

2.5 Year MS & MSE Plan		Requirement	Notes	Course #		Credits			
Engineering	Chemical Engineering Core	21CR in ChE courses at the 500 level or higher	Required: All courses in Chemical Engineering courses (see next page)	ChE 527		3			
				ChE 528		3			
				ChE 538		3			
				ChE 542		3			
				ChE 595		1			
				ChE 505		3			
Natural Resources and Environment	SS Core [SS-specific requirements]	6CR in Systems Analysis for Sustainability	Required: NRE 557/CEE 586 And one course from List A1 (next page)	NRE 557/CEE 586					
				9CR total	Sustainable Design & Technology Minimum 3CR	Required: NRE 574 See List A2 for other acceptable courses (next page)	NRE 574		
					Sustainable Enterprise Minimum 3CR	See List A3 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	10CR in total						
		IAMS Requirement Two courses; 3CR minimum Please see page 3 for approved courses.							
	Analytics	3CR in Analytics	NRE 538 or equivalent required:						
	Opus*	Master's Project/Thesis/Practicum	At most 6CR of NRE 700/701						
	Cognates		Please see next page for cognate requirement information						
	TOTALS	MINIMUM CREDIT HOURS BY SCHOOL	"NRE" - Minimum 25CR						
"ChE" - Minimum 21CR									
TOTAL CREDIT HOURS		Minimum 54 Credit Hours							

*Please see the Chemical Engineering Student Services Office if you would prefer to complete their Research or Thesis option instead of the Course Work only option.

Chemical Engineering

ChE 527 (3)	Fluid Flow (W)
ChE 528 (3)	Chemical Reactor Engineering (F)
ChE 538 (3)	Statistical and Irreversible Thermodynamics (W)
ChE 542 (3)	Heat and Mass Transport (F)
ChE 595 (1)	Chemical Engineering Research Survey (F)

A) Sustainable Systems Core (1-3)

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

NRE 573 (3cr)	Environ Footprinting and Environ Input- Output Analysis (W)
NRE 597 (3cr)	Environmental Systems Analysis (F)
NRE 610 (1.5cr)	Advanced LCA Methods & Software Tools (W)
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 (TBD)
NRE 531 (4cr)	Principles of GIS (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)
NRE 605/BA 605 (3cr)	Green Development (W)
NRE 687 (4cr)	Landscape Planning (F)
ARCH 575 (3cr)	Building Ecology (F)
CEE 460 (3cr)	Design of Environ Engineering Systems (F)
CEE 582 (3cr)	Environmental Microbiology (F)
CEE 686/ChE 686 (2-3cr)	Case Studies in Environ Sustainability (W)
MECHENG 589 (3cr)	Sustainable Design of Technology Systems (F)

3) Sustainable Enterprise (3CR)

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

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)
EHS 672 (3cr)	Life Cycle Assessment: Human Health & Environ Impacts (F)
NRE 552 (3cr)	Ecosystem Services
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)