

**Bachelor of Engineering (Materials Science & Engineering)
with Second Major in Innovation & Design**

Cohort AY2023/2024

Course Requirements	Units
Common Curriculum	
GEA1000 Quantitative Reasoning with Data	4
CS1010E Programming Methodology	4
ES2631 Critique and Communication of Thinking and Design ¹	4
GE: Cultures and Connections ¹	4
GE: Singapore Studies ¹	4
GE: Communities and Engagement ¹	4
CDE2000 Creating Narratives	4
CDE2501 Liveable Cities	4
DTK1234 Design Thinking	4
EE2211 Introduction to Machine Learning	4
EG1311 Design and Make	4
IE2141 Systems Thinking and Dynamics	4
PF1101 Fundamentals of Project Management	4
CDE4301 Innovation & Design Capstone <u>or</u> CDE4301A Ideas to Start-up (over 2 consecutive semesters) ²	8
Sub-total for Common Curriculum	60
Engineering Core	
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 <u>or</u> CFG2101 NUS Vacation Internship Programme ³ <u>and</u> EG3612 Vacation Industrial Attachment	10
Sub-total for Engineering Core	20
Engineering Programme Requirements	
MLE1001B Materials Science & Engineering Principles & Practice I	4
MLE2001A Materials Science & Engineering Principles & Practice II	4
MLE2102 Thermodynamics and Renewable Energy Technologies	4
MLE2103A Materials Kinetics and Processing	2
MLE2105 Electronic Materials of Materials	4
MLE3101A Materials Characterization	3
MLE3101 Materials Characterization Laboratory	3
MLE3103 Materials Design: Aerospace to Biomedical Applications	4
MLE3111A Materials Properties and Processing Laboratory	2
MLE3112 Machine Learning Approaches in Materials Laboratory	2
Technical electives	8
Sub-total for Engineering Programme Requirements	40
Unrestricted Electives	
Group A course for Second Major	4
Group B course for Second Major	4
Group C courses for Second Major (Innovation & Enterprise electives)	8
CDE3301/EG3301R Ideas to Proof-of-Concept (over 2 consecutive semesters)	12
CDE4301 Innovation & Design Capstone <u>or</u> CDE4301A Ideas to Start-up (over 2 consecutive semesters) ²	4

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Other unrestricted electives	8
Sub-total for Unrestricted Electives	40
Total	160

Notes:

- ¹ Students may read equivalent courses in NUS College (NUSC), University Town College Programme (UTCP), and Ridge View Residential Programme (RVRC).
- ² The 12 units for CDE4301/CDE4301A are counted towards 8 units for the Integrated Project requirement in the Common Curriculum while 4 units are counted as unrestricted elective.

The 12 units for CDE4301/CDE4301A will be fully counted as UE for students who are pursuing a specialisation with MLE4101B B.Eng. Dissertation (8 units) as a compulsory requirement to fulfil Integrated Project.

- ³ May be replaced by CDE2605 Undergraduate Research Opportunities Programme or CDE2605R Undergraduate Research Experience (UREx).

Recommended semester schedule – JC-intake students or equivalent
(for students who opt for vacation internships)

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	CS1010E Programming Methodology	4
DTK1234 Design Thinking	4	EG1311 Design & Make	4
MA1513 Linear Algebra with Differential Equations	2	MA1511 Engineering Calculus	2
CE2407A Uncertainty Analysis for Engineers	2	MA1512 Differential Equations for Engineering	2
PF1101 Fundamentals of Project Management	4	Group A/B course for Second Major	4
Sub-total	20	Sub-total	20

Summer vacation between Semesters 2 and 3	Units
CFG2101 NUS Vacation Internship Programme	4
Sub-total	4

Semester 3	Units	Semester 4	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
CDE2501 Liveable Cities	4	ES2631 Critique and Communication of Thinking and Design	4
EE2211 Introduction to Machine Learning	4	IE2141 Systems Thinking & Dynamics	4
EG2401A Engineering Professionalism	2	GE	4
GE	4	CDE3301/EG3301R Ideas to Proof-of-Concept	6
Group A/B course for Second Major	4		
Sub-total	22	Sub-total	22

