EN3006 ENERGY RESOURCE ENGINEERING

Academic Year	2023-24	Semester	1
Course Coordinator	Dr Lim Tuti Mariana		
Course Type	Core		
Pre-requisites	Nil		
AU	3		
Grading	Letter Grading		
Contact Hours	39 Hours (26 Lecture hours; 13 Tutorial hours)		
Proposal Date	18 April 2023		

Course Aims

This course aims to provide you with a general understanding on the various sources of energy, their availabilities, qualities and impacts on the environment, economic and society in the context of sustainable development. You will be provided with an overview on the current energy trends, issues and challenges as well as overview on the choice of energy use and technologies to meet these challenges in future for sustainable development.

Intended Learning Outcomes (ILO)

By the end of this course, student will be able to:

1. Explain current energy supply and demand situations;
2. Apply basic knowledge of the various sources of energy;
3. Describe the impact of energy on economy, society and the environment;
4. Assess various legislative and regulatory approaches to a sustainable energy management;
5. Evaluate alternative energy solutions that are sustainable.

Course Content

This introductory course provides an overview of energy resources management in the context of sustainable economic development. Topics include energy and human society, energy resources and reserves, supply, distribution, utilisation, recovery and conversion, environmental impacts of energy utilisation, energy economics and policies.

No	Topic	Lecture Hrs	Tutorial Hrs
1.	Introduction to Energy, Technology and Human Society	2	1
2.	Overview on Non-Renewable Energy Resources	2	1
3.	Effect of Energy on Economy, Society and the Environment	4	2
4.	Energy Policy & Regulation	1	1
5.	Energy Policy Efficiency: Trends, Benchmarking, Auditing & Incentives	2	1
6.	Energy Conservation and Efficient Energy Conversion Technology	4	3

7.	Clean Fuels and Fuels Harmonisation	2	1
8.	Renewable Energy Sources and Hydrogen Economy	9	3
	Total	26	13

Assessment (Includes both continuous and summative assessment)

Component	ILO Tested	EAB Graduate Attributes	Weightage	Team / Individual	Rubrics
1. CA1: Quiz 1	1, 2, 3, 4, 5	EAB SLOs a, c, g	20%	Individual	N.A.
2. CA2: Group Project Report	1, 2, 3, 4, 5	EAB SLOs b, e, f, g, h, i, j, l	30% x MF	Team & Individual	Appendix 1
3. Final Examination	1, 2, 3, 4, 5	EAB SLOs a, c, g	50%	Individual	N.A.
Total			**100%**		

Note: The group project assessment for this course is also reliant on you working closely as a team to complete the project. Hence, the Modification Factor (MF) will be applied to account for your individual contribution to the group project work. The MF is derived from panel judges' feedback, weekly discussion session and peer assessment. For more details on the MF calculation, please see Appendix 2.

EAB Graduate Attributes[1]	
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 systems, 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

[1] *Reference: EAB Accreditation Manual*

	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.
k)	**Project Management and Finance** Demonstrate knowledge and understanding of the engineering management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l)	**Life-long Learning** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Formative Feedback

The quiz results will be discussed, and you will be able to view your quiz grade individually through Blackboard Grade Centre.

Each group will submit their comments with respect to other groups' reports to the course instructor. The group project reports' results will be released through Blackboard Grade Centre.

Learning & Teaching Approach

Approach	How does this approach support students in achieving the learning outcomes?
Lecture	Formal lectures on topics with in-class discussions
Tutorials	This helps you to understand the concept taught during lectures as well as promote life-long learning
Group Report	This helps you to achieve one or more of the outcomes as you need to do self-study and research as well as promote team works.

Readings & References

1. J.A. Fay and D.S. Golomb: "Energy and the Environment", 2nd Edition, Oxford University Press, 2011.

2. E. S. Cassedy and P. Z. Grossman: "Introduction to Energy: Resources, Technology & Society", 3nd Edition, Cambridge University Press, 2017.

3. United Nation Environment Programme:www.unep.ch/etb/publications/enviImpAsse.php;

4. US Department of Energy: www.eia.doe.gov

5. UN Intergovernmental Panel on Climate Change (IPCC): www.**ipcc**.ch

6. Singapore's Energy Market Authority (EMA): www.ema.gov.sg

Course Policy & Student Responsibility

(1) General

Students are expected to take all scheduled assignments and tests by due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements. Students are expected to participate in all group project discussions and activities.

