College of Engineering

Dean: Cheryl B. Schrader
Telephone 208 426-1153

Associate Dean: Janet Callahan
Telephone 208 426-1450
Engineering Technology Building, Room 338
FAX 208 426-4466
http://coen.boisestate.edu

Graduate Degrees Offered

Doctor of Philosophy in Electrical and Computer Engineering
Master of Science in Civil Engineering
Master of Engineering in Civil Engineering
Master of Science in Computer Engineering
Master of Engineering in Computer Engineering
Master of Science in Computer Science
Master of Science in Electrical Engineering
Master of Engineering in Electrical Engineering
Master of Science in Instructional & Performance Technology
Master of Science in Mechanical Engineering
Master of Engineering in Mechanical Engineering
Master of Science in Materials Science and Engineering (See Interdisciplinary Programs)
Master of Engineering in Materials Science and Engineering (See Interdisciplinary Programs)
Graduate Certificate in Human Performance Technology

General Information

There are six departments that grant graduate degrees in the College of Engineering at Boise State University: Civil Engineering, Computer Science, Electrical and Computer Engineering, Mechanical and Biomedical Engineering, Materials Science and Engineering, and Instructional & Performance Technology. These departments serve the mission of the College of Engineering by providing accessible, high-quality, nationally recognized programs of instruction, research, and service that prepare students for engineering and other high technology careers, and that support individuals and organizations in Idaho, the Northwest region, and the nation.

The graduate programs in the College of Engineering are offered in a variety of degree options and delivery methods to accommodate student interests and career needs. The Master of Science degrees in Civil Engineering, Computer Engineering, Electrical Engineering, Mechanical Engineering and Materials Science and Engineering, are thesis-based programs designed to prepare students for careers that involve a research component in their field. The thesis-based options often provide funding to students pursuing these options. The Master of Engineering degrees are non-thesis programs that may be satisfied by an approved selection of coursework and culminating activities. A number of graduate level courses are available in an on-line delivery format. The Master of Science in Computer Science offers both a thesis and a non-thesis option. The Master of Science in Instructional & Performance Technology has several different options that include thesis and non-thesis options, and is available in both the traditional on-campus mode of delivery as well as in an on-line delivery format which constitutes an entirely nonresident course of study.

The graduate faculty members in the College of Engineering are active in their academic and research fields, in their professional societies, and are dedicated to providing the highest quality instruction possible. The research facilities available to graduate students pursuing a degree include a variety of equipment housed in a number of different facilities such as the Biomaterials Research Laboratory, the Center for Materials Characterization, the Beowulf Computer Cluster Development Laboratory, the C-MEMS Laboratory, Environmental Sensor Development, the Biomechanics Research Laboratory, the Nanofabrication Laboratory, and more.
Department of Civil Engineering

Chair: Robert Hamilton
Engineering and Technology Building, Room 201
Telephone 208 426-3764
FAX 208 426-4800
http://coen.boisestate.edu/ce/msece.asp

Graduate Faculty: Molly Gribb, Robert Hamilton, David Haws, Mandar Khanal, Sondra Miller, Rebecca Mirsky, George Murgel, Venkataramana R. Sridhar

Graduate Degrees Offered
- Master of Science in Civil Engineering
- Master of Engineering in Civil Engineering

General Information
The Department of Civil Engineering offers two distinct graduate degree programs. The program leading to the Master of Science in Civil Engineering (M.S. CE) is a thesis-based program designed to prepare students for research and development and further study at the doctoral level. The program leading to the Master of Engineering in Civil Engineering (M.Engr. CE) is a non-thesis program with a focus on professional development.

Application and Admission

Requirements

Admission Requirements. An applicant must satisfy the minimum admission requirements of the Graduate College. In addition, the applicant must hold a baccalaureate degree in civil engineering from an ABET-accredited program or a baccalaureate degree in a closely related field, and must follow the application procedures specified below. Admission is competitive and the achievement of minimum requirements does not guarantee admission.

Application Procedures. A prospective student may apply at any time and should follow the general graduate application procedure for degree-seeking students (see Applying as a Degree-Seeking Student in this catalog). The applicant must also (1) submit a statement of purpose to the graduate program coordinator of the Department of Civil Engineering, and (2) arrange to have GRE General Test scores submitted by the Educational Testing Service (www.ets.org) directly to Boise State University (code R4018). The statement of purpose should give the educational and professional background of the student and his or her motivation for graduate study including career goals. Applicants holding a baccalaureate degree from the College of Engineering of Boise State University are not required to submit GRE scores. International students must arrange to have three letters of recommendation submitted directly by the references to the Boise State University International Admissions Office. Once the applicant's file is complete, it will be evaluated by the Civil Engineering Graduate Studies Committee and an admission recommendation (regular, provisional, or denial) will be forwarded to the Dean of the Graduate College. In order to ensure proper mentoring of all graduate students, a recommendation for regular or provisional admission will not be forwarded unless a faculty member of the Department of Civil Engineering is available to serve as the major advisor. The graduate dean will make the final admission decision and notify the applicant and the Civil Engineering Graduate Studies Committee.

Advisor and Supervisory Committee
The Civil Engineering Graduate Studies Committee will assign a supervisory committee (including a major advisor who serves as chair) for each admitted student. The role of the supervisory committee is to guide the student in all aspects of his or her graduate study.

Master of Science in Civil Engineering

Graduate Program Coordinator: George Murgel
Micron Engineering Center, Room 403D
Telephone 208 426-3788
e-mail: gmurgel@boisestate.edu

Degree Requirements
Students must complete at least 31 graduate credits distributed as shown in the degree requirements table. A written thesis proposal and oral presentation...
to the supervisory committee is required prior to the completion of 15 credits applicable to the degree requirements. Work on the thesis can only be undertaken after approval of the thesis proposal by the supervisory committee. The thesis must constitute an original contribution to knowledge in civil engineering and must be successfully defended at a final oral examination. All work directly related to the thesis must be represented by at least 6 credits of CE 593.

The comprehensive examination cannot be attempted prior to the last semester of the program. If the comprehensive examination is failed on the first attempt, then the student will be permitted a second attempt. Failure on the second attempt will result in dismissal from the program.

### Master of Science in Civil Engineering

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### Master of Engineering in Civil Engineering

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**Special Rule on Transfer Credit.** The normal transfer credit policies of the Graduate College hold except that up to 15 transfer credits earned in combination at the University of Idaho and Idaho State University may be applied to either degree program (M.S. CE or M.Engr. CE) with the approval of the supervisory committee.

**Course Offerings**

Additional work will be required to receive graduate credit for undergraduate G courses.

CE – CIVIL ENGINEERING

CE 452G STRUCTURAL STEEL DESIGN (2-3-3)(F/S). Design of steel structures, such as beams and columns, in accordance with latest AISC Manual of Steel Construction, LRFD edition. PREREQ: CE 352.

CE 460G GEOTECHNICAL ENGINEERING DESIGN (3-0-3) (F/S). Subsoil exploration and site investigation methodologies. Soil mechanics in design of earth retaining structures, shallow and deep foundations, embankments, slopes, and excavations. PREREQ: CE 360 and CE 361.

CE 512 (GEOS 512) HYDROGEOLOGY (3-0-3)(F). The study of subsurface water and its relationship to surface water, the hydrologic cycle, and the physical properties of

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**Degree Requirements**

Students must complete at least 31 graduate credits distributed as shown in the degree requirements table. A maximum of 3 credits of CE 696 Directed Research may be applied to meet the degree requirements. The comprehensive examination

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aquifer systems. Flow nets and flow through porous and fractured media. Methods of determination of aquifer characteristics and performance and groundwater modeling. May be taken for CE or GEOS credit, but not for both. PREREQ: MATH 175, junior standing.

CE 516 (GEOPH 516)(GEOS 516) HYDROLOGY (3-0-3)(S). Interdisciplinary earth science concerned with movement and occurrence of water. Watershed-based hydrologic phenomena including hydrologic cycle, water quality, precipitation, evapotranspiration, snow and snowmelt, streamflow, floods, routing and surface runoff events. Application of analytical techniques to solve water resource problems. May be taken for CE, GEOPH or GEOS credit, but not in more than one department. PREREQ: MATH 175 or PERM/INST

CE 520 ENVIRONMENTAL PROCESS CHEMISTRY (3-0-3)(Even years). Chemical principles of water and wastewater treatment processes and reactions in receiving waters. Topics include chemical thermodynamics, reaction kinetics, acid-base equilibria, mineral precipitation/dissolution, and electrochemistry. PREREQ: CHEM 112 or PERM/INST


CE 524 WATER TREATMENT PLANT SYSTEMS AND DESIGN (3-0-3)(Odd years). Theoretical and practical engineering aspects of advanced chemical and physical phenomena and processes applicable to the design for removal of impurities from ground and surface water sources, including experimental problem analysis, conveyance systems and optimal treatment solution reporting. PREREQ: CE 320 or PERM/INST.

CE 525 WASTEWATER TREATMENT PLANT SYSTEMS AND DESIGN (3-0-3)(F)(Odd years). Theoretical and practical engineering aspects of advanced chemical, physical and biological phenomena and processes applicable to the design for removal of impurities from wastewater and industrial wastes and to their transformation in receiving waters, including experimental problem analysis, collection system conveyance and optimal treatment solution reporting. PREREQ: CE 320 or PERM/INST

CE 527 (GEOS 526) AQUEOUS GEOCHEMISTRY (3-0-3)(F/S). Basic tools and topics of aqueous geochemistry with an emphasis on low temperature processes in natural waters. Essentials of thermodynamics, kinetics, aqueous speciation, mineral-water interaction, and elemental cycling in the context of surficial earth processes and environmental challenges. May be taken for CE or GEOS credit, but not both. PREREQ: PERM/INST.

CE 530 (GEOS 530) VADESE ZONE HYDROLOGY (3-0-3)(F). Laboratory and field methods for characterizing physical and hydraulic properties of soils, solution of variably saturated flow problems using analytical and numerical techniques. Computer simulations of flow and transport in variably saturated soils. May be taken for CE or GEOS credit, but not for both. PREREQ: CE 412, GEOS 412, CE 512, or GEOS 512 or PERM/INST.

CE 533 (GEOS 533) CONTAMINANT TRANSPORT (3-0-3)(S). The fate and transport of dissolved solutes and non-aqueous phase liquids in groundwater systems. Students will analyze field data and develop conceptual models for contaminated sites. The role of engineers and hydrologists in environmental litigation will be addressed through case studies. May be taken for CE or GEOS credit, but not for both. PREREQ: CE 412 or CE 512 or GEOS 412 or GEOS 512, or PERM/INST.

CE 538 WATER RESOURCES ENGINEERING (2-3-3)(F/S). Flood frequency analysis, reservoir characteristics and design, open channel flow applications, water project design, model studies, pump and turbine hydraulics and other water resources engineering topics. PREREQ: ENGR 330.

