

## COURSE OUTLINE FOR STUDENTS AT NTU

<b>Academic Year</b>	2022/23	<b>Semester</b>	2
<b>Course Coordinator</b>	Associate Professor Wu Mao See		
<b>Course Code</b>	MA2071		
<b>Course Title</b>	Laboratory Experiments (ME)		
<b>Pre-requisites</b>	Nil		
<b>No of AUs</b>	1		
<b>Contact Hours</b>	Laboratory: 3 hours per week for 10 weeks		
<b>Proposal Date</b>	January 2022		

### Course Aims

The main objective is to provide you with the opportunity to demonstrate the concepts and analytical methods learned in Year 2 core courses in mechanical engineering and to familiarize yourself with basic operations of equipment employed in the laboratory experiments. You will also be able to master basic skills in designing experiments and analyse the results in log-sheets for nine (9) experiments and practice formal Technical Report writing skills with critical discussions for one (1) experiment.

### Intended Learning Outcomes (ILO)

Upon successful completion of the course, you will be able to:

- 1) carry out experiments to verify theories relating to
  - a) materials, components and manufacturing;
  - b) mechanics of materials including stress-strain analysis;
  - c) thermodynamics, fluids mechanics and energy balance, and
- 2) document experimental results in a professional manner as expected of mechanical engineers.

### Course Content

<b>Experiments</b>	
1.	E2.2 Study of fan performance using dimensional analysis
2.	E2.3 Energy balance in a compressor
3.	E2.4 Dimensional measurement of components
4.	E2.5 Two-dimensional strain measurement
5.	E2.6 Frictional losses in pipes and fittings
6.	E2.7 Refrigeration cycle experiment
7.	E2.8 Non-destructive testing
8.	E2.9 Balancing of rotating masses

9.	E2.11 Hands-on Machining Practice - Lathe
10.	E2.12 Hands-on Machining Practice - Milling
11.	E2.13 Hands-on –VR/AR

For the 11 experiments, each student will submit nine log-sheets (on the same day) and one Technical Report (within 1 week).

**Assessment (includes both continuous and summative assessment)**

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team / Individual	Assessment rubrics
<b>1. Log-Sheets:</b>	1	a, b, d, e, i	<b>80%</b>	<b>Team &amp; Individual</b>	
(a) Continuous assessment (CA)			40%	Individual	Appendix 1 (CA)
(b) Written assessment (WA)			40%	Team	Appendix 2 (WA)
<b>2. Technical Report:</b>	1, 2	b, d, j	<b>20%</b>	<b>Individual</b>	
(a) Continuous assessment (CA)			10%	Individual	Appendix 1 (CA)
(b) Report writing (RW)			10%	Individual	Appendix 3 (RW)
Total			100%		

**Formative feedback**

The feedback will consist of: (1) discussion between the instructor and the students during each experiment, in the form of simple questions and responses, and (2) qualitative grades given to students' experimental log-sheets and formal reports.

**Learning and Teaching approach**

Approach	How does this approach support students in achieving the learning outcomes?
Briefing by laboratory instructor	A briefing at the beginning of an experimental session will highlight: (1) the basic theory, analysis and approach of the experiment, (2) experimental procedures, including apparatus set-up,

	measurements, documentation and safety aspects, (3) assumptions, errors, uncertainties and critical observations, and (4) academic integrity in reporting the experimental results.
Oral assessment	The instructor will pose questions and invite students to answer, with an aim to: (1) enable each student to discover his or her own depth of knowledge, (2) encourage critical/creative thinking, and (3) motivate students' interest in the experiments.

### Reading and References

#### Textbook

Nil

#### References

Nil

### Course Policies and Student Responsibilities

As a student of the course, you are required to abide by both the University Code of Conduct and the Student Code of Conduct. The Codes provide information on the responsibilities of all NTU students, as well as examples of misconduct and details about how students can report suspected misconduct.

The university also has the Student Mental Health Policy. The Policy states the University's commitment to providing a supportive environment for the holistic development of students, including the improvement of mental health and wellbeing. These policies and codes concerning students can be found in the following link.