Summer vacation between Semesters 4 and 5	Units
EG3612 Vacation Internship Attachment	6
Sub-total	6

Semester 5	Units	Semester 6 – can be used for SEP	Units
CDE3301/EG3301R Ideas to Proof-of-Concept	6	Innovation & Enterprise Elective 1	4
MLE2103A Materials Kinetics and Processing	2	Innovation & Enterprise Elective 2	4
MLE3101A Materials Characterization	3	Technical Elective 1	4
MLE3101 Materials Characterization Laboratory	3	Technical Elective 2	4
GE	4	UE	4
Sub-total	18	Sub-total	20

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Semester 7	Units	Semester 8	Units
CDE4301 Innovation & Design Capstone	6	CDE4301 Innovation & Design Capstone	6
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
CDE2000 Creating Narratives	4		
Sub-total	16	Sub-total	12

Recommended semester schedule – JC-intake students or equivalent
(for students who opt for vacation internships **plus a specialisation**)

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	CS1010E Programming Methodology	4
DTK1234 Design Thinking	4	EG1311 Design & Make	4
MA1513 Linear Algebra with Differential Equations	2	MA1511 Engineering Calculus	2
CE2407A Uncertainty Analysis for Engineers	2	MA1512 Differential Equations for Engineering	2
PF1101 Fundamentals of Project Management	4	Group A/B course for Second Major	4
Sub-total	20	Sub-total	20

Summer vacation between Semesters 2 and 3	Units
CFG2101 NUS Vacation Internship Programme	4
Sub-total	4

Semester 3	Units	Semester 4	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
CDE2501 Liveable Cities	4	ES2631 Critique and Communication of Thinking and Design	4
EE2211 Introduction to Machine Learning	4	IE2141 Systems Thinking & Dynamics	4
EG2401A Engineering Professionalism	2	GE	4
GE	4	CDE3301/EG3301R Ideas to Proof-of-Concept	6
Group A/B course for Second Major	4		
Sub-total	22	Sub-total	22

Summer vacation between Semesters 4 and 5	Units
EG3612 Vacation Internship Attachment	6
Sub-total	6

Semester 5	Units	Semester 6 – can be used for SEP	Units
CDE3301/EG3301R Ideas to Proof-of-Concept	6	Innovation & Enterprise Elective 1	4
MLE2103A Materials Kinetics and Processing	2	Innovation & Enterprise Elective 2	4
MLE3101A Materials Characterization	3	Specialisation course 1	4
MLE3101 Materials Characterization Laboratory	3	Specialisation course 2	4
GE	4	Specialisation course 3	4
Sub-total	18	Sub-total	20

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Semester 7	Units	Semester 8	Units
CDE4301 Innovation & Design Capstone	6	CDE4301 Innovation & Design Capstone	6
MLE4101B B.Eng. Dissertation #	4	MLE4101B B.Eng. Dissertation #	4
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3111A Materials Properties and Processing Laboratory	2		
CDE2000 Creating Narratives	4		
Sub-total	20	Sub-total	12

May be replaced by Specialisation Elective 4 and Specialisation Elective 5 if MLE4101B is not compulsory.

Recommended semester schedule – JC-intake students or equivalent
(for students who opt for industrial attachment)

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	CS1010E Programming Methodology	4
DTK1234 Design Thinking	4	EG1311 Design & Make	4
MA1513 Linear Algebra with Differential Equations	2	MA1511 Engineering Calculus	2
CE2407A Uncertainty Analysis for Engineers	2	MA1512 Differential Equations for Engineering	2
PF1101 Fundamentals of Project Management	4	Group A/B course for Second Major	4
Sub-total	20	Sub-total	20

Semester 3	Units	Semester 4	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
CDE2501 Liveable Cities	4	ES2631 Critique and Communication of Thinking and Design	4
EE2211 Introduction to Machine Learning	4	IE2141 Systems Thinking & Dynamics	4
EG2401A Engineering Professionalism	2	GE	4
GE	4	CDE3301/EG3301R Ideas to Proof-of-Concept	6
Group A/B course for Second Major	4		
Sub-total	22	Sub-total	22

