose their three elective courses within the same track. However, students are allowed to "mix-and-match" the electives outside these tracks.

Track 1: Smart Mechanism Design	**Track 2: Robot Intelligence**	**Track 3: Collaborative Systems**
Robot Mechanics and Control	Autonomous Robot Systems	Robot Perception
Intelligent Medical Robotics	Fuzzy/Neural Systems for Intelligent Robotics	Human-Robot Interaction
Soft Robotics	Robot Perception	Soft Robotics
Robotic System Design	Robot Mechanics and Control	Robotics in Rehabilitation
Materials for Robotic Sensing and Actuation	Deep Learning for Robotics	Deep Learning for Robotics

Artificial Neural Networks	Robotic System Design	Robotic System Design
Microbotics	Robotic Materials	Robotics Materials
	Fuzzy Logic and Neuro Fuzzy Systems	
	Remote Sensing & Analysis with Deep Learning Techniques	
	Eyes from above: Guidance, Navigation and Control	
	Robot Learning	

* Prerequisites of MLE courses can be waived for Non-MSE students. They are recommended to take MLE2301 Introduction to Materials Science & Engineering

Specialization in MICROELECTRONICS AND QUANTUM MATERIALS (minimum 20 Units)

MLE2105 Electronic Properties of Materials

EE2027 Electronic Circuits

Select electives courses from list below

EE3431C	Microelectronics Materials and Devices
EE4409	Modern Microelectronic Devices & Sensors
EE4435	Modern Transistors and Memory Devices
EE4437	Photonics – Principles and Application
EE4438	Solar Cells and Modules
MLE3105	Dielectric and Magnetic Materials
MLE4201	Advanced Materials Characterisation
MLE4207	Microfabrication Process and Technology OR EE4436 Fabrication Process Technology
MLE4219	Materials for Optics: from Quantum Light to Nanodevices
MLE4220	Two-Dimensional Materials
MLE4222	Electron transport in novel quantum materials
MLE4101B	B.Eng. Dissertation in related area / EE4002D in related area / EE4002R in related area or an equivalent two semester research project in a related area as approved by the Head of Department for either Materials Science & Engineering or Electrical & Computer Engineering;

(only 4 Units from the project will count towards the specialisation)

* Prerequisites of MLE courses can be waived for Non-MSE students. They are recommended to take MLE2301 Introduction to Materials Science & Engineering

Table 5: Recommended Semester Schedule for A-Level Intake

If physics bridging course (PC1201) or chemistry bridging course (CM1417) is required in semester 1, push GEA1000 to semester 3.

If both bridging courses are required in semester 1, push GEA1000, CE2407A and MA1513 to semester 3.
EE2211 will be pushed to semester 5 as CE2407A and MA1513 need to be cleared before reading EE2211.

Course	Units	Course	Units
Semester 1		**Semester 2**	
MLE2001A Materials Science & Engineering Principles & Practice II	4	MLE1001B Materials Science & Engineering Principles & Practice I	4
CE2407A Uncertainty Analysis for Engineers	2	CS1010E Programming Methodology	4
DTK1234 Design Thinking	4	EG1311/EG1311BE Design and Make	4
GEA1000 Quantitative Reasoning with Data	4	MA1511 Engineering Calculus	2
MA1513 Linear Algebra with Differential Equations	2	MA1512 Differential Equations for Engineering	2
PF1101A Project Management & Finance	4	MLE2108 Mechanical and Structural Properties of Materials	4
Sub-total	**20**	**Sub-total**	**20**
Semester 3		**Semester 4**	
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
EE2211 Introduction to Machine Learning or EE2213 Introduction to Artificial Intelligence	4	ES2631 Critique and Communication of Thinking and Design	4
EG2401A Engineering Professionalism	2	CDE2501 Liveable Cities	4
MLE3101A Materials Characterization	3	GEC/GEN	4
UE	4	UE	4
UE	4		
Sub-total	**21**	**Sub-total**	**20**
Semester 5		**Semester 6**	
MLE2103A Materials Kinetics & Processing	2	EG3611A Industrial Attachment *	10
MLE3101 Materials Characterization Laboratory	3	MLE Technical Elective	4
MLE3104 Polymeric and Composite Materials	4	UE	4
MLE3203 Engineering Materials	4		
UE	4		
UE	4		
Sub-total	**21**	**Sub-total**	**18**
Semester 7		**Semester 8**	
MLE4101B B.Eng. Dissertation or MLE4102A Design Project (over two semesters)	4	MLE4101B B.Eng. Dissertation or MLE4102A Design Project (over two semesters)	4
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3111A Materials Properties and Processing Laboratory	2	UE	4
GEC/GEN	4	UE	4
MLE Technical Elective	4	UE	4
		UE	4
Sub-total	**18**	**Sub-total**	**22**
Total Units			**160**

* EG3611A
- Students are highly encouraged to complete MLE3101A Materials Characterization and MLE3101 Materials Characterization Laboratory (in semester 5 or map from SEP) before doing EG3611A Industrial Attachment in semester 6.
- Can be replaced by:

EG3612 Vacation Industrial attachment (6 Units) + either
CFG2101 NUS Vacation Internship Programme (4 Units) or
CDE2605 Undergraduate Research Opportunities Programme (4 Units) or
CDE2605R Undergraduate Research Experience (4 Units)

Table 6: Recommended Semester Schedule for Poly Intake

Assumes 38 Units of Advanced Placement Credits are granted and physics bridging course (PC1201) is required.

If maths bridging course (MA1301) is required in semester 1, push CE2407A and MA1513 to semester 3.
EE2211 will be pushed to semester 5 as CE2407A and MA1513 need to be cleared before reading EE2211.

Course	Units	Course	Units
Semester 1		**Semester 2**	
MLE2001A Materials Science & Engineering Principles & Practice II	4	MLE1001B Materials Science & Engineering Principles & Practice I	4
CE2407A Uncertainty Analysis for Engineers	2	CS1010E Programming Methodology	4
PC1201 Fundamentals of Physics	4	UE	4
GEA1000 Quantitative Reasoning with Data	4	MA1511 Engineering Calculus	2
MA1513 Linear Algebra with Differential Equations	2	MA1512 Differential Equations for Engineering	2
PF1101A Project Management & Finance	4	MLE2108 Mechanical and Structural Properties of Materials	4
Sub-total	**20**	**Sub-total**	**20**
Semester 3		**Semester 4**	
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
EE2211 Introduction to Machine Learning or EE2213 Introduction to Aritificial Intelligence	4	ES2631 Critique and Communication of Thinking and Design	4
EG2401A Engineering Professionalism	2	CDE2501 Liveable Cities	4
MLE3101A Materials Characterization	3	GEC/GEN	4
MLE2103A Materials Kinetics & Processing	2	MLE Technical Elective	4
MLE3101 Materials Characterization Laboratory	3		
Sub-total	**18**	**Sub-total**	**20**
Semester 5		**Semester 6**	
MLE4101B B.Eng. Dissertation or MLE4102A Design Project (over two semesters)	4	MLE4101B B.Eng. Dissertation or MLE4102A Design Project (over two semesters)	4
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3111A Materials Properties and Processing Laboratory	2	GEC/GEN	4
MLE3104 Polymeric and Composite Materials	4	UE	4
MLE3203 Engineering Materials	4	UE	4
MLE Technical Elective	4	UE	4
Sub-total	**22**	**Sub-total**	**22**
Total Units			**122**

Last update: 2 Dec 2025