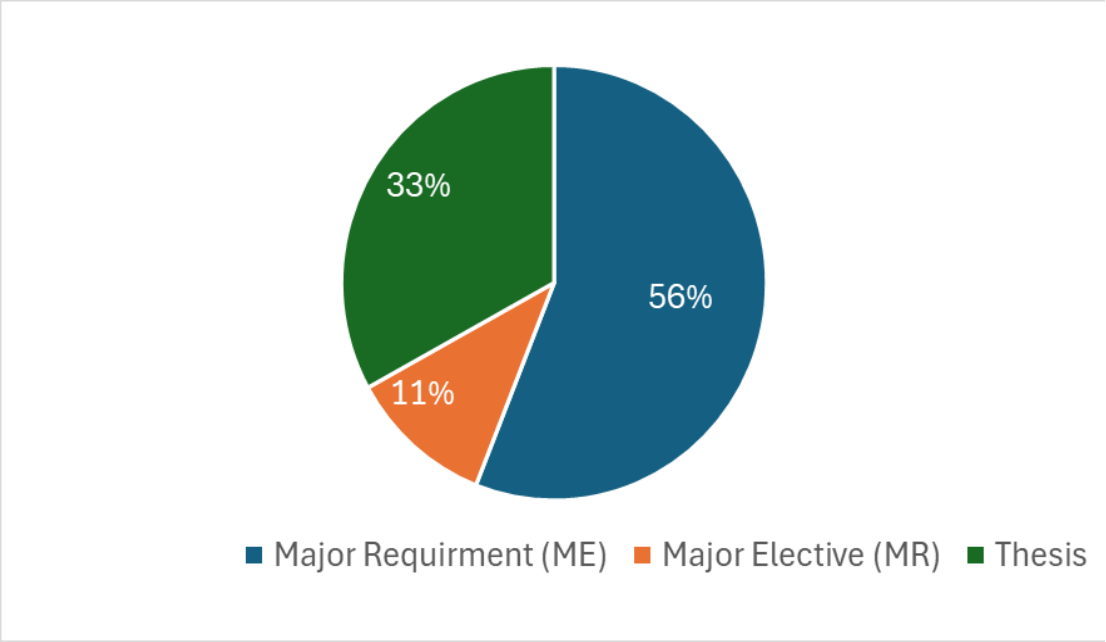
Master of Science in Sustainable Energy Transition Systems 2024

Program Components



Course Type	CRD
University Requirement (UR):	---
College Requirement (CR) :	---
General Studies Compulsory (GSCC):	**0**
Major Requirement (MR)[1]:	**20**
Major Elective (ME)[1]:	**4**
General Studies Elective (GSE)[2] :	**0**
Training (Internship):	0
Thesis[2]:	**12**
Total Credit (CRD)	**36**

[1] Student must select five (6XX) courses from the Major Requirement (MR) List. In addition to this, one course must be selected from the Major Elective(ME) list. This needs consultation and approval of the department.

[2] Students must select a thesis (699) as a Major Requirement (MR) after completing 12 Credits.

Detailed Study Plan

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
SETS 601	Energy Systems	4	0	4	M.R.	None	Yes
SETS 602	Carbon Capture, Utilization, and Storage (CCUS)	4	0	4	M.R.	None	Yes
SETS 603	Corporate Finance, Accounting, and Policy for Energy	4	0	4	M.R.	None	Yes

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
SETS 604	Advanced Energy Conversion	4	0	4	M.R.	None	Yes
SETS 605	Digitalization for Energy Systems	4	0	4	M.R.	None	Yes
SETS 6XX	Elective	4	0	4	M.E.	None	Yes

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
SETS 699	MSc thesis	0	36	12	M.R.	Completion of 12 credit hours	Yes

Major Elective Courses

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
SETS 606	Biofuels and Biorefineries	4	0	4	M.E.	None	Yes
SETS 607	Hydrogen Generation and Storage	4	0	4	M.E.	None	Yes
SETS 608	Special Topics	4	0	4	M.E.	None	Yes

Course Description

Course Code: SETS 601 **Course Title:** Energy Systems
This course covers the analysis of different energy systems. The topics covered in this course comprise the following: energy sources, classification, and utilization; thermodynamic concepts: 1st and 2nd law of thermodynamics and efficiency; thermodynamic analysis of energy conversion processes; power and refrigeration cycles; exergy analysis of conventional energy systems; and application of thermodynamics to renewable energy, biomass, and waste technologies.