CE 540 PAVEMENT DESIGN AND EVALUATION (3-0-3)(F/S). Pavement design processes, materials selection and characterization methods, design of flexible pavements, design of rigid concrete pavements, condition survey and ratings, distress evaluation, and maintenance and rehabilitation techniques. PREREQ: CE 340 and CE 370.


CE 555 STRUCTURES II (3-0-3)(Odd years). Analysis and design of structural systems. Stiffness method including the development of element properties, coordinate transformations, and global analysis theory. Three-dimensional building systems and an introduction to the Finite Element Method. PREREQ: CE 352.

CE 554 TIMBER DESIGN (3-0-3)(F/S). Design of wood, and wood composite, structures and systems based on mechanical and structural characteristics and specifications. PREREQ: CE 352.


CE 564 SEEPAGE, DRAINAGE, FLOW NETS AND EMBANKMENTS (3-0-3)(F/S). Emphasis on the applied aspects of groundwater flow and seepage through porous media from a theoretical point of view; examination and development of governing field equations; flow net construction, modeling techniques, filter design, construction dewatering; simplified design of small earthfill dams and slope stability of embankments. PREREQ: CE 360, CE 381.

CE 570 HIGHWAY AND TRAFFIC SYSTEMS DESIGN (2-
3-3) (F/S). Planning, design, and operations of urban and rural highway systems. PREREQ: CE 360 and CE 370.

CE 572 TRANSPORTATION PLANNING (3-0-3)(S)(Odd years). Theory and practice of transportation planning at the metropolitan as well as regional levels. Use of software and completion of a project will be required. Recent advances in transportation planning will be introduced. PREREQ: CE 370 or PERM/INST.

CE 575 TRAFFIC ENGINEERING (3-0-3)(F)(Odd years). Covers the theory and practice of traffic operations, control, and management. Topics include traffic signal systems, isolated and area-wide signal system operations, and traffic simulation. Use of software and completion of a project will be required. PREREQ: CE 370 or PERM/INST.

CE 623 (GEOS 623)(GEOPH 623) ADVANCED HYDROGEOLOGY (3-0-3)(F). Treatment of groundwater occurrence and flow, theory fundamental mechanisms, hydrologic parameters, flow regimes and systems, geologic controls. May be taken for credit in GEOS, GEOPH, or CE, but not for more than one department. PREREQ: MATH 275, MATH 333, and GEOS 412 or GEOS 512 or CE 412 or CE 512 or PERM/INST.

CE 624 (GEOS 624)(GEOPH 624) APPLIED HYDROGEOLOGY (3-0-3)(S). Quantitative determination of hydrologic parameter values and groundwater flow conditions. Conceptual models and geologic context, boundary condition, analytical and numerical solution techniques, measurement methods, applications to engineering and environmental problems. May be taken for credit in CE, GEOPH, or GEOS, but not for more than one department. PREREQ: CE 623 or GEOPH 623 or GEOS 623 or PERM/INST.

ENGR – ENGINEERING SCIENCE

ENGR 500 RESEARCH METHODS (1-0-1)(F/S). Topics include defining a thesis or other research project, library and internet searching techniques, completing a literature review, preparing a research or project plan, research methods, preparing the thesis proposal, preparing the final thesis or research project document, and preparing a successful oral presentation.
Department of Computer Science

Interim Chair: Amit Jain
Engineering and Technology Building, Room 240B
Telephone 208 426-5640
FAX 208 426-2470
http://cs.boisestate.edu
e-mail: office@cs.boisestate.edu

Graduate Faculty: Tim Anderson, James Buffenbarger, Alex Feldman, John Griffin, Amit Jain, Gang-Ryung Uh, Jyh-haw Yeh

Master of Science in Computer Science

Graduate Program Coordinator: Alex Feldman
Math/Geosciences Building, Room 233
Telephone 208 426-3374
e-mail: afeldman@boisestate.edu

General Information

The Master of Science in Computer Science program has been designed for people who have a good background in computer science at the undergraduate level—that is, either
- a baccalaureate degree in computer science, or
- a degree in a related field with significant course work in computer science.

We expect that most of the students enrolling in the program will have full-time employment commitments. Accordingly, we try to schedule courses in such a way as to meet the needs of working students.

Prospective students whose computer science background is limited are encouraged instead to pursue a second Bachelors degree, in Computer Science. A second Bachelors degree in Computer Science involves taking the required undergraduate Computer Science classes and, in most cases, would require less time than the Masters.

The Computer Science Graduate Committee may grant provisional admission to exceptional students with limited computer science background.

Students who are interested in a master’s degree program that is somewhat less technical and more business-oriented might wish to consider the Master of Business Administration in Information Technology Management, offered by the College of Business and Economics at Boise State University.

Application and Admission Requirements

Applicants must have either a baccalaureate degree in computer science, or a baccalaureate degree in a related field plus substantial course work and/or professional experience in computer science, with an undergraduate GPA of 3.0 or higher.

Admission as a graduate student at Boise State University has two components: 1) admission to the Graduate College, which can occur with unclassified status and 2) admission to a particular program. To apply for admission to the Graduate College, complete the following steps:

- Submit the Boise State University Graduate Admission Application, along with the application fee, to Graduate Admission and Degree Services. The application form is contained in the Boise State University Graduate Catalog, which may be obtained by contacting the Graduate Admission and Degree Services at 208 426-3903 or 208 426-4204, or by e-mail at gradcoll@boisestate.edu. An on-line admission form is available at www.boisestate.edu/gradcoll/.
- Arrange for official transcripts from all post-secondary institutions attended to be sent directly to Graduate Admission and Degree Services.

To apply for admission to the graduate program in Computer Science, you will need to complete the following additional steps. A decision on admission into the masters program (for Regular or Provisional status) will not be considered prior to the completion of these steps.

- Take the GRE General test and arrange for the scores to be sent to the Graduate Admission and Degree Services.
If you do not have a degree in Computer Science or Computer Engineering from a college or university with a CSAB/ABET accredited program in Computer Science, you must take the GRE Computer Science Subject test and arrange for the scores to be sent to the Graduate Admission and Degree Services. Arrange for three letters of reference that address your preparation for graduate study in computer science to be sent directly to the Computer Science Graduate Committee in the Department of Computer Science.

Regular and Provisional Status. Completed applications will be reviewed by the Computer Science Graduate Committee. Applicants who meet the stated requirements and whose computer science background is deemed sufficient will be admitted to the program with Regular status. Applicants whose computer science background is deemed deficient may be granted admission with Provisional status. In this case the applicant will be required to pass specific undergraduate computer science courses in order to remove the deficiency and be granted Regular admission status. Unless otherwise specified, all deficiencies must be removed within two years of Provisional admission to the program. Time spent in Provisional status counts toward the limit of five years (or up to seven years if an extension is granted) allowed for completion of the degree.

Degree Requirements

The degree requirements described below allow the students a fair amount of flexibility in designing a program to fit his or her needs. The only fixed requirements are three “core” classes in algorithms, programming languages, and operating systems. The remainder of the course-work is to be chosen by the student, in consultation with his/her adviser and the graduate computer science committee, to reflect the student’s interests, ensure a coherent program, and fit within the constraints of course availability. The Master of Science in Computer Science requires a minimum of 30 credit hours, as specified in the table below. In addition, the student’s adviser and the Computer Science Graduate Committee must approve the student’s proposed degree plan to ensure that it meets these criteria and forms a coherent program of study. All requirements for the degree must be completed within five years of initial enrollment in the program, unless the Computer Science Graduate Committee grants an explicit extension of time. In no event will more than seven years be allowed for completion of the degree.

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<td>COMPSCI 510 DATABASES (3-0-3)(S)</td>
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<td>COMPSCI 512 ADVANCED TOPICS IN DATABASES (3-0-3)</td>
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<td>COMPSCI 513 DATABASE MANAGEMENT SYSTEMS (3-0-3)</td>
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Course Offerings

COMPSCI – COMPUTER SCIENCE
COMPSCI 510 DATABASES (3-0-3)(S). Foundations of database management systems. Database models: relational, object and other models. Database design: entity-relationship modeling, logical relational schema design, physical design, functional dependencies and normalization, and database tuning. Database application development using database interfaces embedded in host languages. PREREQ: COMPSCI 342 or PERM/INST.
COMPSCI 512 ADVANCED TOPICS IN DATABASES (3-0-3) (F/S). Parallel and distributed database system architectures, distributed database design, client/server database systems. Selected topics from new developments in: extended relational databases, multimedia databases, information retrieval systems, object-oriented databases,
COMPSCI 521 DESIGN AND ANALYSIS OF ALGORITHMS (3-0-3)(F/S). Design techniques such as amortized analysis, dynamic programming, and greedy algorithms. Computational geometry, graph algorithms, primality and other number-theoretic algorithms, specialized data structure techniques such as augmenting data structures, combinatorial graph reduction and functional repetition. NP completeness and approximation algorithms. PREREQ: COMPSCI 342 or PERM/INST.


COMPSCI 531 ADVANCED PROGRAMMING LANGUAGES (3-0-3)(F/S). Advanced topics in programming-language theory, design, and implementation. Topics include: data types; binding, scope, and extent; abstraction, extensibility, and control mechanisms; formal semantics and program verification. Emphasis on alternative programming-language paradigms. PREREQ: COMPSCI 354 or COMPSCI 541 (ECE 532) COMPUTER ARCHITECTURE (3-0-3) (S). Structure of computer systems using processors, memories, input/output (I/O) devices as building blocks. Computer system instruction set design and implementation, including memory hierarchies, microprogramming, pipelining and multiprocessors. Issues and tradeoffs involved in the design of computer system architectures with respect to the design of instruction sets. Applications of hardware description languages (HDL) in the design of computer systems. May be taken for either COMPSCI or ECE credit, but not both. PREREQ: COMPSCI 117 or COMPSCI 125 and ECE 332 or COMPSCI 542 QUANTITATIVE COMPUTER ARCHITECTURE (3-0-3)(S). Quantitative analysis on computer architectures and software optimizations with static and dynamic simulation techniques. Design implications of memory latency and bandwidth limitations. Performance enhancement via within-processor and between-processor parallelism. In particular, the study of pipelining, instruction-level parallelism, memory hierarchy design, storage systems, and multiprocessors are emphasized. PREREQ: COMPSCI 441 or PERM/INST.

COMPSCI 546 COMPUTER SECURITY (3-0-3)(F/S). Computer and network security. Public-key and private-key cryptography, authentication, digital signatures, key exchange, key management, certification authorities, and distributed trust models. File system security, Mail system security, and Web security. Intruders, Trojan Horses, and viruses. Covert channels. Projects will involve using currently available security tools. PREREQ: COMPSCI 453 or COMPSCI 555 DISTRIBUTED SYSTEMS (3-0-3)(S). Principles and paradigms of distributed systems. Communication, processes, naming, synchronization, consistency and replication, fault tolerance and security. In-depth coverage of Remote Procedure Call (RPC), Remote Method Invocation (RMI) and socket programming. Survey of major distributed systems. Several software projects. PREREQ: COMPSCI 453 or COMPSCI 552 or PERM/INST.