Semester 5	Units	Semester 6	Units
CDE3301/EG3301R Ideas to Proof-of-Concept	6	EG3611A Industrial Attachment	10
MLE2103A Materials Kinetics and Processing	2		
MLE3101A Materials Characterization	3		
MLE3101 Materials Characterization Laboratory	3		
GE	4		
UE	4		
Sub-total	22	Sub-total	10

Semester 7	Units	Semester 8	Units
CDE4301 Innovation & Design Capstone	6	CDE4301 Innovation & Design Capstone	6
Innovation & Enterprise Elective 1	4	Innovation & Enterprise Elective 2	4
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3111A Materials Properties and Processing Laboratory	2	Technical Elective 1	4
CDE2000 Creating Narratives	4	Technical Elective 2	4
UE	4		
Sub-total	24	Sub-total	20

Recommended semester schedule – JC-intake students or equivalent
(for students who opt for industrial attachment **plus a specialisation**)

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	CS1010E Programming Methodology	4
DTK1234 Design Thinking	4	EG1311 Design & Make	4
MA1513 Linear Algebra with Differential Equations	2	MA1511 Engineering Calculus	2
CE2407A Uncertainty Analysis for Engineers	2	MA1512 Differential Equations for Engineering	2
PF1101 Fundamentals of Project Management	4	Group A/B course for Second Major	4
Sub-total	20	Sub-total	20

Semester 3	Units	Semester 4	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
CDE2501 Liveable Cities	4	ES2631 Critique and Communication of Thinking and Design	4
EE2211 Introduction to Machine Learning	4	IE2141 Systems Thinking & Dynamics	4
EG2401A Engineering Professionalism	2	GE	4
GE	4	CDE3301/EG3301R Ideas to Proof-of-Concept	6
Group A/B course for Second Major	4		
Sub-total	22	Sub-total	22

Semester 5	Units	Semester 6	Units
CDE3301/EG3301R Ideas to Proof-of-Concept	6	EG3611A Industrial Attachment	10
MLE2103A Materials Kinetics and Processing	2	Specialisation course 2	4
MLE3101A Materials Characterization	3		
MLE3101 Materials Characterization Laboratory	3		
GE	4		
Specialisation course 1	4		
Sub-total	22	Sub-total	14

Semester 7	Units	Semester 8	Units
CDE4301 Innovation & Design Capstone	6	CDE4301 Innovation & Design Capstone	6
Innovation & Enterprise Elective 1	4	Innovation & Enterprise Elective 2	4
MLE4101B B.Eng. Dissertation #	4	MLE4101B B.Eng. Dissertation #	4
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	Specialisation course 3	4
MLE3111A Materials Properties and Processing Laboratory	2	MLE3112 Machine Learning Approaches in Materials Laboratory	2
CDE2000 Creating Narratives	4		
Sub-total	24	Sub-total	20

May be replaced by Specialisation Elective 4 and Specialisation Elective 5 if MLE4101B is not compulsory.

Recommended semester schedule – JC-intake students or equivalent
(for students in year-long NOC programmes)

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	CS1010E Programming Methodology	4
DTK1234 Design Thinking	4	EG1311 Design & Make	4
MA1513 Linear Algebra with Differential Equations	2	MA1511 Engineering Calculus	2
CE2407A Uncertainty Analysis for Engineers	2	MA1512 Differential Equations for Engineering	2
PF1101 Fundamentals of Project Management	4	Group A/B course for Second Major	4
Sub-total	20	Sub-total	20

Semester 3	Units	Semester 4	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
CDE2501 Liveable Cities	4	ES2631 Critique and Communication of Thinking and Design	4
EE2211 Introduction to Machine Learning	4	IE2141 Systems Thinking & Dynamics	4
GE	4	GE	4
Group A/B course for Second Major	4	CDE3301/EG3301R Ideas to Proof-of-Concept	6
Sub-total	20	Sub-total	22

Semester 5	Units	Semester 6 – NOC	Units
CDE3301/EG3301R Ideas to Proof-of-Concept	6	NOC	
MLE2103A Materials Kinetics and Processing	2		
MLE3101A Materials Characterization	3		
MLE3101 Materials Characterization Laboratory	3		
MLE3103 Materials Design: Aerospace to Biomedical Applications	4		
MLE3111A Materials Properties and Processing Laboratory	2		
Sub-total	20	Sub-total	22

