## 2.5 YEAR MS & MSE PLAN

### Engineering

#### Mechanical Engineering Core

- **12CR in ME courses at the 500 or 600 level**
  
  Required Courses:
  - ME 589
  - At least one course from Mechanical Engineering course list (next page)

- **6CR in additional ME courses or research at 400 level or above**
  
  *ME option:
  - Coursework Only

- **6CR in acceptable Mathematics or equivalent**
  
  Please see:
  - ME Graduate Handbook

#### SS Core

- **6CR in Systems Analysis for Sustainability**
  
  Required Course:
  - EAS 557/CEE 586

- **9CR total**

  - **Sustainable Design & Technology**
    - Minimum 3CR
    - See List A2 for acceptable courses

  - **Sustainable Enterprise**
    - Minimum 3CR
    - See List A3 for acceptable courses

  - **3CR minimum from list A1, 2, or 3**
    - See attached list (A1-3) of acceptable courses in these specializations

#### EAS Core

- EAS 509
- EAS 510

- **IAMS Requirement**
  - Two courses; 3CR minimum
  - Please see page 3 for approved

#### Analytics

- **3CR in Analytics**
  
  EAS 538 or equivalent required

#### Opus

- Master’s Project/Thesis/Practicum
  
  At most 6CR of EAS 700/701

#### Cognates [Rackham Requirement]

- Minimum 4 credit hours outside of degree program
  
  Likely fulfilled by other cross-listed courses

### TOTALS

#### MINIMUM CREDIT HOURS BY SCHOOL

- **“EAS” - Minimum 25CR**
- **“ME” - Minimum 18CR**

#### TOTAL CREDIT HOURS

- Minimum 54 Credit Hours
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*)
   - EAS 573 (3cr) Environ Footprinting and Environ Input-Output Analysis (W)
   - EAS 597 (3cr) Environmental Systems Analysis (F)
   - EAS 610 (1.5cr) Advanced LCA Methods & Software Tools (W)
   - EAS 557/CEE 586 (3cr) Industrial Ecology (W)
   - EAS 550/STRAT 566 (3cr) Systems Thinking for Sustainable Development (W)

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

   - EAS 570 (3cr) Environ Economics: Quantitative Methods & Tools (F)
   - EAS 501 (1.5cr) Five courses on selected topics in Env. Economics (TBD)
   - EAS 531 (4cr) Principles of GIS (F&W)

2) Sustainable Design & Technology (3CR)
   - EAS 537 (3cr) Urban Sustainability (F)
   - EAS 501.087 (3CR) Technology and Community Sustainable Development (W)
   - EAS 615 (3CR) Renewable Electricity and the Grid (W)
   - EAS 574/PUBPOL 519 (3cr) Sustainable Energy Systems (F)
   - EAS 548 (3cr) Land Use and Global Change (F)
   - EAS 605/BA 605 (3cr) Green Development (W)
   - EAS 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)
   - EAS 530 (3cr) Decision Making for Sustainability (W)
   - EAS 501.014/CEE 686/ChE 686 (3cr) Environmental Finance (F)
   - EAS 501.018 (3cr) Energy Justice (F)
   - EAS 535/LHC 536 (2.25) Ethics Corporate Management (F or W)
   - EAS 512/STRAT 564 (1.5) Strategies for Sustainable Development I (F)
   - EAS 513/STRAT 565 (1.5) Strategies for Sustainable Development II (F)
   - EAS 527/BE 527 (3cr) Energy Markets and Energy Politics (F)
   - EAS 532 (3cr) Natural Resources and Environ Conflict Management (F)
   - EAS 533 (3cr) Negotiation Skills (F)
   - BE 555 (1.5) Non Market Strategy (F)
   - EAS 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)
   - EAS 572 (2cr) Environmental Impact Assessment (F)
EAS 523 (3cr)  Environmental Risk Assessment (W)
EHS 672 (3cr)  Life Cycle Assessment: Human Health & Environ Impacts (F)
EAS 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.sEAS.umich.edu/node/7746/#energy
Mobility Systems - http://www.sEAS.umich.edu/node/7746/#transportation
Water Systems - http://www.sEAS.umich.edu/node/7746/#water
Food Systems - http://www.sEAS.umich.edu/node/7746/#food
Built Environment - http://www.sEAS.umich.edu/node/7746/#builtenv
Climate Change - http://www.sEAS.umich.edu/node/7746/#climchange

**Cognates**
SEAS – Minimum 4 credits outside SEAS. Can be fulfilled with CEE coursework.
CEE – 6 credits of non-CEE coursework. Can be fulfilled with one advanced Mathematics course (proper choice of SEAS Analytical courses can also satisfy this requirement) and one SEAS course.

**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
530 - Decision Making for Sustainability
552 – Ecosystem Services
572 – Environmental Impact Assessment
533 – Negotiation Skills
536 – Mediation Skills
547 – Forest Ecology
553 – Diverse Farming Systems
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
532 – Natural Resource Conflict Management
545- Applied Ecosystem Modeling
549 – Analysis and Modeling of Ecological Data
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)