# Interdisciplinary Studies

## MISSION AND OBJECTIVES

The University provides several options for students to pursue education more broadly than one field of undergraduate study might allow, including interdisciplinary and multidisciplinary programs. These programs allow broader instruction and research opportunities, especially in emerging fields that haven't reached the academic breadth to constitute a full academic department or in cases in which collaboration between one or more departments allows faculty from each existing department to contribute to the interdisciplinary or multidisciplinary major. In the Catalog of Studies, requirements for each interdisciplinary program are listed in the chapter of the college or school that oversees the program.

Two interdisciplinary minors — Microelectronis-Photonics and Sustainability — are not administered by an academic department. The minor in Microelectronics-Photonics is administered by the Division of Interdisciplinary Studies in the Graduate School. The minor in Sustainability is administered by the Provost's Office. The requirements for completing each minor are listed below.

## MICROELECTRONICS-PHOTONICS (MEPH)

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**Biological and Agricultural Engineering Faculty:**
- Professor Li
- Assistant Professors Jin, Kavdia, Kim, Ye

**Chemical Engineering Faculty:**
- Professors Beitle, Ulrich
- Associate Professor Roper
- Assistant Professors J. Hestekin (J.), Servoss

**Chemistry Faculty:**
- Professors Fritsch, Peng, Stenken
- Assistant Professors Tian, Chen

**Civil Engineering Faculty:**
- Professor Selvam

**Computer Science/Computer Engineering Faculty:**
- Assistant Professor Di

**Electrical Engineering Faculty:**
- Distinguished Professors Varadan (V.K), Varadan (V.V.)
- Professors Ang, Balda, Manasreh, Mantooth, Naseem
- Associate Professor El-Shanawee
- Assistant Professors Ji, Yu
- Research Professor Lostetter
- Research Associate Porter

**Mechanical Engineering Faculty:**
- Professors Gordon, Malshe
- Associate Professors Tung, Zou
- Assistant Professors Huang, Spearot, Wejinya

**Microelectronics-Photonics Faculty:**
- Research Assistant Professor Benamara
- Adjunct Professors DePriest, Foster

**Physics Faculty:**
- Distinguished Professors Salamo, Xiao
- Professors Bellaiche, Singh
- Research Professor Vickers
- Associate Professors Fu, Oliver
- Assistant Professors Gross, Li, Tchakhalian

Microelectronics-Photonics (microEP) is an interdisciplinary program based in the Division of Interdisciplinary Studies in the Graduate School that prepares students for careers involving micro/nano materials, processing, and devices applied in areas such as photonics, microelectronics, bio/chemical analysis, etc. The microEP Graduate Program offers M.S. and Ph.D. degrees, as well as an undergraduate minor in Microelectronics-Photonics.

The purpose of this minor is to allow undergraduates in science and engineering to be able to capitalize on the research and educational core of the microEP Graduate Program as they prepare to enter the job market or compete for positions in top level graduate programs.

Requirements for a minor in Microelectronics-Photonics: Three hours of required courses (One of INEG 4323, INEG 4433, or INEG 4443). At least 12 additional hours must be taken from the following undergraduate courses (BENG 4123, CHEM 4213, ELEG 4203, ELEG 4223, MEEG 4303, MEEG 4443, MEPH 488V, PHYS 3603, PHYS 4713, and PHYS 4213), or from other appropriate courses not on this list if approved first by the microEP Program and by the course instructor. See examples at the microEP Web site.

Students accepted into the microEP minor must attend an orientation session at the beginning of each semester as well as the monthly microEP graduate student research presentations. Students enrolled in the microEP minor must attend at least one public presentation of a Master of Science thesis in microEP or a Doctor of Philosophy dissertation in microEP each semester. Students wishing to declare this minor must apply through the microEP Program Web site, http://microEP.uark.edu, and be accepted into the minor at least two regular semesters before their graduation date.

## SUSTAINABILITY (SUST-M)

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**Sustainability Curriculum Steering Committee**

- Professor Stephen Boss, co-director, Geosciences
- Associate Professor Tahar Messadi, co-director, Architecture
- Associate Dean Carol Gattis, Honors College
- Professor Kevin Fitzpatrick, Sociology
- Professor Jon Johnson, Management
- Professor Kim LaScola-Needy, Industrial Engineering
- Professor Marty Matlock, Biological and Agricultural Engineering
- Professor Jennie Popp, Agricultural Economics and Agribusiness
- Research Assistant Professor Harrison Pittman, Agricultural Law
- Assistant Professor Gregory Benton, Recreation and Sports Management

The minor in Sustainability is interdisciplinary, drawing from faculty and course work across all colleges of the University of Arkansas. The minor is accessible to all undergraduate students, regardless of degree program. The purpose of the minor in Sustainability is to provide foundational knowledge and skills related to the emerging discipline of sustainability, organized around four thematic areas reflecting strength in scholarship of University of Arkansas academic colleges: Sustainability of Social Systems, Sustainability of Natural Systems, Sustainability of Built Systems, and Sustainability of Managed Systems. Students who complete the minor in Sustainability will be expected to:

- Articulate commonly accepted definitions of sustainability and discuss various nuances among those definitions;
- Have an understanding of the interdisciplinary nature of sustainability issues, particularly as they pertain to the thematic areas of knowledge addressed by the minor (sustainability of natural systems, sustainability of managed systems, sustainability of built systems, and sustainability of human social systems);
- Be conversant regarding acquisition and analysis of data pertinent to sustainability issues;
- Communicate orally and in writing organized thoughts defining sustainability issues;
- Identify appropriate potential strategies to address sustainability issues using data and provide results of rudimentary analyses of data using novel metrics or statistics;
- Make recommendations, based on data analysis and interpretation, to advance sustainability of individuals or institutions.

