

**INTERCOLLEGIATE****CENTER FOR INTERDISCIPLINARY RESEARCH AND GRADUATE EDUCATION  
(CIRE)****All changes effective Fall 2011**

- ▲ ADD NEW DEPARTMENT, MAJOR, AND DEGREE (CIRE / 218)
- ▲ ADD NEW ACADEMIC DISCIPLINE AND SUBJECT CODE (324 / ESE)

**I. COURSE CHANGES**

- ▲ ADD NEW ACADEMIC DISCIPLINE, SUBJECT CODE AND COURSES

**(324) (ESE) Energy Science and Engineering**

**ESE 502 Registration For Use of Facilities (1-15)** Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.

*Grading Restriction: Satisfactory/No Credit grading only.*

*Repeatability: May be repeated.*

*Credit Restriction: May not be used toward degree requirements.*

*Registration Restriction: Minimum student level – graduate.*

**ESE 511 Introduction to Energy Science and Technology I (3)** Topics include: Energy basics, history of energy and society, current and future supply and demand, political and environmental aspects of energy production, energy technologies (fossil fuels, biomass, nuclear fission, nuclear fusion, solar, wind, geothermal), energy conversion, storage, transportation, and distribution, energy efficiency, and innovation.

**ESE 512 Introduction to Energy Science and Technology II (3)** Topics include: Energy basics, history of energy and society, current and future supply and demand, political and environmental aspects of energy production, energy technologies (fossil fuels, biomass, nuclear fission, nuclear fusion, solar, wind, geothermal), energy conversion, storage, transportation, and distribution, energy efficiency, and innovation.

**ESE 593 Independent Study (1-3)**

*Repeatability: May be repeated. Maximum 9 hours.*

*Credit Restriction: Only 6 hours may be applied toward degree requirements.*

**ESE 599 Seminar (1)**

*Grading Restriction: Satisfactory/No Credit grading only.*

*Repeatability: May be repeated. Maximum 15 hours.*

*Credit Restriction: Only 3 hours may be applied toward degree requirements.*

**ESE 600 Doctoral Research and Dissertation (3-15)**

*Grading Restriction: P/NP grading only.*

*Repeatability: May be repeated.*

ADD AND REQUEST VARIABLE TITLE

**ESE 597 Special Topics (1-3)**

*Repeatability: May be repeated. Maximum 9 hours.*

**ESE 697 Special Topics (1-3)**

*Repeatability: May be repeated. Maximum 9 hours.*

Rationale: A new interdisciplinary doctorate degree in Energy Science and Engineering (ESE) is proposed, to educate students in energy-related fields that are increasing in importance to the state and the country. Faculty formed from current researchers at the University of Tennessee Knoxville and Oak Ridge National Laboratory provide research opportunities in various fields relating to the scientific and engineering challenges in energy supply and usage, including impacts on the environment and climate. A few new courses are proposed at the 500- and 600- levels, while existing 500- and 600-level courses in various departments are utilized to provide the course component of the PhD, different depending on the specific area of specialization of the ESE student. This is a program that was initiated by Governor Bredesen and funded by the State Legislature. This degree will be administered by the newly created Center for Interdisciplinary Research and Graduate Education (CIRE), which has been established by UTK and Oak Ridge National Laboratory.

**II. PROGRAM CHANGES****▲ ADD NEW MAJOR AND DEGREE**

ENERGY SCIENCE AND ENGINEERING, PHD (*PENDING THEC APPROVAL*)

**Energy Science and Engineering, PhD\***

*\*This program is pending approval from the Tennessee Higher Education Commission. Students will be admitted to the major should the program be approved.*

A graduate program is offered leading to the Doctor of Philosophy (PhD) degree in Energy Science and Engineering (ESE). This interdisciplinary degree is a collaborative effort supported by selected faculty in the College of Arts and Sciences, the College of Agricultural Sciences and Natural Resources, and the College of Engineering, in addition to research staff of Oak Ridge National Laboratory. These research and educational leaders are appointed as faculty members of the Center for Interdisciplinary Research and Graduate Education (CIRE). Members of the CIRE faculty determine the curriculum and serve as the primary resource for the teaching, research, and mentoring of the students admitted to the program. The CIRE Graduate Education Committee makes decisions on admissions, transfer, evaluation, and continuation of graduate students in the program.