(2) Absenteeism

Group work requires each member to contribute to team-work. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

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 recognise 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 about the definitions of any of these terms, you should refer to the Academic Integrity Handbook for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office	Phone	Email
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Planned Weekly Schedule

Week	Topic	Course ILO	Readings/ Activities
1	Introduction to Energy, Technology and Human Society	1	Lecture and Tutorial
2	Overview on Non-Renewable Energy Resources	1 and 5	Lecture and Tutorial
3 - 4	Effect of Energy on Economy, Society and the Environment	1, 2 and 3	Lectures and Tutorial Group Project: Grouping, Topic Selection & Allocation.
5	Energy Policy & Regulation Energy Policy Efficiency: Trends, Benchmarking, Auditing & Incentives Energy Conservation	4 4 & 5	Lecture and Tutorial
6	Energy Policy Efficiency: Trends, Benchmarking, Auditing & Incentives Energy Conservation Efficient Energy Conservation Technology	4 & 5 1, 2, 3, 4, 5	Lecture and Tutorial
7	Efficient Energy Conversion Technology	1, 2, 3, 4, 5	Lecture and Tutorial
8	Efficient Energy Conversion Technology Clean Fuels and Fuel Harmonisation	1, 2, 3, 4, 5	Lecture and Tutorial
9	Clean Fuels and Fuel Harmonisation Renewable Energy Sources Hydrogen Economy	1, 2, 3, 4, 5	Lecture and Tutorial
10-13	Renewable Energy Sources Hydrogen Economy	1, 2, 3, 4, 5	Lectures and Tutorials Group Project Report

Appendix 1: Assessment Criteria for Group Project Report

The assessment of the group project report will be based on assessment by the tutor and peer review evaluation.

Assessment Rubric by Tutor (weightage = 30%)

Criteria	Good (8-10)	Ave (6-7)	Fair (4-5)	Poor (1-3)	Remarks
Introduction/Project Background (20%)					Appreciation of project background and description. Well defined project; clear objectives.
Discuss current specific energy technology and possible solutions (30%)					Basic knowledge and application of energy technologies including the pro and con as well as the current application status
Assess the feasibility of applying the specific energy technology in Singapore (20%)					Application of the specific energy technology for Singapore
Conclusion (10%)					Summarize the report clearly and concisely
Report format and layout including clarity of expression / Style of report (20%)					Clear and concise; good grammar and spelling with appropriate Tables/graphs/Figures; Report is presented well with logical sequence
TOTAL					

Appendix 2: Criteria for Peer Assessment

Criteria	Outstanding: 4	Good: 3	Average, meet expectation: 2	Below expectations: 1
Collaborative behaviour	Cooperative and always delivered assigned tasks on time. Take initiative to help other to ensure success of team project.	Cooperative and always delivered assigned tasks on time. Willing to assist others upon request.	Stop short at delivering assigned tasks, sometimes after reminder(s).	Uncooperative, non-committed, always miss deadlines.
Quality of works	Quality of works higher than overall group quality, or go extra miles to assist teammate to enhance the quality of group works.	Good quality of deliverables under individual responsibility.	Acceptable quality of deliverables under individual responsibility.	Quality of works not acceptable.
Ideas & participations	Active participation and initiatives, good ideas & suggestions in enhancing the quality of group works.	Contributed suggestions and ideas to enhance the quality of group works.	Somewhat contributed in enhancing the quality of group works.	Did not participate in group works.

Average Peer Assessment Score	MF
3.51 to 4.00	1.05
2.76 to 3.50	1.00
2.51 to 2.75	0.95
2.00 – 2.50	0.9
Below 2.0	Separate Assessment

Peer assessment exercise will be anonymous and done towards the end of the semester.

For student who has average peer assessment score below 2.0, Course coordinator might contact/call up the student as well as the other team member(s) to further assess the appropriate MF.

In addition to peer assessment, MF might be moderated by course coordinator and panel judges from the interaction during consultation, feedbacks from the team members.