COMPSCI 557 ARTIFICIAL INTELLIGENCE (3-0-3)(F/S). Course will include a survey of some of the following topics, plus a project: Principles of knowledge-based search techniques; automatic deduction; knowledge representation using predicate logic, semantic networks, connectionist networks, frames, rules; applications in problem solving, expert systems, game playing, vision, natural language understanding, learning, robotics; LISP programming. PREREQ: COMPSCI 342 and COMPSCI 354 or PERM/INST.
of computer science. PREREQ: COMPSCI 342 or PERM/INST.

COMPSCI 562 COMPLEXITY THEORY (3-0-3)(S). Abstract machines, relativizations, upper and lower bounds on complexity, recursive hierarchies and alternation, time-space interaction, parallel and randomized complexity classes, approximation algorithms. PREREQ: COMPSCI 461 or COMPSCI 561

COMPSCI 564 COMPUTER GRAPHICS I (3-0-3)(F). The mathematics and programming techniques for computer graphics emphasizing raster graphics, rasterization algorithms, and scanline rendering. Two- and three-dimensional transformations, homogeneous coordinates, projections; clipping, hidden-surface removal. PREREQ: COMPSCI 342 and MATH 301; MATH 275 recommended.


COMPSCI 567 CRYPTOLOGY I (4-0-4)(F). Introduction to modular arithmetic. The study of: the RSA, El-Gamal, Diffie-Hellman, and Blum-Blum-Shub public key cryptosystems, authentication and digital signatures, anonymity protocols. Protocol failures for these systems. Crosslisted with MATH 307 and COMPSCI 367; credit may be received for only one of these three courses. PREREQ: MATH 170, MATH 171, and MATH 187.

COMPSCI 568 CRYPTOLOGY II (4-0-4)(S). Introduction to groups, fields, polynomial rings and Lucas numbers. The study of: the Elliptic Curve, LUC, and NTRU public key cryptosystems, authentication and digital signatures, anonymity protocols. Crosslisted with MATH 308 and COMPSCI 368; credit may be received for only one of these three courses. PREREQ: MATH 170, MATH 171, and MATH 187.

COMPSCI 571 SOFTWARE ENGINEERING (3-0-3)(F). A formal study of the software development process. Topics include: lifecycle models, requirements definition, specification, design, implementation, validation, verification, maintenance, and reuse. Students work in small teams on significant projects. PREREQ: COMPSCI 342 or PERM/INST.

COMPSCI 572 OBJECT-ORIENTED DESIGN PATTERNS (3-0-3)(S). Reviews object-oriented design principles, explains the goals and form of design patterns, and examines several well-known patterns. PREREQ: COMPSCI 342 or PERM/INST.

COMPSCI 573 ADVANCED SOFTWARE ENGINEERING (3-0-3)(S). A study of selected aspects of contemporary software development methodology. Topics are taken from recent research articles. These topics include: definition of user requirements, formal specification of solutions, design and implementation techniques, validation and testing, verification, maintenance, and reuse. PREREQ: COMPSCI 471 or PERM/INST.

SELECTED TOPICS. (Variable credit). In depth study of current trends and advanced topics in targeted areas of computer science.

COMPSCI 580 PARALLEL COMPUTING
COMPSCI 581 ALGORITHMS
COMPSCI 583 COMPUTER SECURITY
COMPSCI 584 NETWORKS
COMPSCI 585 OBJECT-ORIENTED DESIGN
COMPSCI 586 DATABASES
COMPSCI 587 SOFTWARE ENGINEERING

COMPSCI 591 PROJECT (Variable credit).
COMPSCI 593 THESIS (Variable credit).
COMPSCI 600 ASSESSMENT [Comprehensive Examination] (1 Credit)(Graded Pass/Fail).
Department of Electrical and Computer Engineering

Chair: Thad B. Welch
Engineering Technology Building, Room 240
Telephone 208 426-5640
FAX 208 426-2470
e-mail: thadwelch@boisestate.edu

Graduate Faculty: Said Ahmed-Zaid, R. Jacob Baker, Elisa H. Barney Smith, Kris Campbell, John Chiasson, William Knowlton, Wan Kuang, Sin Ming Loo, Nader Rafla, Cheryl B. Schrader, Scott Smith

Graduate Degrees Offered
- Doctor of Philosophy in Electrical and Computer Engineering
- Master of Science in Computer Engineering
- Master of Engineering in Computer Engineering
- Master of Science in Electrical Engineering
- Master of Engineering in Electrical Engineering

Doctor of Philosophy in Electrical and Computer Engineering

Doctoral Program Coordinator: John Chiasson
Engineering Technology Building, Room 240
Telephone 208 426-2283
FAX 208 426-2470
http://coen.boisestate.edu/ece/home.asp
e-mail: jenniferambrose@boisestate.edu

General Information
Boise State University offers a Doctor of Philosophy in Electrical and Computer Engineering through the Department of Electrical and Computer Engineering (ECE). The degree requires the completion of a prescribed course of study in ECE, satisfactory performance on the comprehensive examination and dissertation proposal, and independent completion of original research that results in a publicly defended dissertation that contributes significantly to ECE knowledge.

Graduate Teaching and Research Fellowships
Graduate fellowships including tuition and fee waivers are funded from three sources: appropriated state funds, endowments, and research grants and contracts. Applicants to the Ph.D. in ECE program who submit all documents required by the admission procedure by January 7 of any given year will be considered for a state appropriated or endowed graduate fellowship to start the following fall semester; notification of successful applicants will be during February and March. Information on graduate fellowships funded by research grants and contracts is available from the Coordinator of the ECE doctoral program.

Doctoral Program Committee
The Doctoral Program Committee in ECE consists of the ECE Doctoral Program Coordinator, the program coordinators for the electrical engineering and computer engineering Master's programs, and the associate chair of the department. The duties of the Doctoral Program Committee include development of recommendations for admission of prospective graduate students, decision on transfer credits and required background courses, appointment of Supervisory Committees for graduate students, and administration of the comprehensive examination.

Supervisory Committee
The Supervisory Committee is charged with general guidance of the doctoral student, including design and approval of the program of study, administration of the oral dissertation proposal, supervision of the dissertation research, and participation in the dissertation defense. The Supervisory Committee consists of a principal advisor from the student's chosen area of major emphasis who acts as chair, one member from the student's chosen area of minor emphasis, and at least two additional members, all of whom must be members of the University regular or research faculty and must also be members of the Graduate Faculty. One or more additional members may be appointed when such appointments enhance the function of the Committee. In all cases, regular or research faculty members of the Department of Electrical and Computer Engineering must constitute
a majority of the Supervisory Committee.

Application and Admission

Admission Requirements. An applicant must satisfy the minimum admission requirements for the Graduate College. Applicants are required to have a Bachelor’s or Master’s degree in electrical engineering or computer engineering from an ABET-accredited program or a baccalaureate or Master’s degree in a closely related field from an accredited college or university, and must follow the application procedures specified below. Admission is competitive and the achievement of minimum requirements does not guarantee admission into the program.

Application Procedures. Admission decisions are made each year in January. However, a prospective student may apply at any time and should follow the general graduate application procedure for degree-seeking students (see Applying as a Degree-Seeking student in this catalog). Admission to the program will be based on: 1) transcripts, 2) professional references, preferably three, 3) scores on the general test of the Graduate Record Examination (GRE), and 4) a two-page statement of teaching and research interests. Students whose native language is not English must submit a TOEFL score of 587 or higher for the written examination or 240 or higher for the computer-based examination. Test scores must be submitted directly to Boise State University (code R4018). Once the applicant’s file is complete, it will be evaluated by the ECE Doctoral Program Committee and an admission recommendation (regular, provisional, or denial) will be forwarded to the Dean of the Graduate College. In order to ensure proper mentoring of all graduate students, a recommendation for admission will not be forwarded unless a faculty member in ECE is available to serve as the major advisor. The graduate dean will make the final admission decision and notify the applicant and the ECE Doctoral Program Committee.

Degree Requirements

The program of study for the Doctor of Philosophy (Ph.D.) in Electrical and Computer Engineering will require at least 72 credits beyond the Bachelor’s Degree or 48 credits beyond a Master’s Degree, and adhere to all policies and procedures of the Graduate College. Courses applied to meet the 72-credit minimum requirement must be taken for a letter grade (A-F), except for ECE 600 Assessment which is graded P (Pass) or F (Fail), and ECE 693 Dissertation which is initially graded IP (In Progress) and later graded P or F depending on the outcome of the dissertation defense. Credit for coursework must be distributed as shown in the degree requirements table. For those entering the program with a Master’s Degree, no more than 24 credits of previous graduate coursework can be applied as course credit. For a student entering with a Bachelor’s degree, a maximum of 9 credits of post graduate coursework can be applied towards the Ph.D. program. All programs of study must be approved by the student’s Supervisory Committee.

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<tr>
<th>Course Number and Title</th>
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<td><strong>TOTAL</strong></td>
<td>72</td>
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Areas of Concentration and Emphasis

15 credits of coursework are required in a Major Area of Concentration. This is to be 5xx and 6xx courses beyond the core sequence from one area chosen from the three ECE Areas: Computer Engineering, Circuits and Devices, or Signals and Systems. An additional 9 credits of coursework is required beyond the core sequence in an Emphasis or Minor Area also at the 5xx or 6xx level. This should be in one of the two remaining ECE Areas. The Areas are defined
as follows: Computer Engineering (all ECE courses with a middle digit of 3), Circuits and Devices (all ECE courses with a middle digit of 1, 2, 4 or 8), and Signals and Systems (all ECE courses with a middle digit of 5, 6 or 7).

Ph.D. Examinations and Dissertation Requirements

Students admitted to the Ph.D. program will be required to pass a comprehensive exam and an oral dissertation proposal. As a culminating activity, the student will be required to present, and successfully defend, a doctoral research dissertation presenting significant research augmenting existing knowledge in the field of electrical and computer engineering.

Comprehensive Examination

The comprehensive examination is given yearly in January. Generally, students entering the program with a Bachelor’s degree take the comprehensive examination after the third semester of study. Students entering with a Master’s degree take the written comprehensive examination, generally, the first time it is offered after their admission. This examination will test depth and breadth of knowledge over 3 of the 6 core courses: ECE 510 (circuits), 520 (devices), 530 (digital), 550 (communications), 560 (systems), and 580 (electromagnetics). The results of the comprehensive examination can lead to three possible outcomes: 1) pass, 2) pass after completion of background coursework with grades of A or B to resolve deficiencies (note that this coursework will not count towards the Ph.D. degree credits required for graduation), or 3) failure. If the student fails the comprehensive examination they may take it again the following year. Failure a second time will result in administrative withdrawal from the doctoral program.