### Required Courses for a Minor in Sustainability

Students must earn a grade of 'C' or better for all courses used to fulfill requirements of the minor in Sustainability.

| | Hours |
|---|---|
| SUST 1103 Fundamentals of Sustainability | 3 |
| SUST 2103 Applications of Sustainability | 3 |
| Elective courses with sustainability focus selected from a broad menu of offerings in four thematic areas:<br>• Sustainability of Social Systems<br>• Sustainability of Natural Systems<br>• Sustainability of Built Systems<br>• Sustainability of Managed Systems<br>Elective courses are categorized as Tier 1 and Tier 2. Tier 1 courses are those with dominant sustainability content or fundamental principles related to understanding sustainability. Tier 1 courses must comprise at least 6 hours of the 9 elective hours.<br>Tier 2 courses are those with subordinate sustainability content or associated principles related to understanding sustainability, but with content useful in preparing students with prerequisite knowledge for Tier 1 courses.<br>Only 3 hours of Tier 2 courses will be accepted in fulfillment of the elective hours in the Minor in Sustainability.<br>Complete lists of Tier 1 and Tier 2 courses by thematic areas are presented below. | 3 |
| SUST 4103 Capstone Project in Sustainability or substitute approved by UA Sustainability Curriculum Steering Committee to serve as capstone experience for the Foundations in Sustainability minor. | 9 |

**List of Available Elective Courses:** Students choose 9 hours from menus below; at least 6 hours must be chosen from Tier 1 courses (prerequisites are in italics):

**Sustainability of Natural Systems Courses**

Tier 1

BENG 4903 Watershed Ecology & Hydrology (*CVEG 3213*)
BIOL 3863/BIOL 3861L General Ecology and lab
General Ecology 7 hours of biological sciences
CSES 3214 Soil Resources & Nutrient Cycles (*CSES 2203 and lab component*)
ENSC 3003 Introduction to Water Science (*ENGL 1023 and ENSC 1003 or CHEM 1053 or higher or GEOL 1113 or higher or BIOL 1543*)
ENSC 3103 Plants and Environmental Restoration (*CSES 1203 or HORT 2003 or BIOL 1613*)
ENSC 3223/3221L Ecosystem Assessment and lab (*BIOL 1543, CSES 2203, ENSC 3003*)
ENSC 3263 Soil and Water Conservation (*CSES 2203*)
ENSC 4023 Water Quality (*CHEM 1123/1121L*)
ENSC 4263 Environmental Soil Science (*CSES 3214*)

Tier 2

BIOL 1543/1541L Principles of Biology and lab
CHEM 1103 University Chemistry I; the lab component, CHEM 1101L, is recommended (*MATH 1203 and Drill*)
CHEM 1123/1121L University Chemistry II and lab (*MATH 1203, CHEM 1103*)
CSES 2203/2201L Soil Science and lab (*CHEM 1103 or CHEM 1074; Same as ENSC 2203*)
ENSC 1003 Environmental Science
GEOG 2003 World and Regional Geography
GEOG 3333 Oceanography (*Junior standing*)
GEOG 3383 Principles of Landscape Evolution
GEOG 4353 Elements of Weather (*Junior standing*)
GEOG 4363 Climatology (*GEOG 1003 or GEOG 4353*)
GEOL 1113/1111L General Geology and lab (Pre- or corequisite: *GEOL 1113*)
GEOL 1133/1131L Environmental Geology and lab (*GEOL 1113/GEOL 1111L*)
GEOL 4033 Hydrogeology (*MATH 2564, GEOL 3513/GEOL 3511L*)
GEOL 4053 Geomorphology (*GEOL 1113 or GEOL 3002*)
GEOL 4063 Principles of Geochemistry (*CHEM 1121L and CHEM 1123*)

GEOS 4413 Principles of Remote Sensing (*University science course*)
MATH 4163/BIOL4163 Dynamic Models in Biology (*MATH 2554; Same as BIOL 4163*)
PHYS 2054 Univeristy Physics I (*MATH 2554*)
PHYS 2074 Univeristy Physics II (*PHYS 2054, Prerequisite or corequisite: MATH 2564*)