Course Code: SETS 602 **Course Title:** Carbon Capture, Utilization, and Storage
This course is dedicated to carbon dioxide emission, capture, utilization, and storage. The topics covered in this course comprise the following: sources and effects of carbon emissions; advanced concepts associated with carbon capture and energy transition; CO_2 phase behavior, transportation, and its flow assurance issues; CO_2 utilization in mineral carbonation, enhanced oil recovery, and cement, chemicals, and fuels production; and carbon capture and storage.

Course Code: SETS 603 **Course Title:** Corporate finance, Accounting, and Policy for Energy
This course covers finance and accounting concepts and laws and policies associated with the energy industry. The topics covered in this course comprise the following: an overview of the energy industry; financial analysis, risk, and uncertainty in the energy industry; capital budgeting, investment analysis, and financing of energy projects; valuation of energy companies and assets; energy trading and risk management; environmental and social considerations in the energy industry; and energy policies and regulations.

Course Code: SETS 604 **Course Title:** Advanced Energy Conversion
This course is dedicated to advanced energy conversion systems.
The topics covered in this course comprise the following: fuel and combustion; gas and vapor power cycles; electrochemical energy systems, including fuel cells and conventional, molten-salt, and flow batteries; sustainable and renewable energy systems, including geothermal, ocean, wind, and solar energies; and nuclear energy, reactors, and technologies.

Course Code: SETS 605 **Course Title:** Digitalization for Energy Systems
This course is dedicated to the digitalization of energy systems. The topics covered in this course comprise the following: integration of digital technologies in process operations; disruptive technologies; data types and sources in modern industries; advanced analytics maturity; Cross-Industry Standard Process for Data Mining (CRISP-DM); machine learning for supervised, unsupervised, and reinforcement learnings; digital twin concept; virtual reality; Pinch analysis; and data-driven applications in energy systems.

Course Code: SETS 606 **Course Title:** Biofuels and Biorefineries
This elective course is devoted to biofuels and biorefineries. The topics covered in this course comprise the following: sources of biomass, their extraction, and processing; types and sources of biofuels, agro-industrial byproducts, and biodegradable materials; genomics of biofuels; metabolic engineering; biorefineries for fuels (e.g., ethanol and

biodiesel), electricity, and useful chemicals; biobased industrial products; green biorefineries for waste material from agriculture and forests; lignocellulosic feedstock biorefinery; and whole crop biorefinery processes.

Course Code: SETS 607 **Course Title:** Hydrogen Generation and Storage
This elective course covers advanced techniques of hydrogen production and storage. The topics covered in this course comprise the following: hydrogen production technologies, including steam reforming of fossil fuels, biomass gasification, and electrolysis; merits/demerits and applications of liquefied, cryo-compressed, and material-based hydrogen storage systems; hydrocarbon reservoirs, aquifers, and salt caverns; and hydrogen storage in depleted oil and gas reservoirs.

Course Code: SETS 608 **Course Title:** Special topics
This elective course covers any advanced and important, relevant topic that is not covered in the given course list. Topics may be varied subject to students' interests and the availability of staff

Course Code: SETS 699 **Course Title:** MSc thesis
The last semester of the Master's program provides the student with an opportunity to undertake an extensive investigation of an advanced or specialized topic relating to the management and optimization of energy systems; to provide the opportunity to plan and execute a significant research project, investigation, or development.