Dissertation Proposal

The oral dissertation proposal is designed to assess the suitability of a Ph.D. student for research in a specific area and will focus on advanced coursework and research in the student’s dissertation area. Satisfactory completion is required for the student to become a Ph.D. candidate. The dissertation proposal should be presented before, or at the beginning of, the student's Ph.D. research and within one year of satisfactory completion of the comprehensive examination. To initiate the dissertation proposal, the student must submit a research proposal for their doctoral dissertation to their Supervisory Committee. After the Supervisory Committee reviews the proposal they can give their approval to proceed with scheduling the oral presentation or they can ask the student to make changes to the proposal and to resubmit it. The oral dissertation presentation consists of the student presenting their proposed doctoral research and answering questions about the proposal, related background material and the material covered in all courses listed in their program of study. If a student fails the oral presentation, they may be allowed to reininitiate the dissertation proposal once with the approval of the Supervisory Committee. Students who fail a second time or do not receive approval to resubmit the proposal will be administratively withdrawn from the program.

Dissertation Requirements

The dissertation must be the result of independent and original research by the student and must constitute a significant contribution to electrical and computer engineering knowledge equivalent to multiple peer-reviewed publications. The style and format of the dissertation are to conform to the standards of the Department of Electrical and Computer Engineering and the Graduate College.

Final Oral Examination

A public defense of the dissertation is scheduled after the Supervisory Committee has reviewed a draft that is considered to be nearly a final version. The date of the defense is determined jointly by the Supervisory Committee and the student and must be consistent with any guidelines provided by the Graduate College. A Defense Committee is formed that consists of the following voting members: an appointed chair, the chair and members of the Supervisory Committee, and an external examiner. The chair of the Defense Committee is appointed by the Dean of the Graduate College and must be a member of the Graduate Faculty, but must not be the chair or a member of the Supervisory Committee. The external examiner is a faculty member from another university who is a recognized expert in the field of the dissertation research and is appointed to the Defense Committee by the Dean of the Graduate College. Attendance at the defense by the external examiner is not required, but a written evaluation of the dissertation and a pass or fail vote must be submitted by the external examiner to the chair of the Defense Committee at least 3 weeks prior to the defense. The written evaluation provided by the external examiner is distributed to the other members
of the Defense Committee at least 2 weeks before the defense. The chair of the Defense Committee conducts the defense according to the procedure established by the Doctoral Program Committee. A student who fails the defense may be permitted to try again, but failure a second time will result in dismissal from the program.

Final Approval of the Dissertation

If the defense is completed with a result of pass, the Supervisory Committee prepares a statement describing final requirements such as additions or modifications to the dissertation and any additional requirements such as archival of data. When these requirements have been met to the satisfaction of the Supervisory Committee, the approval page of the dissertation is signed by the members of the Committee.

Graduate College Requirements

The general requirements of the BSU Graduate College also govern the Doctor of Philosophy in Electrical and Computer Engineering degree program.

Master of Science/
Master of Engineering

General Information

The Department of Electrical and Computer Engineering offers four distinct computer engineering graduate degree programs. Two programs leading to the Master of Science in Computer Engineering (M.S. COMPE) and Master of Science in Electrical Engineering (M.S. EE) are thesis-based programs designed to prepare students for research and development and further study at the doctoral level. The programs leading to the Master of Engineering in Computer Engineering (M.Engr. COMPE) and Master of Engineering in Electrical Engineering (M.Engr. EE) are non-thesis programs with a focus on professional development.

Application and Admission Requirements

Admission Requirements. An applicant must satisfy the minimum admission requirements of the Graduate College. In addition, the applicant must hold a baccalaureate degree in computer or electrical engineering from an ABET-accredited program or a baccalaureate degree in a closely related field, and must follow the application procedures specified below. Admission is competitive and the achievement of minimum requirements does not guarantee admission.

Application Procedures. A prospective student may apply at any time and should follow the general graduate application procedure for degree-seeking students (see Applying as a Degree-Seeking Student in this catalog). The applicant must also arrange to have GRE General Test scores submitted by the Educational Testing Service (www.ets.org) directly to Boise State University (code R4018). Applicants holding a baccalaureate degree from the College of Engineering of Boise State University are not required to submit GRE scores. International applicants must submit a statement of purpose to the graduate program coordinator and arrange for three letters of recommendation to be submitted directly by the references to the Boise State University International Admissions Office. The statement of purpose should give the educational and professional background of the student and his or her motivation for graduate study including career goals. Once the applicant’s file is complete, it will be evaluated by the Graduate Studies Committee and an admission recommendation (regular, provisional, or denial) will be forwarded to the Dean of the Graduate College. In order to ensure proper mentoring of all graduate students, a recommendation for regular or provisional admission will not be forwarded unless a faculty member of the Department of Electrical and Computer Engineering is available to serve as the major advisor. The graduate dean will make the final admission decision and notify the applicant and the Graduate Studies Committee.

Advisor and Supervisory Committee

For a student admitted to the M.S. in Computer Engineering or the M.S. in Electrical Engineering program, the Graduate Studies Committee will initiate the assignment of a supervisory committee including a major advisor who serves as chair. The role of the supervisory committee is to guide the student in all aspects of his or her graduate study. For a student admitted to the M.Engr. in Computer Engineering or the M.Engr. in Electrical Engineering, the Graduate Studies Committee will appoint a major advisor; student mentoring will be provided by the major advisor and the chair of the department.
Special Rule on Transfer Credit. The normal transfer credit policies of the Graduate College hold except that up to 15 transfer credits earned in combination at the University of Idaho and Idaho State University may be applied to either degree program (M.S.COMPE, M.S. EE, M.Engr. COMPE, or M.Engr. EE) with the approval of the supervisory committee.

Master of Science in Computer Engineering
Graduate Program Coordinator: Scott Smith
Micron Engineering Center, Room 202L
Telephone 208 426-5743
e-mail: sfsmith@boisestate.edu

Degree Requirements
Students must complete at least 30 graduate credits distributed as shown in the degree requirements table. A written thesis proposal with oral presentation to the supervisory committee is required prior to the completion of 15 credits applicable to the degree requirements. Work on the thesis can only be undertaken after approval of the thesis proposal by the supervisory committee. The thesis must constitute an original contribution to knowledge in computer engineering and must be successfully defended at a final oral examination. All work directly related to the thesis must be represented by at least 6 credits of ECE 593.

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<th>Course Number and Title</th>
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</table>

Master of Engineering in Computer Engineering
Graduate Program Coordinator: Scott Smith
Micron Engineering Center, Room 202L
Telephone 208 426-5743
e-mail: sfsmith@boisestate.edu

Degree Requirements
Students must complete at least 31 graduate credits distributed as shown in the degree requirements table. A maximum of 3 credits of ECE 696 Directed Research may be applied to meet the degree requirements. The comprehensive examination cannot be attempted prior to the last semester of the program. If the comprehensive examination is failed on the first attempt, then the student will be permitted a second attempt. Failure on the second attempt will result in dismissal from the program.

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<th>Course Number and Title</th>
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Master of Science in Electrical Engineering
**Graduate Program Coordinator:** Kris Campbell  
Engineering Technology Building, Room 240  
Telephone 208 426-5640  
e-mail: kriscampbell@boisestate.edu

**Degree Requirements**

Students must complete at least 30 graduate credits distributed as shown in the degree requirements table. A written thesis proposal with oral presentation to the supervisory committee is required prior to the completion of 15 credits applicable to the degree requirements. Work on the thesis can only be undertaken after approval of the thesis proposal by the supervisory committee. The thesis must constitute an original contribution to knowledge in electrical engineering and must be successfully defended at a final oral examination. All work directly related to the thesis must be represented by at least 6 credits of ECE 593.

<table>
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<th>Course Offerings</th>
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<td><strong>Master of Science in Electrical Engineering</strong></td>
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<td><strong>TOTAL</strong></td>
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| **Master of Engineering in Electrical Engineering** |
| **Course Number and Title** | **Credits** |
| 18-30 | |
| 0-12 | |
| 1 | |
| **TOTAL** | **31** |

**Course Offerings**

Additional work will be required to receive graduate credit for undergraduate G courses.

**ECE – ELECTRICAL AND COMPUTER ENGINEERING**  
**ECE 500 ADVANCED EM THEORY (3-0-3)(F/S).** Advanced study of electromagnetic theory, its content, methods, and applications. Topics include boundary value problems, propagation in bounded structures, forces in quasi-static systems, scattering and diffraction. PREREQ: ECE 390 or equivalent.

**ECE 510 INTEGRATED CIRCUIT PHYSICAL DESIGN (3-0-3)(F/S), CMOS IC layout, modeling, parasitic capacitance extraction, SPICE simulation. Design of logic gates, counters, registers, memories, and photomasks. PREREQ: ECE 322.**

**ECE 511 CMOS ANALOG IC DESIGN (3-0-3)(F/S).** Design,
ECE 410/510.

ECE 518 MEMORY CIRCUIT DESIGN (3-0-3)(F/S). Transistor level design of memory circuits. Memory technologies including DRAM, Flash, MRAM, Glass-based, and SRAM will be discussed. The course will be a practical introduction to the design of memory circuits. PREREQ: ECE 410 or ECE 411.

ECE 520 ADVANCED DEVICE DESIGN AND SIMULATION (3-0-3)(F/S). MOSFET device physics, scaling rules, analytical short channel models, hot-electron effects/modeling, LDD design, gate oxide breakdown and reliability, TDBB, GIDL, channel mobility, electromigration, BSIM3 device modeling, 2-D TCAD device simulation. PREREQ: ECE 410 or ECE 411.

ECE 520L ADVANCED DEVICE CHARACTERIZATION LAB (0-3-1)(F/S). Advanced measurement and parameter extraction techniques for MOSFETs. High frequency CV, Quasistatic CV, Charge-Pumping measurements. PREREQ: ECE 432.

ECE 521 ADVANCED TOPICS IN SEMICONDUCTOR DEVICES (3-0-3)(F/S). Study of advanced semiconductor devices, particularly photonic, microwave, power, and high temperature/radiation resistant devices, including physics and applications. TCAD simulation and modeling of these devices will be included. PREREQ: ECE 420/520.

ECE 522 MICROWAVE SEMICONDUCTOR DEVICES (3-0-3)(F/S). Covers the various aspects of design, fabrication, and characterization of ultra-low-power, RF-CMOS devices. Short-channel CMOS device physics, Parasitic CMOS device elements, Advanced small-signal bulk and SOI RF-CMOS device models, Ultra-low-power device & circuit design techniques, On-wafer microwave measurement and calibration techniques, and S-parameter device evaluation methods. PREREQ: ECE 420/520.