**Sustainability of Managed Systems courses**

Tier 1
AGEC 3413 Principles of Environmental Economics (*AGEC 1103 or ECON 2023*)
AGEC 3523 Environmental and Natural Resource Law
AGED 4003 Issues in Agriculture Junior standing
CSES 3214 Soil Resources and Nutrient Cycles with lab (*CSES 2203*)
ECON 3843 Economic Development, Poverty, & the Role of the World Bank and IMF in Low-Income Countries (*ECON 2013 and ECON 2023, or ECON 2143*)
ENSC 3103 Plants and Environmental Restoration (*CSES 1203 or HORT 2003 or BIOL 1613*)
ENSC 3223/3221L Ecosystems Assessment and lab (*BIOL 1543, CSES 2203, and ENSC 3003*)
ENSC 3263 Soil and Water Conservation with lab component (*CSES 2203*)
ENSC 4023 Water Quality with lab component (*CHEM 1123/CHEM 1121L*)
ENSC 4263 Environmental Soil Science (*CSES 3214*)
HORT 3503 Sustainability and Organic Horticulture (*suggested but not required: BIOL 1613 , CSES 1203, CSES 1003, or HORT 2003*)
WCOB 3023 Sustainability in Business (*Junior standing*)

Tier 2
AGED 4443 Methods of Technological Change (Junior standing)
AGME 1613 Fundamentals of Agricultural Systems Technology with lab component
CSES 2012 Organic Crop Production
CSES 2203/2201L Soil Science with drill (*CHEM 1103 or CHEM 1074; Same as ENSC 2203*)
ENSC 1003 Environmental Science
MGMT 4243 Ethics and Corporate Responsibility (*Junior standing*)

**Sustainability of Built Systems courses**

Tier 1
ARCH 4023H Sustainability and Design Permission of instructor
CVEG 488V Sustainability in Civil Engineering (*CVEG majors*)
GEOG 4383 Hazard Assessment and Risk Policy (*Junior standing*)
INEG 4583 Renewable Energy: Green Power Sources (*Senior standing*)
MEEG 4453 Industrial Waste and Energy Management (*MEEG 4413 or equivalent*)
MEEG 4473 Indoor Environmental Design (*MEEG 4413 or equivalent*)
LARC 5043 Housing As If The Future Matters
LARC 5063 Alternative Storm Water Management

Tier 2
GEOG 3543 Geographic Information Science
GEOG 4063 Urban Geography (*Junior standing*)
ARCH 2114 Building Environmental Technology: Passive Systems Buildings (*ARCH 1024 and ARCH 1222, Corequisite: ARCH 2016*)
ARCH3134 Building Systems: Lighting, Acoustics, and HVAC (*ARCH 2124, Corequisite: ARCH 3016*)
LARC 4743 Site Plannning in Landscape Architecture
CVEG 3243 Environmental Engineering with lab component (*MATH 3404 and CHEM 1123*)
CVEG 4243 Environmental Engineering Design (*CVEG 3243*)
CVEG 4323 Design of Structural Systems (*CVEG 4303 and CVEG 4313*)
CSCE 4233 Low Power Digital Systems (*CSCE 2123*)

**Sustainability of Social Systems courses**

Tier 1
AGEC 3523 Environmental and Natural Resource Law
AGEC 4163 Agriculture and Rural Development (*AGEC 1103 or ECON 2023*)
COMM 4643 Environmental Communications
ENGL 4133 Environmental Literature and Nature Writing
ENSC 3933/ PHIL 3113 Environmental Ethics (*ENSC 1003 or PHIL 2003 or PHIL 2103*)
GEOS 4693 Environmental Justice
RESM 1023 Recreation and Natural Resources (*RESM 1003*)
RESM 4023 Outdoor Adventure Leadership
RSOC 4603/SOCI 4603 Environmental Sociology

Tier 2
ANTH 4143 Ecological Anthropology
HIST 4773 Environmental History
HLSC 6553 Environmental Health
HLSC 4643/5643 Multicultural Health
SCWK 4093 Human Behavior and Social Environments I (*PSYC 2003, SOCI 2013, SCWK 2133, and SCWK 3193 and either BIOL 1543/1541L, or ANTH 1013/1011L*)
SCWK 4103 Human Behavior and Social Environments II (*SCWK 4093 and SCWK 4153*)
SCWK 3193 Human Diversity and Social Work
SOCI 2033 Social Problems
SOCI 3013 Population and Society
SOCI 3193 Race, Class, Gender in the U.S. (*SOCI 2013*)
SOCI 4013 Special Topics: The City (*SOCI 2013*)

**Capstone Experience**

All students participating in the minor in Sustainability must complete a capstone experience focused on service learning, research learning, or internship in sustainability. Student engagement in community service, research, or relevant work on sustainability through a summer internship provides opportunities for students to apply sustainability theories and principles learned from prior coursework toward advancing sustainability across society.

Students may formally petition the University of Arkansas Sustainability Curriculum Steering Committee to substitute sustainability-oriented senior design projects, Honors College research projects, other service learning courses, or equivalent internship experiences for SUST 4103 to satisfy the capstone element of minor in Sustainability. Details of the procedure to substitute alternative experiences for SUST 4103 can be found in the Foundations of Sustainability Program Handbook.

To qualify for SUST 4103 or other sustainability capstone experience, students must have successfully completed SUST 1103, SUST 2103, and 6 hours of elective course work toward the minor in Sustainability.