

Engineering Sustainable Systems

Summary of Requirements for a Master of Science
(**Sustainable Systems**) and a Master of Science in
Engineering (**Environmental Engineering**)

Sustainable Energy Systems specialization

Effective Fall 2014

2-2.5 Year MS & MSE Plan		Requirement	Notes	Course #	Credits	Term			
Engineering	Environmental Engineering Core	18CR in CEE courses at the 500 or 600 level 6CR in additional CEE courses	Required: CEE 581 CEE 582 CEE 591 CEE 881 (1 st Fall in program) And one course from List A (next page) *	CEE 581					
				CEE 582					
				CEE 591					
				CEE 881					
				CEE 880					
Sustainable Energy Systems Major	12CR from, the "Sustainable Energy Systems" Major	CEE 567 and 9CR from List A (see next page)	CEE 567						
Advanced Math Requirement	3CR in approved Mathematics or equivalent	See Env. Eng dept. requirements and Cognates (next page)							
Natural Resources and Environment	SS Core 1	6CR in Systems Analysis for Sustainability	Required: NRE 557/CEE 586 And one course from List 1 (next page)	CEE 586					
				9CR total	Sustainable Design & Technology Minimum. 3CR	Required: NRE 574 See List 2 for other acceptable courses (next page)	NRE 574		
					Sustainable Enterprise Minimum 3CR	See List 3 for acceptable courses (next page)			
					Additional 3CR minimum from list A1, 2, or 3	See attached list (A1-3) of acceptable courses in these specializations			
	NRE Core	NRE 509 NRE 510							
		IAMS Requirement Two courses; 3CR minimum Please see page 3 for approved courses.							
	Analytics	One statistics course	NRE 538 or equivalent required						
	Opus	Master's Project/Thesis/Practicum	At most 6CR of NRE 700/701						
	Cognates <i>[Rackham requirement]</i>		Please see next page for cognate requirement information						
	TOTALS	TOTAL CREDIT HOURS BY SCHOOL	"NRE" - Minimum 25CR						
"CEE" - Minimum 18CR									
	TOTAL CREDIT HOURS	Minimum 54 Credit Hours							

**Please see the Civil and Environmental Engineering Student Services Office if you would prefer to complete their Research or Thesis in Engineering

A) Sustainable Energy Systems (12CR total)

Required:

CEE 567 (3)	Energy Infrastructure Systems (W)
Civil and Environmental Engineering (choose one):	
CEE 526 (3)	Design of Hydraulic Systems (W)
CEE 549 (3)	Geoenvironmental Engineering (F)
CEE 592 (3)	Biological Processes in Environ Eng (W)
Energy Electives (choose two):	
CHE 548 (3)	Electrochemical Engineering (F)
CHE 568 (3)	Fuel Cells and Fuel Processors (F)
EECS 463 (4)	Power Systems Des & Operations (F)
EECS 498 (4)	Grid Integrations of Alt Energy Sources (W)
ME 432 (3)	Combustion (W)
ME 433 (3)	Advanced Energy Solutions (F,W)
ME 571 (3)	Energy Generation and Storage (F)
ME 589 (3)	Sustainable Des of Technology Systems (F)
NERS 531 (3)	Nuclear Waste Management (W)

A) Sustainable Systems Core (1-3)

1) Systems Analysis for Sustainability (at least 6CR*)

NRE 573 (3cr)	Environmental Footprinting and Environmental Input-Output Analysis (W)
NRE 610 (1.5cr)	Advanced LCA Methods & Software Tools (W)
NRE 597 (3cr)	Environmental Systems Analysis (F)
NRE 557/CEE 586 (3cr)	Industrial Ecology (W)
NRE 550/STRAT 566 (3cr)	Systems Thinking for Sustainable Development (W)

*At least two courses need to be from the courses listed above

NRE 570 (3cr)	Environ Economics: Quantitative Methods & Tools (F)
NRE 501 (1.5cr)	Five courses on selected topics in Env. Economics (FA B & WN A&B)
NRE 531 (4cr)	Principles of GIS (F&W)

2) Sustainable Design & Technology (3CR)