ECE 530 DIGITAL HARDWARE DESIGN (3-0-3)(F/S). Advanced topics in digital system design emphasizing the specification and design of complex digital hardware systems. Applications include design of synchronous state machines, asynchronous digital systems, and simple digital control circuits using hardware descriptive languages for field programmable gate arrays and complex programmable logic. PREREQ: ECE 230 and either COMPSCI 117 or COMPSCI 125.

ECE 532 COMPUTER ARCHITECTURE (3-0-3)(F/S). Structure of computer systems using processors, memories, input/output (I/O) devices as building blocks. Computer system instruction set design and implementation, including memory hierarchies, microprogramming, pipelining, and multiprocessors. Issues and tradeoffs of multi-variable optimization algorithms using linear and nonlinear programming methods to design problems in structures, machine components, and energy systems. PREREQ: ECE 332 and COMPSCI 117 or COMPSCI 125.

ECE 533 EMBEDDED AND PORTABLE COMPUTING SYSTEMS (3-0-3)(F/S). Comparison of commercially available microcontrollers and their use in embedded communications and control applications. Power consumption, software development, interprocessor communication, and interfacing with sensors, actuators, and input/output devices. Use of microcontroller cores implemented in programmable logic devices as an alternative to hardwired microcontrollers. An embedded system project is designed and built. PREREQ: ECE 332.


ECE 535 SYSTEMS FOR MULTIMEDIA PROCESSING (3-0-3)(F/S). Study of the general information theory and its applications in speech, imaging, and video processing. Focuses on the underlying structures and architectures for efficient algorithm implementation of video and speech processing systems. Current and future trends in processing, storing, coding, decoding, restoring, and transmission of multimedia information. PREREQ: ECE 457/557 and ECE 430/530, or PERM/INST.

ECE 536 DIGITAL SYSTEMS RAPID PROTOTYPING (3-0-3)(F/S). Use of hardware description languages and hardware programming languages as a practical means to simulate/implement hybrid sequential and combinational systems. Rapid prototyping techniques will be utilized during the implementation. Course covers specifications and timing verification issues, synthesis, design optimization, testing, and evaluation. The course supports individual and group projects to build ASICs implementing RISCs/DSPs/Superscalars/Fuzzy Logic based systems using standard ASIC design CAD tools. PREREQ: ECE 430/530.

ECE 537 ASIC CHIP DESIGN (3-0-3)(F/S). Study of phases of ASIC development implementing standard, specialized and DSP applications. Course covers specifications and pre-design analysis mapping design units into architectures, evaluation of early design choices using CAD behavioral synthesis tools and design libraries, simulation, functional and timing verification issues, synthesis, design optimization, testing, and evaluation. The course supports individual and group projects to build ASICs implementing RISCs/DSPs/Superscalars/Fuzzy Logic based systems using standard ASIC design CAD tools. PREREQ: ECE
ECE 540 INTRO TO INTEGRATED CIRCUIT AND MEMS PROCESSING (3-0-3)(F). Fundamentals of integrated circuit and micro electromechanical systems (MEMS) fabrication technology; semiconductor substrates; theory of unit processes such as diffusion, oxidation, ion implantation, rapid thermal processing, photolithography, wet etching and cleaning, dry etching, thin-film deposition; chemical mechanical polishing; process integration; metrology; statistical process control; TCAD. COREQ: ECE 540L. PREREQ: ECE 323 or PERM/INST.

ECE 540L INTRO TO INTEGRATED CIRCUIT AND MEMS PROCESSING LAB (0-3-1)(F). Semiconductor cleanroom practices; heavy lab safety; students will fabricate and test simple structures in lab; application of TCAD to practical problems. COREQ: ECE 540.

ECE 541 ADVANCED TOPICS IN SILICON TECHNOLOGY (3-0-3)(S). Advanced models for unit processes such as diffusion, oxidation, ion implantation, thin film deposition, etching, rapid thermal processing, chemical mechanical polishing, lithography. CMOS, bipolar, and micro electro mechanical systems (MEMS) process integration. Process and device modeling using TCAD. PREREQ: ECE 440/540.


ECE 542L PHOTOLITHOGRAPHY LAB (0-3-1)(F/S). Cleanroom lab experience accompany ECE 542, utilizing a projection-printing wafer stepper, photoresist wafer track, SEM, and optical metrology equipment. Use of TCAD lithography simulation software. PREREQ: ECE 342. COREQ: ECE 542.

ECE 543 INTRODUCTION TO MEMS (3-0-3)(F/S). Overview of MEMS; MEMS device physics including beam theory, electrostatic actuation, capacitive and piezoresistive sensing, thermal sensors and actuators; basic MEMS fabrication techniques; MEMS technologies: bulk micromachining, surface micromachining, and LIGA; MEMS design and modeling; case studies in various MEMS systems. PREREQ: ECE 440/540, or PERM/INST.

ECE 550 STOCHASTIC SIGNALS AND SYSTEMS (3-0-3)(S). Deterministic signal representations and analysis, introduction to random processes and spectral analysis, correlation function and power spectral density of stationary processes, noise mechanisms, the Gaussian and Poisson processes. Markov processes, the analysis of linear and nonlinear systems with random inputs, stochastic signal representations, orthogonal expansions, the Karhunen-Loeve series, channel characterization, introduction to signal detection, linear mean-square filtering, the orthogonality principle, optimum Wiener and Kalmen filtering, modulation theory, and system analysis.

PREREQ: ECE 350 and MATH 360 or MATH 361 or equivalent.

ECE 551 COMMUNICATION SYSTEMS (3-0-3)(F). Signals, noise, propagation and protocol in analog and digital communication systems. Bandwidth, Fourier transforms, signal to noise ratio and receiver noise figures. Introduction to modern wireless communication systems such as cellular, wireless data and satellite data systems. PREREQ: ECE 350, and MATH 360 or MATH 361, or PERM/INST.

ECE 552 WIRELESS COMMUNICATIONS (3-0-3)(F/S). Modern cellular communication systems, including propagation, handoff, noise, and interference studies. CDMA and other spread-spectrum systems. PREREQ: ECE 451 or ECE 551.


ECE 557 DIGITAL IMAGE PROCESSING (3-0-3)(F). Pictures and their computer representation. Image digitization, transformation, and prediction methods. Digital enhancement techniques, histogram equalization, restoration, filtering and edge detection. Color models and transformations. Wavelets and morphological algorithms. PREREQ: ECE 350 and COMPSCI 125, or PERM/INST.

ECE 560 LINEAR SYSTEMS (3-0-3)(F/S). Methods of analysis for continuous and discrete-time linear systems. Classical solution of dynamic equations, transforms and matrices are reviewed. Emphasis is on the concept of state space. Linear spaces, concept of state, modes, controllability, observability, canonical forms, state transition matrices and irreducible realizations. State variable feedback, compensation and decoupling. PREREQ: ECE 360, ME 360 or graduate standing.

ECE 561 (ME 561) CONTROL SYSTEMS (3-0-3)(S). Time and frequency domain analysis and design of feedback systems using classical and state space methods. Observability, controllability, pole placement, observers, and discrete time. Multivariable and optimal methods are introduced. May be taken for either ECE or ME credit, but not both. PREREQ: ECE 360 or ME 360.

ECE 563 ASIC CHIP DESIGN (3-0-3)(F/S). Study of phases of ASIC development implementing standard, specialized and DSP applications. Course covers specifications and
Three-phase AC systems, generators, transformers, electric drives and power quality fundamentals. PREREQ: ECE 572 POWER ELECTRONICS (3-0-3)(F). Power 470/570, or PERM/INST.

ECE 573 POWER SYSTEM ANALYSIS I (3-0-3)(F). Three-phase AC systems, generators, transformers, transmission lines, one-line diagrams, per-unit system, network calculations, load flow studies, power system operation. PREREQ: ECE 225, ECE 390.

ECE 574 POWER SYSTEM ANALYSIS II (3-0-3)(S). Fault analysis, symmetrical components, power system transients, protection and relaying, transient stability, power system operation and control, power system economics, power quality, and power system reliability. PREREQ: ECE 473 /573.

ECE 614 ADVANCED ANALOG IC DESIGN (3-0-3)(F)/S). Advanced analog design considerations including: noise, common-mode feedback, high-speed, design for signal processing, filter design. PREREQ: ECE 411/511.

ECE 615 CMOS MIXED-SIGNAL IC DESIGN (3-0-3)(F/S). Design of Nyquist-rate A/D and D/A converters, sigma-delta data converters, and custom digital filters. PREREQ: ECE 411/511.

ECE 629 QUANTUM EFFECTS IN MOS DEVICES (3-0-3)(F/S). Computational methods will be used to examine quantum mechanical effects in MOS devices. Effects such as tunneling, triangular quantum well effects and poly-Si depletion will be examined. PREREQ: ECE 323 and PHYS 310.

ECE 631 DIGITAL SYSTEM TESTING AND TESTABLE DESIGN (3-0-3)(F/S). In-depth theory and practice of fault analysis, test set generation, and design for testability of digital systems. Topics include system modeling; fault sources and types; fault simulation methods; automatic test pattern generation (ATPG) for combinatorial and sequential circuits; testability measures; design-for-testability; scan design; test compression methods; logic-level diagnosis; built-in self-testing (BIST); VLSI testing issues; processor and memory testing. Advance research issues, including topics on mixed signal testing are also discussed. PREREQ: ECE 430/530, and ECE 410/510.

ECE 632 ADVANCED COMPUTER ARCHITECTURE (3-0-3)(F/S). Fundamental principles, critical issues and latest techniques involved in the design of advanced computer controlled systems. Emphasizes using design requirements, hardware-software tradeoffs, redundancy, and testability to develop highly reliable systems. Topics include software-hardware tradeoffs, memory hierarchy design, calculation of availability, simulation, and communication requirements. Tools and techniques used to develop systems. Incorporates case studies of actual systems. A design project will be included and consists of designing a system driven by embedded computers. PREREQ: ECE 432/532.

ECE 633 LARGE SCALE DISTRIBUTED SYSTEMS DESIGN (3-0-3)(F/S). Study of up-to-date multiprocessor systems and parallel computing architectures. Covers basic architectural concepts and their performance evaluation, design principles of VLIW and superscalar architectures, multithread and data-flow computers, shared and distributed memory MIMDS, associative and neural architectures. Focuses on significant trends in building systems on a chip. PREREQ: ECE 432/532.

ECE 635 HARDWARE IMPLEMENTATION OF DSP ALGORITHMS (3-0-3)(F/S). Implementation methods of DSP algorithms in programmable logic environment. Hardware required for DSP implementation: architectures; arithmetic; digital filters including FIR, IIR and CIC. Course will also cover the efficient implementation of these algorithms and their impact on the implementation process and product costs. PREREQ: ECE 454/554 and ECE 430/530.

ECE 636 HARDWARE/SOFTWARE CODESIGN (3-0-3)(F/S). Covers system level design of embedded systems with a top-down design approach. The students will learn various design steps starting from system specifications to hardware/software implementation and will experience process optimization while considering various design decisions. Students will gain design experience with project/case studies using contemporary high-level methods and tools. PREREQ: ECE 436/536.