<http://www.ntu.edu.sg/SAO/Pages/Policies-concerning-students.aspx>

### Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

**Course Instructors**

<b>Instructor</b>	<b>Office Location</b>	<b>Phone</b>	<b>Email</b>
(overall coordinator) Wu Mao See	N3.2-01-16	6790 5545	MMSWU@ntu.edu.sg
(E2.2 S1) Chan Weng Kong	N3-02c-80	67905497	mwkchan@ntu.edu.sg
E2.2 S2) Lam Chung Yau			mcylam@ntu.edu.sg
(E2.3-S1) Liu Shukui	N3.2-01-21	6790 4457	skliu@ntu.edu.sg
(E2.3-S2) Fei Duan	N3.2-02-84	6790 5510	feiduan@ntu.edu.sg
(E2.4) Lam Yee Cheong	N3-02b-39	6790 5866	MYClam@ntu.edu.sg
(E2.5) Ang Whye Teong	N3.2-02-86	6790 5937	MWTANG@ntu.edu.sg
(E2.6-S1) Shu Jian Jun	N3-02c-81	6790 4459	MJJShu@ntu.edu.sg
(E2.6-S2) Huang Xiaoyang	N3.2-02-02	6790 4448	MXHUANG@ntu.edu.sg
(E2.7) Ng Yin Kwee	N3.2-02-70	6790 4455	mykng@ntu.edu.sg
(E2.8 S1) Zhou Wei	N3.2-02-16	6790 4700	MWZHOU@ntu.edu.sg
(E2.8 S2) Chian Kerm Sin	N3.2-01-01	67904449	ASKSChian@ntu.edu.sg
(E2.9) Wu Mao See	N3.2-01-16	6790 5545	MMSWU@ntu.edu.sg
(E2.11 S1) Su Pei Chen	N3.2-02-10	6790 5586	peichensu@ntu.edu.sg
(E2.11 S2) Yeo Swee Hock	N3-02b-52	67905539	mshyeo@ntu.edu.sg
(E2.12 S1) Appa Iyer Sivakumar	N3-02c-77	6790 5050	MSiva@ntu.edu.sg
(E2.12 S1) Lam Yee Cheong	N3-02b-39	6790 5866	MYClam@ntu.edu.sg
(E2.13) Cai Yiyu	N3.2-01-08	6790 5777	MYYCai@ntu.edu.sg

**Planned Weekly Schedule – Semester Example (Please check your timetable for updated schedule)**

**MA2071 Experiment Schedule– ME students**

LM01-LM10 - Mondays (1.30pm – 4.20pm)  
LM11-LM20 - Tuesdays (1.30pm – 4.20pm)

LM21-LM30– Wednesdays (1.30pm – 4.20pm)  
LM31LM40 – Thursdays (1.30pm – 4.20pm)

**Schedule for MA2071 Laboratory Experiments (ME)  
Mondays, 1:30PM to 4:20PM**

**Lab Groups LM01 to LM10**

Exp No	Laboratory	Venues	Faculty-in-Charge	Week of Semester	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
				Date/Month	Mon 17 Jan	Mon 24 Jan	Mon 31 Jan	Mon 07 Feb	Mon 14 Feb	Mon 21 Feb	Mon 07 Mar	Mon 14 Mar	Mon 21 Mar	Mon 28 Mar	Mon 04 Apr	Mon 11 Apr
E2.11 (MIE)	ONLINE	NTULEARN	Yeo Swee Hock		LM01	LM10		LM09	LM08	LM07	LM06	LM05	LM04	LM03	LM02	
E2.12 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong		LM02	LM01		LM10	LM09	LM08	LM07	LM06	LM05	LM04	LM03	
E2.13 (RD)	ONLINE	NTULEARN	Cai Yiyu		LM03	LM02		LM01	LM10	LM09	LM08	LM07	LM06	LM05	LM04	
E2.2 (TFM)	ONLINE	NTULEARN	Lam Chung Yau		LM04	LM03		LM02	LM01	LM10	LM09	LM08	LM07	LM06	LM05	
E2.3 (TFM)	ONLINE	NTULEARN	Fei Duan		LM05	LM04		LM03	LM02	LM01	LM10	LM09	LM08	LM07	LM06	
E2.4 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong		LM06	LM05		LM04	LM03	LM02	LM01	LM10	LM09	LM08	LM07	
E2.6 (TFM)	ONLINE	NTULEARN	Huang Xiaoyang		LM07	LM06		LM05	LM04	LM03	LM02	LM01	LM10	LM09	LM08	
E2.7 (TFM)	ONLINE	NTULEARN	Ng Yin Kwee		LM08	LM07		LM06	LM05	LM04	LM03	LM02	LM01	LM10	LM09	
E2.8 (MIE)	ONLINE	NTULEARN	Chian Kerm Sin		LM09	LM08		LM07	LM06	LM05	LM04	LM03	LM02	LM01	LM10	
E2.9 (MOE)	ONLINE	NTULEARN	Wu Mao See		LM10	LM09		LM08	LM07	LM06	LM05	LM04	LM03	LM02	LM01	