Semester 7 – NOC	Units	Semester 8	Units
NOC		MLE3112 Machine Learning Approaches in Materials Laboratory	2
		Technical Elective 1	4
		Technical Elective 2	4
		CDE2000 Creating Narratives	4
		GE	4
		UE	2
Sub-total	20	Sub-total	20

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A year-long NOC programme comprises the following courses:

- ETP3206L Innovation & Enterprise Internship (16 units) – replaces EG3611A (10 units), EG2401A (2 units), and UE (4 units)
- ETP3202L Innovation & Enterprise Case Study & Analysis (8 units) – replaces CDE4301A (8 units out of 12 units)
- ETP3203L Innovation & Enterprise Internship Practicum (8 units) – replaces CDE4301A (4 units out of 12 units) and UE (4 units)
- ETP2271 Discovering Resilience and Purpose (2 units) – counted as UE (2 units)
- Entrepreneurship courses (4 or 8 units) – replaces Innovation & Enterprise electives (up to 8 units – students will need to complete additional Innovation & Enterprise Electives in NUS if they are unable to complete 8 units of entrepreneurship courses during NOC)

Recommended semester schedule – JC-intake students or equivalent
(for students in one-semester NOC programmes)

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	CS1010E Programming Methodology	4
DTK1234 Design Thinking	4	EG1311 Design & Make	4
MA1513 Linear Algebra with Differential Equations	2	MA1511 Engineering Calculus	2
CE2407A Uncertainty Analysis for Engineers	2	MA1512 Differential Equations for Engineering	2
PF1101 Fundamentals of Project Management	4	Group A/B course for Second Major	4
Sub-total	20	Sub-total	20

Semester 3	Units	Semester 4	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	MLE2105 Electronic Properties of Materials	4
CDE2501 Liveable Cities	4	ES2631 Critique and Communication of Thinking and Design	4
EE2211 Introduction to Machine Learning	4	IE2141 Systems Thinking & Dynamics	4
GE	4	GE	4
Group A/B course for Second Major	4	CDE3301/EG3301R Ideas to Proof-of-Concept	6
Sub-total	20	Sub-total	22

Semester 5	Units	Semester 6 – NOC	Units
CDE3301/EG3301R Ideas to Proof-of-Concept	6	NOC	
MLE2103A Materials Kinetics and Processing	2		
MLE3101A Materials Characterization	3		
MLE3101 Materials Characterization Laboratory	3		
GE	4		
UE	4		
Sub-total	22	Sub-total	22

Semester 7	Units	Semester 8	Units
CDE4301 Innovation & Design Capstone	6	CDE4301 Innovation & Design Capstone	6
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3111A Materials Properties and Processing Laboratory	2	Technical Elective 1	4
CDE2000 Creating Narratives	4	Technical Elective 2	4
		UE	2
Sub-total	16	Sub-total	18

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A one-semester NOC programme comprises the following courses:

- ETP3201L Innovation & Enterprise Internship (12 units) – replaces EG3611A (10 units) and EG2401A (2 units)
- ETP3204S Innovation & Enterprise Internship Practicum (4 units) – replaces Innovation & Enterprise Elective 1 (4 units)
- Entrepreneurship course (4 units) – replaces Innovation & Enterprise Elective 2 (4 units)
- ETP2271 Discovering Resilience and Purpose (2 units) – counted as UE (2 units)

Recommended semester schedule – JC-intake students or equivalent
(for students in Engineering Scholars Programme)

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	MLE2105 Electronic Properties of Materials	4
DTK1234 Design Thinking	4	MA1512 Differential Equations for Engineering	2
MA1513 Linear Algebra with Differential Equations	2	UTCP course 2 (replaces GE)	4
CE2407A Uncertainty Analysis for Engineers	2	CDE3301/EG3301R Ideas to Proof-of-Concept	6
PF1101 Fundamentals of Project Management	4	Group A/B course for Second Major	4
UTCP course 1 (replaces GE)	4	UE (or IE2141 Systems Thinking & Dynamics if not in RC4)	4
Sub-total	24	Sub-total	28