ECE 637 SYSTEM ON A PROGRAMMABLE CHIP (3-0-3)(F/S). Covers the design of embedded system within a
single integrated circuit. Such a system consists of multiple intellectual property cores interconnected by common infrastructure. This course will also explore the challenges to design and test a complete system on chip. Exercises/projects will be given to design, synthesize, and simulate using modern computer aided design (CAD) tools. Resulting systems will be targeted in reprogrammable hardware. PREREQ: ECE 436/536.

ECE 640 ADVANCED MICROFABRICATION (3-0-3)(F/S). Advanced micro/nano-fabrication techniques; advanced process modeling and simulation of thermal processes, ion implantation, thin-film deposition, dry etching, CMP, and lithography; CMOS/device integration; process variability and control; metrology; parametric test. PREREQ: ECE 440/540.

ECE 646 FRONTIERS OF IC PROCESSING (3-0-3)(F/S). Recent and proposed developments in semiconductor process technology Course modules: Lithography, Deposition, Doping and Etch processes. PREREQ: ECE 440/540.

ECE 651 INFORMATION AND CODING THEORY (3-0-3)(F/S). Information measures, characterization of information sources, coding for discrete sources, the noiseless coding theorems, construction of Huffman codes. Discrete channel characterization, channel capacity, noisy-channel coding theorems, reliability exponents. Various error-control coding and decoding techniques, including block and convolutional codes. Introduction to waveform channels and rate distortion theory. PREREQ: ECE 550.


ECE 657 ADVANCED DIGITAL IMAGE PROCESSING (3-0-3)(F/S). Advanced course in digital image processing. Topics will include image storage formats, image compression techniques, acquisition system calibration, geometric transformations, edge detection and image segmentation, adaptive techniques, video, halftoning, 3D images and topics of specific student interest. PREREQ: ECE 557 or equivalent.


ECE 681 MMIC DESIGN (3-0-3)(F/S). Technology, design and analysis of monolithic microwave integrated circuits; passive and active microwave circuit elements; high frequency substrates, individual design projects utilize modern computer-aided design software. PREREQ: ECE 500.

ECE 682 QUANTUM ELECTRONICS (3-0-3)(F/S). Quantized electromagnetic field, interaction of radiation and atomic systems, laser oscillation, semiconductor lasers, parametric amplification, phase conjugate optics. PREREQ: PHYS 412/512.
Department of Instructional & Performance Technology

**Chair: Donald Stepich**
Engineering and Technology Building, Room 327
Telephone 208 426-1312
FAX 208 426-1970
http://ipt.boisestate.edu
e-mail: lburnett@boisestate.edu

**Graduate Faculty:** Yonnie Chyung, Linda Huglin, Anthony Marker, Donald Stepich, Donald Winiecki

**Adjunct Graduate Faculty:** Dale Brethower, David Cox, Gary Dickelman, Diane Gayeski, Judith Hale, Robert Horton, Linda Lohr, Terrell Perry, David Ripley, Penelope Schweibert, Swasailam Thiagarajan, Mary Norris Thomas

**Graduate Degrees Offered**
- Master of Science in Instructional and Performance Technology
- Graduate Certificate in Human Performance Technology

**Master of Science in Instructional & Performance Technology**

**Graduate Program Coordinator:** Donald Stepich
Engineering and Technology Building, Room 327
Telephone 208 426-1312
FAX 208 426-1970
http://ipt.boisestate.edu
e-mail: lburnett@boisestate.edu

**General Information**
The Master of Science degree in Instructional & Performance Technology (IPT) is intended to prepare students for careers in the areas of instructional design, training and development, training management, human resources, organizational redesign, and job performance improvement. The IPT program equips students with skills needed to identify, analyze, and solve a variety of human and organizational performance problems in settings such as industry, business, the military, education, and private consulting.

The M.S. program emphasizes scholarly understanding of research and theory as they apply to instructional technology and performance technology. Students are also exposed to a broad range of practical skills and knowledge in instructional systems design, program development, computer-based training, consulting, media selection/utilization, instructional use of computers, and program evaluation. In addition, students learn how to identify and assess needs and how to appraise, select, and design proposed training programs and delivery systems. With respect to training and instruction, the emphasis is not so much on how to personally be a good presenter or instructor as it is on how to **design** effective programs that can be “packaged” for implementation by other individuals.

Human performance improvement in organizations requires more than education or training alone. In this program, students explore the many factors that affect job performance, such as knowledge and skills, job expectations, task design, human factors, ergonomic and environmental factors, incentive systems, feedback systems, tools, job aids, and resources. In the IPT program, students learn how to think strategically and design interventions that will address all the needed factors (in addition to training or instruction) to achieve the desired results. They learn how to define and clarify those results and how to integrate instruction with other factors that impact human performance.

**On-Campus and Online Course Options**
In addition to the traditional on-campus mode of delivering courses, the IPT Department has been in the forefront of technology-delivered education by offering its internationally recognized degree online since 1989. This option constitutes an entirely nonresident course of study for a complete M.S. in IPT. The on-campus and online options are fully accredited by the Northwest Commission on Colleges and Universities (NWCCU).

Online classes are conducted primarily through asynchronous computer conferencing via the Web or Lotus Notes client software. Courses taught in this medium enable students to view the questions and comments of the instructor and students in a
Access to online courses makes it possible for students anywhere in the world who have Internet access to obtain a highly useful and versatile Master’s degree. These courses have been especially helpful to full-time professionals who need flexibility in time and/or location. Evaluations show that students in the online courses are quite enthusiastic about the rigor and value of the academic experience they receive. Many have reported that these courses have substantially increased their capability and credibility in the workplace. Online courses also make it possible for students who relocate before finishing the on-campus program to complete the IPT degree from their new location.

The online option uses the same admission standards and required courses as the on-campus option. However, the fees are higher for the online courses than for on-campus courses, special equipment is required, and course offerings are scheduled through Extended Studies. The reason for the additional cost is that the online courses are entirely self-supporting and are not subsidized by state taxes. However, a discounted rate is available for Idaho residents and active military personnel. Online courses may follow a schedule different from the one in the course descriptions which follow. Schedules for online courses are available in an official release from Extended Studies and on the IPT website at http://ipt.boisestate.edu.

Graduate Assistantships

A limited number of graduate assistantships are available for full-time, on-campus students. Graduate assistantships include a stipend and a waiver of fees. Graduate assistantship appointments require approximately 20 hours service per week to the University. The appointment is made for a period of one academic year. Appointments are renewed at the discretion of the IPT Department. Graduate assistants must have been fully admitted into the IPT degree program, must enroll for a minimum of nine credit hours each semester, and must meet any other requirements as set forth by the Graduate College. Applications are available in the IPT office, the Graduate College office, or online. The application deadline is January 20 for the next academic year.

Application and Admission Requirements

Admission requirements will be based on the following information:

- Documented evidence of an earned baccalaureate degree from an accredited institution.
- A cumulative GPA of 3.0 for all undergraduate credits, or a 3.0 GPA for the last 60 credits of undergraduate course work. All course work must be verified by official transcripts. If a person fails to meet the GPA requirement, that person may submit a petition to the IPT Program Committee.
- Appropriateness of background experience and of the fit between the prospective student’s career goals and what the IPT program offers. (Applicants must submit a resume and a one-to-two page essay of intent to help determine satisfaction of this requirement.)

Admission Procedures

Obtain a graduate application and submit it with a $55 application fee to the Graduate Admissions Office. Note: International students should submit the International Student Graduate Application, a $55 application fee, and follow the admission requirements listed in the front of this catalog.

Have the Registrar of ALL institutions attended send official transcripts directly to the Graduate Admissions office. PLEASE DO NOT HAVE TRANSCRIPTS SENT PRIOR TO SUBMITTING YOUR GRADUATE ADMISSION APPLICATION.

Submit to the IPT office a resume of personal qualifications and work experience and a one-to-two page essay of intent describing why you want to pursue this degree and how it will contribute to your career goals.

If you do not meet the GPA requirement, you may submit a petition to the IPT Program Committee asking that the requirement be waived.

Students intending to take online courses must also complete the IPT Equipment Availability
Checklist and have it verified by the IPT Systems Administrator. (Go to http://ipt.boisestate.edu/eac.htm.)

After Steps 1 through 5 are completed, your records will be evaluated and forwarded to the IPT Program Committee for a decision on your admission to the program. As soon as this process is completed, you will receive official notification as to the decision and, if you are admitted, who your faculty advisor will be.

Timing of Application and Admission

It is extremely important that you complete the above admissions procedures and are officially admitted to the program before you begin taking the courses you hope to apply toward the M.S. degree. Please note that permission from the Graduate Admissions Office to take graduate courses does NOT constitute admission to the IPT program. If, at your own discretion, you enroll in a Boise State graduate course before you are admitted to the M.S. program in IPT, you are urged to complete the admissions procedures before the end of that course. If you are accepted before the semester closes, the credit you receive at the end of the semester is eligible for application toward the degree.

Degree Requirements

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<tr>
<th>Course Number and Title</th>
<th>Credits</th>
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<tr>
<td>24</td>
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TOTAL 36

Academic Scholarship Requirement

Students are expected to meet the Graduate College academic requirements. In addition, grades below B in required or elective courses cannot be used to meet the requirements of the M.S. degree in IPT. A student who earns a grade of C or lower in a required course will be asked by the IPT Program Committee to retake the course or to take another course deemed to be equivalent in purpose. With special permission of the Program Committee, a student may apply 3 ELECTIVE credits of C toward the degree.

Residency Requirement for Project or Thesis Option

In order to complete the project or thesis option, students are required to be in residence on campus for at least one semester during which they are enrolled in IPT 591 Project or IPT 593 Thesis. (Petitions for exceptions should be made to the IPT Program Committee.) Consequently, students in the online IPT program are invited to come to campus to participate in the project/thesis option, or they may pursue the portfolio or nonthesis option with no obligation to be on campus at any time.

Graduate Certificate in Human Performance Technology

Graduate Program Coordinator: Donald Stepich
Engineering & Technology Building, Room 327
Telephone 208 426-1312
http://ipt.boisestate.edu
lburnett@boisestate.edu
General Information
The Graduate Certificate in Human Performance Technology program is designed for individuals who wish to develop skills in diagnosing and solving performance problems in the workplace. The program emphasizes the practical application of process models, tools, and techniques to workplace performance improvement situations. Students admitted to the certificate program are required to be familiar with all policies of the Graduate College that govern graduate certificate programs.

Admission Requirements
Admission to the certificate program requires a baccalaureate degree from a regionally accredited college or university and admission to the Graduate College. In addition, the academic background of the applicant must be judged by the Graduate Program Coordinator to be adequate for enrollment in graduate courses in instructional and performance technology. However, meeting those minimum requirements does not guarantee admission to the certificate program. If the student skill set is judged insufficient the student may be admitted provisionally with the expectation of prerequisite course work.