**Schedule for MA2071 Laboratory Experiments (ME)  
Tuesdays, 1:30PM to 4:20PM**

**Lab Groups LM11 to LM20**

Exp No	Laboratory	Venues	Faculty-in-Charge	Week of Semester	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
				Date/Month	Tue 18 Jan	Tue 25 Jan	Tue 01 Feb	Tue 08 Feb	Tue 15 Feb	Tue 22 Feb	Tue 08 Mar	Tue 15 Mar	Tue 22 Mar	Tue 29 Mar	Tue 05 Apr	Tue 12 Apr
E2.11 (MIE)	ONLINE	NTULEARN	Yeo Swee Hock		LM11	LM20		LM19	LM18	LM17	LM16	LM15	LM14	LM13	LM12	
E2.12 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong		LM12	LM11		LM20	LM19	LM18	LM17	LM16	LM15	LM14	LM13	
E2.13 (RD)	ONLINE	NTULEARN	Cai Yiyu		LM13	LM12		LM11	LM20	LM19	LM18	LM17	LM16	LM15	LM14	
E2.2 (TFM)	ONLINE	NTULEARN	Lam Chung Yau		LM14	LM13		LM12	LM11	LM20	LM19	LM18	LM17	LM16	LM15	
E2.3 (TFM)	ONLINE	NTULEARN	Fei Duan		LM15	LM14		LM13	LM12	LM11	LM20	LM19	LM18	LM17	LM16	
E2.4 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong		LM16	LM15		LM14	LM13	LM12	LM11	LM20	LM19	LM18	LM17	
E2.6 (TFM)	ONLINE	NTULEARN	Huang Xiaoyang		LM17	LM16		LM15	LM14	LM13	LM12	LM11	LM20	LM19	LM18	
E2.7 (TFM)	ONLINE	NTULEARN	Ng Yin Kwee		LM18	LM17		LM16	LM15	LM14	LM13	LM12	LM11	LM20	LM19	
E2.8 (MIE)	ONLINE	NTULEARN	Chian Kerm Sin		LM19	LM18		LM17	LM16	LM15	LM14	LM13	LM12	LM11	LM20	
E2.9 (MOE)	ONLINE	NTULEARN	Wu Mao See		LM20	LM19		LM18	LM17	LM16	LM15	LM14	LM13	LM12	LM11	