**Admission Requirements**

In order to be admitted to the PhD program in energy science and engineering, student applicants must fulfill the general admission criteria for the Graduate School of the University of Tennessee Knoxville. In addition, the student must have a Bachelor of Science degree in either engineering or a scientific field (physics, chemistry, biology, mathematics, computational science, etc.), or the equivalent. Students with other undergraduate degrees may also be admitted on a case-by-case basis by the CIRE Graduate Coordinating Committee. Dependent on the student's background, additional coursework may be required to satisfy co- and prerequisites.

## Requirements

A minimum of 72 hours is required beyond the bachelor's degree, exclusive of credit for an MS thesis, and completion of the core requirements, as outlined in the section on Course Requirements. Of this number, a minimum of 24 and up to 36 hours of 600 Doctoral Research and Dissertation and six hours of 600-level coursework at UTK will be required.

No later than one year after entering the program, each student must take a qualifying examination. A student must pass the qualifying examination to proceed in the PhD program.

No later than the end of the second year following entrance into the PhD program, each student must take and pass a comprehensive examination that includes presentation and approval of the proposed dissertation research. After passing the comprehensive exam, the student should submit the Admission to Candidacy Application to the Graduate School. Admission to candidacy indicates that the student has demonstrated the ability to do acceptable work in the area of study and has made satisfactory progress toward the degree. This action usually connotes that all prerequisites to admission have been completed and the program of study/research has been approved (see details in a later section).

After completion of the dissertation, prior to graduation, each student must pass a dissertation defense examination administered by the student's doctoral committee.

## Course Requirements

Out of the 72 hours required for the program, 36 hours of coursework is required beyond the BS degree. Of these, the following 30 hours of coursework or their equivalent must be completed at a minimum, including the Core Curriculum, a Knowledge Breadth Curriculum, a Knowledge Specialization Curriculum, and Seminar Series, as summarized below.

### A. Core Curriculum (6 credits)

ESE 511 and ESE 512 Introduction to Energy Science and Technology (3, 3)

### B. Knowledge Breadth Curriculum (6 Credits): select two courses from the three following areas

Political, social, legal, ethical and security issues related to energy (3-4 courses, each 3 credits)

Entrepreneurship, leadership, and management (3-4 courses, each 3 credits).

Environmental and climate sciences related to energy (3-4 courses, each 3 credits)

### C. Knowledge Specialization Curriculum (15 Credits)

Choose five courses from participating department as defined in the CIRE Graduate Student Handbook.

Nuclear energy

Bioenergy and biofuels

Renewable energy

Energy conversion and storage

Distributed energy and grid management

Environmental and climate sciences related to energy

**D. ESE 599 Seminar** (3 credits; 1+1+1)**Faculty Committee***Advisor/Major Professor*

Each graduate student must have an advisor/major professor. This professor advises the student about course selection, supervises the student's research, and facilitates communication within the degree program and/or student's major department, to other departments, and with the Graduate School relative to requirements. A temporary advisor may be assigned to direct the entering student's work during the period in which the student is becoming acquainted with the institutions and determining the focus of research interests. Once the major professor is determined, the major professor and the student together select a doctoral committee. The student is expected to maintain close consultation with the major professor and other members of the graduate committee with regard to progress in the program.