NRE 537 (3CR)	Urban Sustainability (F)
NRE 501.087 (3CR)	Technology and Community Sustainable Development (W)
NRE 615 (3CR)	Renewable Electricity and the Grid (W)
NRE 574/PUBPOL 519 (3cr)	Sustainable Energy Systems (F)
NRE 548 (3cr)	Land Use and Global Change (F – every other year)
NRE 605/BA 605 (3cr)	Green Development (W)
NRE 687 (4cr)	Landscape Planning (F)
ARCH 575 (3cr)	Building Ecology (F)
CEE 480 (3cr)	Design of Environ Engineering Systems (F)
CEE 582 (3cr)	Environmental Microbiology (F)
MECHENG 589 (3cr)	Sustainable Design of Technology Systems (W)

3) Sustainable Enterprise (3CR)

NRE 501.159 (3cr)	Decision Making for Sustainability (W)
NRE 512/BL 536 (2.25cr)	Ethics Corporate Management (F or W)
NRE 513/STRAT 564&565 (3cr)	Strategies for Sustainable Development (F)
NRE 527/BE 527 (3cr)	Energy Markets and Energy Politics (F)
NRE 532 (3cr)	Natural Resources and Environ Conflict Management (F)
NRE 533 (3cr)	Negotiation Skills (W)
BE 555 (1.5)	Non Market Strategy (F)
NRE 560/UP 560 (3cr)	Behavior and Environment (F)
NRE 501.014/CEE 686/ChE 686 (3cr)	Environmental Finance (F)
ENGR 521 (3cr)	CleanTech Entrepreneurship (W)
FIN 637 (2.25cr)	Finance and Sustainable Enterprises (F)
STRAT 735-739 (1.5cr)	Topics in Global Sustainable Enterprise (F)
FINANCE 583 (1.5cr)	Energy Project Finance (W)

B) Sustainable Systems Electives

B1) Additional SS courses (can count towards Non-Opus option)

NRE 514 (2cr)	Environmental Impact Assessment (F)
NRE 523(3cr)	Environmental Risk Assessment (W)
NRE 552 (3cr)	Ecosystem Services (F)
EHS 672 (3cr)	Life Cycle Assessment: Human Health & Environ Impacts (F)
NRE 686/PUBPOL 563 (3cr)	Environmental Policy (W)
BA 612 (2.25cr)	Strategies for the Base of the Pyramid (F)
ESENG 501 (3cr)	Seminars in Energy Science, Technology, and Policy (F)
Econ 437 (3cr)	Energy Economics & Policy (W)
UP 533/ARCH 506 (3cr)	Sustainable Urbanism and Architecture (F)

B2) Sustainable Systems Themes (see links for course listings):

Energy Systems - <http://www.snre.umich.edu/node/7746/#energy>

Mobility Systems - <http://www.snre.umich.edu/node/7746/#transportation>

Water Systems - <http://www.snre.umich.edu/node/7746/#water>

Food Systems - <http://www.snre.umich.edu/node/7746/#food>

Built Environment - <http://www.snre.umich.edu/node/7746/#builtenv>

Climate Change - <http://www.snre.umich.edu/node/7746/#climchange>

Integrated Analytic Methods and Skills Requirement

Students are required, at some point during their time enrolled in the program, to take 2 courses composing at least 3 credits from a faculty-approved list of courses that focus on integrative analytic methods and skills. The faculty-approved existing courses that satisfy this requirement are listed below:

Fall

501 – Social Vulnerability & Adaptation to Environ Change

578 – Urban Stormwater

552 – Ecosystem Services

514 – Environmental Impact Assessment

533 – Negotiation Skills (Fall A)

536 – Mediation Skills

548 – Land Use and Global Change

570 – Environmental Economics

597 – Environmental Systems Analysis

564 – Localization Seminar

677 – Climate Adaptation Seminar

687 – Landscape Planning

Winter

501 – Stakeholder Network Analysis
501 – Science and Management of the Great Lakes
501 - Decision Making for Sustainability
532 – Natural Resource Conflict Management
545- Applied Ecosystem Modeling
550 – Systems Thinking for Sustainable Development
557 – Industrial Ecology
581 – Advanced Environmental Education
589 – Ecological Restoration
610 – Advanced LCA Methods and Software Tools
641 – Interdisciplinary Research Methods
787 – Metro Studio (MLA only)