**Schedule for MA2071 Laboratory Experiments (ME)**  
**Wednesdays, 1:30PM to 4:20PM**

**Lab Groups LM21 to LM30**

			Week of Semester	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
			Date/Month	Wed 19 Jan	Wed 26 Jan	Wed 02 Feb	Wed 09 Feb	Wed 16 Feb	Wed 23 Feb	Wed 09 Mar	Wed 16 Mar	Wed 23 Mar	Wed 30 Mar	Wed 06 Apr	Wed 13 Apr
Exp No	Laboratory	Venues	Faculty-in-Charge												
E2.11 (MIE)	ONLINE	NTULEARN	Yeo Swee Hock	LM21	LM30		LM29	LM28	LM27	LM26	LM25	LM24	LM23	LM22	
E2.12 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong	LM22	LM21		LM30	LM29	LM28	LM27	LM26	LM25	LM24	LM23	
E2.2 (TFM)	ONLINE	NTULEARN	Lam Chung Yau	LM23	LM22		LM21	LM30	LM29	LM28	LM27	LM26	LM25	LM24	
E2.3 (TFM)	ONLINE	NTULEARN	Fei Duan	LM24	LM23		LM22	LM21	LM30	LM29	LM28	LM27	LM26	LM25	
E2.4 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong	LM25	LM24		LM23	LM22	LM21	LM30	LM29	LM28	LM27	LM26	
E2.5 (MOE)	ONLINE	NTULEARN	Ang Whye Teong	LM26	LM25		LM24	LM23	LM22	LM21	LM30	LM29	LM28	LM27	
E2.6 (TFM)	ONLINE	NTULEARN	Huang Xiaoyang	LM27	LM26		LM25	LM24	LM23	LM22	LM21	LM30	LM29	LM28	
E2.7 (TFM)	ONLINE	NTULEARN	Ng Yin Kwee	LM28	LM27		LM26	LM25	LM24	LM23	LM22	LM21	LM30	LM29	
E2.8 (MIE)	ONLINE	NTULEARN	Chian Kerm Sin	LM29	LM28		LM27	LM26	LM25	LM24	LM23	LM22	LM21	LM30	
E2.9 (MOE)	ONLINE	NTULEARN	Wu Mao See	LM30	LM29		LM28	LM27	LM26	LM25	LM24	LM23	LM22	LM21	

**Schedule for MA2071 Laboratory Experiments (ME)**  
**Thursdays, 1:30PM to 4:20PM**

**Lab Groups LM31 to LM40**

			Week of Semester	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
			Date/Month	Thu 20 Jan	Thu 27 Jan	Thu 03 Feb	Thu 10 Feb	Thu 17 Feb	Thu 24 Feb	Thu 10 Mar	Thu 17 Mar	Thu 24 Mar	Thu 31 Mar	Thu 07 Apr	Thu 14 Apr
Exp No	Laboratory	Venues	Faculty-in-Charge												
E2.11 (MIE)	ONLINE	NTULEARN	Yeo Swee Hock	LM31	LM40	LM39	LM38	LM37	LM36	LM35	LM34	LM33	LM32		
E2.12 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong	LM32	LM31	LM40	LM39	LM38	LM37	LM36	LM35	LM34	LM33		
E2.13 (RD)	ONLINE	NTULEARN	Cai Yiyu	LM33	LM32	LM31	LM40	LM39	LM38	LM37	LM36	LM35	LM34		
E2.2 (TFM)	ONLINE	NTULEARN	Lam Chung Yau	LM34	LM33	LM32	LM31	LM40	LM39	LM38	LM37	LM36	LM35		
E2.3 (TFM)	ONLINE	NTULEARN	Fei Duan	LM35	LM34	LM33	LM32	LM31	LM40	LM39	LM38	LM37	LM36		
E2.4 (MIE)	ONLINE	NTULEARN	Lam Yee Cheong	LM36	LM35	LM34	LM33	LM32	LM31	LM40	LM39	LM38	LM37		
E2.6 (TFM)	ONLINE	NTULEARN	Huang Xiaoyang	LM37	LM36	LM35	LM34	LM33	LM32	LM31	LM40	LM39	LM38		
E2.7 (TFM)	ONLINE	NTULEARN	Ng Yin Kwee	LM38	LM37	LM36	LM35	LM34	LM33	LM32	LM31	LM40	LM39		
E2.8 (MIE)	ONLINE	NTULEARN	Chian Kerm Sin	LM39	LM38	LM37	LM36	LM35	LM34	LM33	LM32	LM31	LM40		
E2.9 (MOE)	ONLINE	NTULEARN	Wu Mao See	LM40	LM39	LM38	LM37	LM36	LM35	LM34	LM33	LM32	LM31		

## Appendix 4: Student Learning Outcomes

The list for the Engineering Accreditation Board Student Learning Outcomes is as follows:

- a) **Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems
- b) **Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c) **Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- d) **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- e) **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- f) **The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- g) **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.
- h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- i) **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.