*Doctoral Committee*

The major professor directs the student's dissertation research and chairs the doctoral committee. The student and major professor identify a doctoral committee composed of at least four faculty members holding the rank of assistant professor or above, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be outside the CIRE faculty. Committee members should be chosen to insure multidisciplinary breadth. The Center Director has oversight responsibility to insure the multidisciplinary nature of the committee. A doctoral student, in collaboration with the major professor, should begin to form the doctoral committee during the first year of study. Once formed, the doctoral committee, by request of the major professor, will meet annually, at the minimum, with the student to insure timely progress toward the degree.

**Admission to Candidacy**

Admission to candidacy indicates that the student has demonstrated ability to do acceptable graduate work and that satisfactory progress has been made toward the degree. This action usually connotes that all prerequisites to admission have been completed and a program of study has been approved.

A student may be admitted to candidacy for the doctoral degree after passing the comprehensive examination and maintaining at least a B average in all graduate coursework. Each student is responsible for filing the Admission to Candidacy form, which lists all graduate courses to be used for the degree, including courses taken at the University of Tennessee or at other institutions prior to admission to the doctoral program. The Admission to Candidacy form is signed by the doctoral committee.

**Graduate Student Examinations**

This section provides a description of the graduate student examination requirements for the PhD degree program. Three examinations are required as part of the doctoral program: qualifying examination, comprehensive examination, and defense of dissertation examination.

*Qualifying Examination*

The qualifying examination is developed, administered, and graded by the faculty (or designated subset of the faculty) of the PhD program under the coordination of the CIRE Director and tests the student's general knowledge related to the course requirements. In case of failure, the candidate may appeal to retake the examination through the CIRE Graduate Education Committee within 30 days of notification of the result. If the appeal is granted, the student must retake the examination at the next offering. The result of the second examination is final.

*Comprehensive Examination*

**Timing.** The Comprehensive Examination must be taken no later than the end of the second year following entrance into the PhD program and prior to admission to candidacy. The timing is late enough in a student's academic program to permit most of his/her graduate course work to be covered on the examination, and early enough to permit modification of the student's program based on the results of the exam.

**Prerequisites for the exam.** Two requirements must be satisfied before a student takes the Comprehensive Examination.

A written Dissertation Proposal, approved by the major professor, must be submitted to each member of the student's Doctoral Committee two weeks prior to the examination. Each member of the student's Doctoral committee must agree that the student is ready to take the Comprehensive Exam. In order to satisfy each member of the committee that he/she is ready for the exam, the student may be required to perform satisfactorily on either written or oral tests as prescribed by the committee member. The committee member will communicate to the major professor when they are satisfied that the student is ready to take the Comprehensive Exam.

**Format.** The Comprehensive Examination will consist of two parts:

A one-day to two-day open book written examination will be given at an agreed upon date. This exam will be composed by the members of the Doctoral Committee at the request of the student's major professor, and the exam will be administered by the major professor.

Approximately three to six weeks after the written examination, the student will be required to defend his/her dissertation research proposal to the committee. An oral examination will be given. In addition, the student may be further examined in an oral examination on subject matter similar to that covered on the written exam.

Once the Comprehensive Examination is passed, the student should file for and be admitted to candidacy. At the discretion of the Doctoral Committee, supplemental reexaminations for the Comprehensive Examination and/or proposed dissertation research may be required. In case of failure, the candidate may not apply for reexamination until the following semester. The result of the second examination is final.

*Defense of Dissertation Examination*

A doctoral candidate must pass an oral examination on the dissertation. The dissertation, in the form approved by the major professor, must be distributed to the committee at least two weeks before the examination. The examination must be scheduled through the Office of the University Registrar at least one week prior to the

examination and must be conducted in university-approved facilities. The examination is announced publicly and is open to all students and faculty members. The defense of dissertation will be administered by all members of the doctoral committee after completion of the dissertation and all course requirements. This examination must be passed at least two weeks before the date of submission and acceptance of the dissertation by Graduate Student Services. The major professor must submit the results of the defense by the dissertation deadline.