Application Procedures
An applicant to the certificate program must follow the general application procedures of the Graduate College for admission to a graduate program. The applicant must also submit a letter of interest to the Graduate Program Coordinator briefly summarizing his or her background and motivation for enrolling in the certificate program. Once the applicant’s file is complete, it will be reviewed by the Graduate Program Coordinator who will provide an admission recommendation to the Dean of the Graduate College. The Dean will make the final admission decision and notify the applicant.

Special Relationships with Other Programs
A student may be simultaneously enrolled in the Master of Science in Instructional and Performance Technology program and the Graduate Certificate in Human Performance Technology program subject to the approval of the student’s advisor, the graduate program coordinators of both programs, and the Dean of the Graduate College. Please note that admission to the certificate program does not guarantee admission to the degree program and vice versa.

Certificate Requirements

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<tr>
<th>Course Number and Title</th>
<th>Credits</th>
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<td><strong>TOTAL</strong></td>
<td><strong>16</strong></td>
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Course Offerings

IPT – INSTRUCTIONAL/PERFORMANCE TECHNOLOGY
IPT 510 COLLABORATIVE ONLINE COMMUNICATIONS AND LEARNING (1-0-1)(F, S, SU). Students will learn technologies that help develop collaborative online learning communities and learn technical skills that help them become successful online learners. Students will examine synchronous and asynchronous online communication tools to facilitate small and large group communications, and conduct research using online library systems on the web.

IPT 520 TRAINING VIDEO PRODUCTION (3-0-3)(Demand). Focuses on the study of video as a tool in training and instruction. Hands-on projects help students understand video, its production process, its capabilities, its limitations, its ability to complement other media, and its demands on project resource. PREREQ: PERM/INST.

IPT 523 AUTHORING SKILLS FOR INSTRUCTIONAL MULTIMEDIA (3-0-3)(F). Students learn how to use basic software tools that are used by professionals in authoring computer-based instruction. This course focuses on the mechanics of multimedia authoring, demonstrating how advanced authoring can be used to enhance presentation programs by adding CBT elements, including testing, feedback, and interactive exercises. Topics covered will include an overview of programming code and multimedia integration.

IPT 524 INTERNET APPLICATIONS FOR IPT PROFESSIONALS (3-0-3)(SU). An examination of the Internet and World Wide Web for instructional and performance technologists. Through the application of practical and relevant activities, students will learn to use electronic communications effectively, search for and access electronic resources, prepare electronic documents for the Web, and examine critical issues related to the
Internet, such as copyright, censorship, design and usability issues, evaluation of online information, and instructional applications.

IPT 525 E-LEARNING PRINCIPLES AND PRACTICES (3-0-3)(F). Students will explore theoretical foundations for implementing online instruction and knowledge management interventions. They will study e-learning standards, reusable learning objects, shareable content objects, and learning (content) management systems. Students will discuss issues in conducting e-learning readiness assessment. They will also experience designing online courses using a course management system. PREREQ: IPT 537.

IPT 529 NEEDS ASSESSMENT (4-0-4). Through analysis of case studies, guided practice, field work, and other methods, students learn to use tools, data, and systematic methods to identify and assess current or future performance problems and their causes, and help decision makers target critical problems with feasible solutions. Students will conduct an authentic project. PREREQ: IPT 536

IPT 530 EVALUATION METHODOLOGY (4-0-4)(S). Students learn how to use methods of inquiry and analysis to evaluate the effectiveness of instructional or performance improvement programs. They explore various models of both formative and summative evaluations and ways to implement the results of such research efforts. Students will gain hands-on experience, actually conducting one or more evaluations.

IPT 531 OVERVIEW OF RESEARCH DESIGN, MEASUREMENT, AND STATISTICS (3-0-3)(S). Students receive a foundation in the relationships among research design, measurement, and statistics. Topics covered include scaling, reliability, validity, norm- vs. criterion-referenced testing, forms of distributions, measures of central tendency & variability, basic quantitative research designs and their appropriate statistical tests, and methods for critiquing quantitative research.

IPT 532 ETHNOGRAPHIC RESEARCH IN ORGANIZATIONS (3-0-3)(F). Ethnography is an approach to learning about the social and cultural life of communities, organizations, institutions and other settings that discovers how the activities of people in those settings contribute to the creation of society and culture. Students receive a foundation in philosophical perspectives and methods supporting ethnographic research, learn when to conduct ethnographic research, and explore strategies for presenting and critiquing ethnographic research. They will also be provided with an opportunity to implement ethnographic research in organizational settings. PREREQ: IPT 536.

IPT 535 LEARNING THEORY FOR INSTRUCTIONAL DESIGNERS (4-0-4)(S). Students discover how theories of human learning can be applied to the instructional process in order to make it more effective and efficient. They explore conditions both internal and external to the learner, which are known to affect learning outcomes. They also explore alternative methods, strategies, and technologies that increase instructional effectiveness in various learning situations and circumstances. They conduct a project to apply these principles to an authentic situation of instructional need.

IPT 536 FOUNDATIONS OF INSTRUCTIONAL AND PERFORMANCE TECHNOLOGY (4-0-4)(F). Foundational knowledge to become competent practitioners in the field of instructional and performance technology. Historical foundations, prominent figures and important events that contributed to its development. Apply principles and models of instructional performance improvement to real or realistic organizational settings.

IPT 537 INSTRUCTIONAL DESIGN (4-0-4)(F). This course gives an overview of several models for instructional systems design and examines the processes involved in designing effective instructional interventions. Working with a real client and instructional need, students conduct a full-scale instructional design project in phases over the duration of the course. PREREQ: IPT 536 and IPT 535, or PERM/INST.

IPT 538 INSTRUCTIONAL STRATEGIES (3-0-3)(F). Instructional strategies constitute the “recipes,” templates, or prescriptive patterns that guide, simplify, and “automate” the voluminous task of actually designing the learning activities called for by the front-end analysis in an instructional design project. Students will identify, clarify, justify, and experiment with several types of instructional strategies. Given a variety of instructional needs, students will practice selecting and implementing appropriate strategies. PREREQ: IPT 537.

IPT 540 APPLICATIONS OF LEARNING STYLES IN INSTRUCTIONAL AND PERFORMANCE TECHNOLOGY (3-0-3)(S). The behavioral characteristics exhibited by different learning/cognitive styles, modalities, personality types, multiple intelligences, and emotional intelligences will be explored. Related preferences for different learning environments, media, instructional and testing methods will be examined, as well as the utility of these constructs for addressing performance problems in the workplace.

IPT 550 DELIVERY TECHNOLOGY IN INSTRUCTIONAL AND PERFORMANCE TECHNOLOGY (3-0-3)(S). Students investigate the applications of various types of media and technology to instruction and performance interventions. In the culminating class project, students analyze and evaluate authentic instructional or performance interventions by critically applying analytic and design principles, theories and models. PREREQ: IPT 536.

IPT 551 DESIGNING COMPUTER-BASED TRAINING (3-0-3)(F). Students learn to apply the principles of instructional design, instructional message design and human-computer interface design within the context of Computer-Based Training (CBT). PREREQ: IPT 537.

IPT 560 HUMAN PERFORMANCE TECHNOLOGY (4-0-4)(F). Students examine the foundations, process models, interventions, professional practice issues, and future trends of the field of human performance technology (HPT) which aims to improve performance in the work place or in learning situations. In a hands-on project, students practice applying HPT to design effective performance interventions.
PREREQ: IPT 536 or PERM/INST.

IPT 561 HUMAN FACTORS ENGINEERING (3-0-3)(Demand). This course provides a basic introduction to Human Factors Engineering to design of performance environments (including human-machine interfaces). Students learn principles of work and learning system design that help to improve human performance.

IPT 563 JOB PERFORMANCE AIDS & ELECTRONIC PERFORMANCE SUPPORT SYSTEMS (3-0-3)(S). Job Performance Aids (JPAs) and Electronic Performance Support Systems (EPSSs) are non-instructional devices that are used to help human workers overcome cognitive limits and improve job related performance. This course will provide students with a review of research and methods related to prescribing, designing, implementing, evaluating and revising JPAs and EPSSs. Students in this class will analyze a human performance problem; then prototype, evaluate and propose revisions on JPAs and EPSSs for the solution of that problem. PREREQ: IPT 536 or PERM/INST.

IPT 564 MOTIVATION IN INSTRUCTIONAL AND PERFORMANCE TECHNOLOGY (3-0-3)(Demand). An in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and performance improvement. Students examine theories of motivation and apply the principles derived therefrom to produce strategies that motivate learning and improved performance.

IPT 571 MANAGEMENT CONCERNS FOR PERFORMANCE TECHNOLOGISTS (3-0-3)(Demand). This course provides students with an exposure to current topics in management which are related to understanding performance systems.

IPT 572 LINKING PERFORMANCE TO CRITICAL BUSINESS ISSUES (3-0-3)(Demand). Review, analysis, and discussion of cases based on actual projects. Development of action plans that include effective techniques for transforming requests for training solutions into value-adding work. PREREQ: IPT 536 or PERM/INST.

IPT 583 SELECTED TOPICS IN INSTRUCTIONAL TECHNOLOGY (3-0-3)(Demand). Students explore issues and topics of current interest. Content will be revised continually to reflect current developments in the field of instructional and performance technology. PREREQ: IPT 536 or PERM/INST.


IPT 585 SELECTED TOPICS: PERFORMANCE CONSULTING (3-0-3)(Demand). Examine the major theoretical foundations, principles and practices of performance consulting. PREREQ: IPT 536 or PERM/INST.

Refer to the "University-wide Graduate Course" section in this catalog for additional course offerings.
Department of Materials Science and Engineering

Chair: Amy Moll
Engineering and Technology Building, Room 240
Telephone 208 426-5788
FAX 208 426-2470
e-mail: bgee2@boisestate.edu

Engineering Graduate Faculty: Darryl Butt,
Kris Campbell, Sean M. Donovan, Megan Frary,
Janet Callahan, William Knowlton, Amy Moll, Peter Mullner

Physics Graduate Faculty: Charles Hanna,
Byung-II Kim, Alex Punnoose

Chemistry and Biochemistry Graduate Faculty:
Jeff Peloquin, Dale Russell, Martin Schimpf, Don Warner

Biological Sciences Graduate Faculty: Julia
Thom Oxford

Graduate Degrees Offered
- Master of Science in Materials Science and Engineering
- Master of Engineering in Materials Science and Engineering

General Information
The Department of Materials Science and Engineering offers two distinct graduate degree programs. The program leading to the Master of Science in Materials Science and Engineering (M.S. MSE) is a thesis-based program designed to prepare students for research and development and further study at the doctoral level. The program leading to the Master of Engineering in Materials Science and Engineering (M.Engr. MSE) is a non-thesis program with a focus on professional development. Both programs are interdisciplinary and involve faculty members from the College of Engineering and the College of Arts and Sciences with expertise in electrical engineering, mechanical engineering, physics, chemistry, and biology.