Semester 3	Units	Semester 4 – NOC	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	NOC	
MLE2103A Materials Kinetics and Processing	2		
MLE3101A Materials Characterization	3		
MLE3101 Materials Characterization Laboratory	3		
CDE2501 Liveable Cities	4		
UTCP course 3 (replaces GE)	4		
CDE3301/EG3301R Ideas to Proof-of-Concept	6		
Sub-total	26	Sub-total	22

Semester 5	Units	Semester 6	Units
CDE4301 Innovation & Design Capstone	6	CDE4301 Innovation & Design Capstone	6
Group A/B course for Second Major	4	MLE3112 Machine Learning Approaches in Materials Laboratory	2
UTCP course 4 (replaces ES2631 Critique and Communication of Thinking and Design)	4	Technical Elective 1	4
EE2211 Introduction to Machine Learning	4	Technical Elective 2	4
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	CDE2000 Creating Narratives	4
MLE3111A Materials Properties and Processing Laboratory	2	UE	4
Sub-total	24	Sub-total	24

Students are highly encouraged to complete the following courses before Semester 1 through advanced placement credits:

- CS1010E Programming Methodology (4 units)
- EG1311 Design & Make (4 units)
- MA1505 Mathematics I (4 units) – replaces MA511 Engineering Calculus (2 units) and counted as UE (2 units)

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A one-semester NOC programme comprises the following courses:

- ETP3201L Innovation & Enterprise Internship (12 units) – replaces EG3611A (10 units) and EG2401A (2 units)
- ETP3204S Innovation & Enterprise Internship Practicum (4 units) – replaces Innovation & Enterprise Elective 1 (4 units)
- Entrepreneurship course (4 units) – replaces Innovation & Enterprise Elective 2 (4 units)
- ETP2271 Discovering Resilience and Purpose (2 units) – counted as UE (2 units)

Recommended semester schedule – poly-intake students

Semester 1	Units	Semester 2	Units
MLE1001B Materials Science & Engineering Principles & Practice I	4	MLE2001A Materials Science & Engineering Principles & Practice I	4
GEA1000 Quantitative Reasoning with Data	4	CS1010E Programming Methodology	4
MA1301 Introductory Mathematics * (UE)	4	MA1511 Engineering Calculus	2
PC1201 Fundamentals of Physics (UE)	4	MA1512 Differential Equations for Engineering	2
Group A/B course for Second Major	4	PF1101 Fundamentals of Project Management	4
		CDE3301/EG3301R Ideas to Proof-of-Concept	6
		Group A/B course for Second Major	4
Sub-total	20	Sub-total	26

Semester 3	Units	Semester 4	Units
MLE2102 Thermodynamics and Renewable Energy Technologies	4	Innovation & Enterprise Elective 1	4
MLE2103A Materials Kinetics and Processing	2	MLE2105 Electronic Properties of Materials	4
MLE3101A Materials Characterization	3	ES2631 Critique and Communication of Thinking and Design	4
MLE3101 Materials Characterization Laboratory	3	IE2141 Systems Thinking & Dynamics	4
MA1513 Linear Algebra with Differential Equations	2	GE	4
CE2407A Uncertainty Analysis for Engineers	2	GE	4
EG2401A Engineering Professionalism	2		
CDE3301/EG3301R Ideas to Proof-of-Concept	6		
Sub-total	24	Sub-total	24

Semester 5	Units	Semester 6	Units
CDE4301 Innovation & Design Capstone	6	CDE4301 Innovation & Design Capstone	6
CDE2501 Liveable Cities	4	Innovation & Enterprise Elective 2	4
EE2211 Introduction to Machine Learning	4	MLE3112 Machine Learning Approaches in Materials Laboratory	2
MLE3103 Materials Design: Aerospace to Biomedical Applications	4	Technical Elective 1	4
MLE3111A Materials Properties and Processing Laboratory	2	Technical Elective 2	4
CDE2000 Creating Narratives	4	GE	4
Sub-total	24	Sub-total	24

* Students who are exempted from MA1301 can take MA1513 and CE2407A in Semester 1.

Poly-intake students with accredited diplomas will receive the following exemptions:

- DTK1234 Design Thinking (4 units)
- EG1311 Design & Make (4 units)
- EG3611A Industrial Attachment (10 units)
- Unrestricted electives (20 units)