<table>
<thead>
<tr>
<th>Requirement</th>
<th>Notes</th>
<th>Course #</th>
<th>Credits</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>12CR in ME courses at the 500 or 600 level</td>
<td>Required Courses: ME 589</td>
<td>ME 589</td>
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<td></td>
<td>At least one course from Mechanical Engineering course list (next page)</td>
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<tr>
<td>6CR in additional ME courses or research</td>
<td>*ME option: • Coursework Only</td>
<td>ME 455</td>
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<td></td>
<td>Please see: <a href="http://me.engin.umich.edu/students/master_math.shtml">http://me.engin.umich.edu/students/master_math.shtml</a></td>
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<tr>
<td>6CR in acceptable Mathematics or equivalent</td>
<td>Please see: <a href="http://me.engin.umich.edu/students/acceptable_math.shtml">http://me.engin.umich.edu/students/acceptable_math.shtml</a></td>
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<tr>
<td>6CR in Systems Analysis for Sustainability</td>
<td>Required Course: NRE 557/CCE 586</td>
<td>NRE 557</td>
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<tr>
<td>Sustainable Design &amp; Technology</td>
<td>See List A2 for acceptable courses (next page)</td>
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<tr>
<td>Minimum 3CR</td>
<td>See List A3 for acceptable courses (next page)</td>
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<tr>
<td>9CR total</td>
<td>Additional 3CR minimum from list A1, 2, or 3</td>
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<tr>
<td>Sustainable Enterprise</td>
<td>See attached list (A1-3) of acceptable courses in these specializations</td>
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<tr>
<td>Minimum 3CR</td>
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<tr>
<td>NRE 509</td>
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<td>NRE 510</td>
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<tr>
<td>IAMS Requirement</td>
<td>Two courses; 3CR minimum</td>
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<td>Please see page 3 for approved</td>
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<tr>
<td>3CR in Analytics</td>
<td>NRE 538 or equivalent required</td>
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<tr>
<td>Opus</td>
<td>Master's Project/Thesis/Practicum</td>
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<td></td>
<td>At most 6CR of NRE 700/701</td>
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<tr>
<td>Minimum 4 credit hours outside of degree program (likely fulfilled by other course listed above)</td>
<td>Can be satisfied by courses meeting other requirements; cannot double-credit</td>
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<tr>
<td>Minimum 25CR</td>
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<tr>
<td>Minimum 18CR</td>
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<td>Minimum 54 Credit Hours</td>
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*Please see the Mechanical Engineering Student Services Office if you would prefer to complete their Research or Thesis option.
Mechanical Engineering
MECHENG 555 (3) Design Optimization (W)
MECHENG 577 (3) Materials in Manufacturing and Design (W)
MECHENG 581 (3) Global Product Development
MECHENG 587 (3) Global Manufacturing (F)

A) Sustainable Systems Core (1-3)

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

NRE 501.036 (3cr) Consumption, Trade, and Environmental Input-Output Analysis (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 (1.5cr) Environ Economics: Quantitative Methods & Tools (WN A)
NRE 501 (1.5cr) Five courses on selected topics in Env. Economics (F A B & WN A&B)
NRE 531 (4cr) Principles of GIS (F)

2) Sustainable Design & Technology (3CR)

NRE 501.037 (3cr) Urban Sustainability (F)
NRE 501.091 (3cr) Renewable Energy and the Grid (W)
NRE 574/PUBPOL 519 (3cr) Sustainable Energy Systems (F)
NRE 501.039 (3cr) Land Use and Global Change (F)
NRE 576/UP 576 (3cr) Ecological Design Approaches to Brownfield Redevelopment (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)
DESCI 502 (3) Design Process Models (W)
DESCI 790 (1-4) Design Science Colloquium (F or W)
EECS 498 (3) Grid Integration of Alternative Energy Sources (TBD)

3) Sustainable Enterprise (3CR)

NRE 567 (3cr) Transportation Energy & Climate (W)
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 (F)
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)
ES 520 (1.5cr) CleanTech Venture Opportunities (F)
FIN 637 (2.25cr) Finance and Sustainable Enterprises (F)
STRAT 735-739 (1.5cr) Topics in Global Sustainable Enterprise (F)
FIN 583 (1.5cr) Energy Project Finance (W)

B) Sustainable Systems Electives

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

Last Revised 07/14/2014
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 558/CEE 587 (3cr) Water Resource Policy (TBD)
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](http://www.snre.umich.edu/node/7746/#energy)
Mobility Systems- [http://www.snre.umich.edu/node/7746/#transportation](http://www.snre.umich.edu/node/7746/#transportation)
Water Systems - [http://www.snre.umich.edu/node/7746/#water](http://www.snre.umich.edu/node/7746/#water)
Food Systems- [http://www.snre.umich.edu/node/7746/#food](http://www.snre.umich.edu/node/7746/#food)
Built Environment - [http://www.snre.umich.edu/node/7746/#builtenv](http://www.snre.umich.edu/node/7746/#builtenv)
Climate Change - [http://www.snre.umich.edu/node/7746/#climchange](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 – Land Use and Global Change
501 – Urban Stormwater
501 – Ecosystem Services
514 – Environmental Impact Assessment
533 – Negotiation Skills
536 – Mediation Skills
597 – Environmental Systems Analysis
662 – Localization Seminar
677 – Climate Adaptation Seminar (2nd 7 week)

**Winter**

501 – Science and Management of the Great Lakes
501 – Biofuels and Sustainability
501 – Advanced LCA Methods and Software Tools (W14 – 2nd 7 weeks)
501 - Applied Ecosystem Modeling (W14 – 2nd 7 weeks)
550 – Systems Thinking for Sustainable Development
557 – Industrial Ecology
570 – Environmental Economics
581 – Advanced Environmental Education
589 – Ecological Restoration
641 – Interdisciplinary Research Methods
687 – Landscape Planning
787 – Metro Studio (MLA only)

Last Revised 07/14/2014