(See Section on Interdisciplinary Programs for program descriptions and course offerings.)
Department of Mechanical and Biomedical Engineering

Chair: James R. Ferguson
Engineering Technology Building, Room 201
Telephone 208 426-3679
FAX 208 426-4800
e-mail: jferguson@boisestate.edu

Graduate Faculty: Paul Dawson, Rudy Eggert, James Ferguson, John Gardner, Joe Guarino, Donald Parks, Michelle Sabick, Steven Tennyson

Adjunct Graduate Faculty: Steven Hatten

Graduate Degrees Offered

- Master of Science in Mechanical Engineering
- Master of Engineering in Mechanical Engineering

General Information

The Department of Mechanical and Biomedical Engineering offers two distinct engineering graduate degree programs. The program leading to the Master of Science in Mechanical Engineering (M.S. ME) is a thesis-based program designed to prepare students for research and development and further study at the doctoral level. The program leading to the Master of Engineering in Mechanical Engineering (M.Engr. ME) is a non-thesis program with a focus on professional development.

Application and Admission

Requirements

Admission Requirements. An applicant must satisfy the minimum admission requirements of the Graduate College. In addition, the applicant must hold a baccalaureate degree in mechanical engineering from an ABET-accredited program or a baccalaureate degree in a closely related field, and must follow the application procedures specified below. Admission is competitive and the achievement of minimum requirements does not guarantee admission.

Application Procedures. A prospective student may apply at any time and should follow the general graduate application procedure for degree-seeking students (see Applying as a Degree-Seeking Student in this catalog). The applicant must also (1) submit a statement of purpose to the mechanical engineering graduate program coordinator, (2) have three letters of recommendation submitted directly by references to the graduate program coordinator, and (3) arrange to have GRE General Test scores submitted by the Educational Testing Service (www.ets.org) directly to Boise State University (code R4018). The statement of purpose should give the educational and professional background of the student and his or her motivation for graduate study including career goals. Applicants holding a baccalaureate degree from the College of Engineering of Boise State University are not required to submit GRE scores. Once the applicant’s file is complete, it will be evaluated by the Mechanical Engineering Graduate Studies Committee and an admission recommendation (regular, provisional, or denial) will be forwarded to the Dean of the Graduate College. In order to ensure proper mentoring of all graduate students, a recommendation for regular or provisional admission will not be forwarded unless a faculty member of the Department of Mechanical and Biomedical Engineering is available to serve as the major advisor. The graduate dean will make the final admission decision and notify the applicant and the Mechanical Engineering Graduate Studies Committee.

Advisor and Supervisory Committee

For a student admitted to the M.S. ME program, the Mechanical Engineering Graduate Studies Committee will initiate the assignment of a supervisory committee including a major advisor who serves as chair. The role of the supervisory committee is to guide the student in all aspects of his or her graduate study. For a student admitted to the M.Engr. ME program, the Mechanical Engineering Graduate Studies Committee will appoint a major advisor; student mentoring will be provided by the major advisor and the chair of the department.

Master of Science in Mechanical Engineering

Graduate Program Coordinator: John Gardner
Engineering Technology Building, Room 205
Telephone 208 426-5702
e-mail: jgardner@boisestate.edu
Degree Requirements
Students must complete at least 30 graduate credits distributed as shown in the degree requirements table. A written thesis proposal with oral presentation to the supervisory committee is required prior to the completion of 15 credits applicable to the degree requirements. Work on the thesis can only be undertaken after approval of the thesis proposal by the supervisory committee. The thesis must constitute an original contribution to knowledge in mechanical engineering and must be successfully defended at a final oral examination. All work directly related to the thesis must be represented by at least 6 credits of ME 593.

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<th>Master of Science in Mechanical Engineering</th>
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<td>Course Number and Title</td>
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<td>TOTAL</td>
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Special Rule on Transfer Credit. The normal transfer credit policies of the Graduate College hold except that up to 15 transfer credits earned in combination at the University of Idaho and Idaho State University may be applied to either degree program (M.S. ME or M.Engr. ME) with the approval of the supervisory committee.

Course Offerings
Additional work will be required to receive graduate credit for undergraduate G courses.
ME – MECHANICAL ENGINEERING
ME 420G THERMODYNAMICS II (3-0-3)(F/S). Advanced
topics and applications of thermodynamics include power and refrigeration cycles, combustion, mixed gas properties, chemical equilibrium, and psychometric applications. PREREQ: ENGR 320 and MATH 275.

ME 472G VIBRATIONS (3-0-3)(F/S). Theory and methods for analysis of vibrating physical systems. Natural frequencies, mode shapes, damping, forced vibrations, and frequency-response functions are analyzed by using computer simulation. PREREQ: ENGR 220 and MATH 333.

ME 486G HUMAN FACTORS DESIGN (3-0-3)(F/S). Anthropometry, biomechanics, and psychology applied to machinery and systems designs which involve human interaction. Design considerations include efficiency, productivity, environmental factors, human capabilities, comfort, and safety. Design projects demonstrate concepts and methodologies. PREREQ: Senior standing.

ME 522 ADVANCED THERMODYNAMICS (3-0-3)(F/S). Advanced topics selected from Statistical Thermodynamics, Thermodynamics of Chemically Reacting Gases, Thermodynamics Property Formulation for Computer Applications and others at the discretion of the professor. PREREQ: ME 420.

ME 530 FLUID DYNAMICS (3-0-3)(F/S). Advanced fluid mechanics theory and applications in potential flow, boundary layer theory, viscous flow, turbulence, vorticity dynamics and circulation, compressible flow and gas dynamics, open channel flow, turbomachinery, stratified flow, laws, and introduction to computational fluid dynamics. PREREQ: ENGR 330, MATH 333, and either MATH 275 or MATH 272.


ME 533 DYNAMIC METEOROLOGY (3-1-3)(F/S). Atmospheric dynamics, conservation laws, planetary boundary layers, large scale motions and circulations, numerical modeling, prediction, meteorological resources, weather analysis, and forecasting. PREREQ: MATH 333 and either MATH 275 or MATH 272.

ME 536 COMPUTATIONAL FLUID DYNAMICS (3-0-3)(F/S). Theory and numerical modeling in fluid dynamics. Finite difference, finite volume, and finite element techniques will be treated. The course will include projects and research applications in engineering and environmental flows. PREREQ: ENGR 330, structured programming, or PERM/INST.

ME 538 CONVECTIVE HEAT TRANSFER (3-0-3)(F/S). Treatment of energy and linear momentum conservation equations; laminar and turbulent forced convective HT in internal and external flow fields; free convection. PREREQ: ME 320, ME 321.


ME 556 INTRODUCTION TO SOLID BIOMECHANICS (3-0-3)(S). Students will learn to apply the principles of engineering mechanics to the human musculoskeletal system. Topics covered include functional anatomy, human motion analysis, mechanical properties of biological tissues, and modeling of the human body. PREREQ: ENGR 220 or PERM/INST.

ME 560 COMPUTER AIDED DESIGN (3-0-3)(F/S). Computer programs used to develop 3-D CAD database for design, analysis, simulation, and manufacturing. Machinery design to meet functional, performance, reliability and manufacturing requirements. Design projects reinforce concepts and methodologies. For students desiring higher level CAD sills prior to taking ME 480. PREREQ: ME 320 and ME 382.

ME 561 (ECE 561) CONTROL SYSTEMS (3-0-3)(S). Time and frequency domain analysis and design of feedback systems using classical and state space methods. Observability, controllability, pole placement, observers, and discrete time. Multivariable and optimal methods are introduced. May be taken for either ECE or ME credit, but not both. PREREQ: ECE 360 or ME 360.


ME 574 ADVANCED VIBRATIONS (3-0-3)(F/S). Theory and applications of vibrating continuous and discrete multi degree of freedom systems, modal analysis, acquisition and synthesis of data. Experimental and analytical characterization of the vibration response of linear and nonlinear systems, including Transfer and Frequency Response Functions, MIMO and SIMO, and mathematical modeling. PREREQ: ME 472 or PERM/INST.

ME 576 ADVANCED DYNAMICS (3-0-3)(F/S). Analytical modeling to predict the performance of linked, multi-body mechanical systems undergoing large displacements and rotations. Theoretical considerations in preparing models for computer simulations and interpreting results. Application of a state of the art computer package in creating realistic simulations. PREREQ: ME 380 or PERM/INST.

ME 577 (BIOL 577)(MSE 577) BIOMATERIALS (3-0-3)(F/S). Theory of biomaterials science. Medical and biological materials and their applications. Selection, properties, characterization, design and testing of materials used by or in living systems. May be taken for BIOL, ME, or MSE credit, but not from more than department. PREREQ: ENGR 245 or CHEM 112.

ME 578 DESIGN AND ANALYSIS OF MECHATRONIC
SYSTEMS (3-0-3)(F/S). Design and analysis of engineering systems containing mechanical, electromechanical and embedded computer elements. The course provides an overview of basic electronics, digital logic, signal processing and electromechanical devices. Fundamentals of event-driven programming will also be covered. PREREQ: ENGR 240.

ME 582 OPTIMAL DESIGN (3-0-3)(F/S). Analytical and computer methods used to provide optimal design of products or processes. Formulation, specification, figures of merit, controllable variables, constraints and relationships among design variables. Single and multi-variable optimization algorithms using linear and nonlinear programming methods to design problems in structures, machine components, and energy systems. PREREQ: MATH 272 or MATH 275, PHYS 211, PHYS 211L.

ME 584 ROBUST DESIGN (3-0-3)(F/S). Statistics and probability applied to the design of products and processes. Stochastic modeling and analysis of mechanical systems. Product reliability, series and parallel systems reliability, structural reliability, Taguchi methods, failure modes and effects analysis, and Monte Carlo simulation. PREREQ: ME 320 and ME 382.

ME 585 VEHICLE DESIGN (3-0-3)(F/S). Subsystem design for wheeled vehicles including bicycles, motorcycles, cars, trucks and ATVs. Static and dynamic analyses of traction and reaction forces during acceleration, braking and cornering. Suspension response analysis. Subsystem design including suspension, chassis, steering, transmission, brakes, and tires. PREREQ: ENGR 220, ENGR 245, ENGR 350, and ME 280.

ME 586 ADVANCED ENGINEERING DESIGN (3-0-3)(F/S). Integration of systematic methods used to define, develop, and produce competitive products. Topics include: Quality Function Deployment; Functional Decomposition; Design Specification; Failure Modes and Effects Analysis; Design Analysis & Evaluation; Optimal & Robust Design; Design for Manufacture, Assembly, and Service. PREREQ: ME 480 or PERM/INST.