2090, and grade of C or better in IE 3302.

4425 Quality Assurance (3) Prereq.: grade of C or better in IE 3302. Principles and practice of quality assurance and control; theory of statistical sampling and control charts; control chart analysis; Quality Systems; Six Sigma principles and practice.

4461 Human Factors Engineering (3) Prereq.: senior standing. Basic principles of chemical hazards, air contamination, ionizing and nonionizing radia-
tion, sound and vibration, and thermal stresses; theoretical
foundation and application of theory in the control of occupational health hazards.

4465 Biomechanics for Engineers (3) See IE 4323.

4466 Human Computer Interaction (3) Prereq.: IE 2060 or
equivalent. Systems approach to the identification, design,
analysis, and development of human-operated information
processing systems in organizations; prototyping in indus-
try, military, health systems, and education.

4470 Knowledge-Based Systems in Engineering (3) Prereq.: EC 3010 or experience. 2 hrs. lecture; 3 hrs. lab. Tools and techniques of knowledge-based expert systems as applied to engineering problems; expert systems building tools; state-of-the-art engineering expert systems.

4480 Manufacturing Automation (3) Prereq.: IE 3520 and
ME 3633. 2 hrs. lecture; 3 hrs. lab. Application of com-
puter-based control system technologies to manufacturing
automation; programming of numerically controlled machine
tools using Compact II and API; robotics with multidegree
of freedom linkages; NC programming using CAC/CDAM;
computer-automated part programming.

4485 Systems Design and Manufacturing (3) Prereq.: IE 2060;
ME 3633, IE 2950. 2 hrs. lecture; 3 hrs. lab. Principles and
application of information technologies to monitoring,
control, and integration of manufacturing operations
at all levels within the organization.

4490 Engineering Management (3) Prereq.: IE 1002, IE 1003,
or equivalent. 2 hrs. lecture; 3 hrs. lab. Problem solving
and decision making in the context of project and
program management; evaluation of alternative
solutions; risk analysis; project control; project
monitoring and control.

4520 Supply Chain Logistics II (3) Prereq.: grade of C or better in IE 3520. Production logistics: forecasting, aggregate
production, inventory systems, and materials requirements
planning; lean supply system and supply chain management;
warehouse and distribution systems; supply chain
information technologies, and government policies/regulations.

4530 Lean Manufacturing Systems (3) Prereq.: IE 2060,
3230 and credit or registration in IE 4362. 2 hrs. lecture; 3 hrs. lab. Principles of Lean Manufacturing Systems, Queuing
Variance Reduction; Data Analysis, In-Process Reduction, Waste Reduction, Zero Inventory and Just-in-time
Production Systems; Design for Lean Manufacturing; Material and Shop Floor Control; Simulation Modeling and
Analysis of Lean Systems.

4540 Reliability Engineering (3) Prereq.: IE 3302. Refi-
nement of the basic reliability design process with
emphasis on human reliability and safety during pre-production development and testing; and special
problems in maintenance, spare parts, and Markov processes.

4599 Industrial Engineering Capstone (4) Prereq.: IE 4425,
4453, 4516, 4520, 4530 and ME 3633; consent of department. Must be taken during the last semester of the undergraduate degree program; must be taken in fall semester immediately prior to graduation; for spring or summer graduates, must be taken in the spring semester immediately prior to graduation. Students entering this course must have completed all courses from the core. Application of previous industrial engineering courses in a comprehensive design project; preparation for the professional engineering examination (PE exam) as suggested by the EAE. Options: Projects for Design, Systems Engineering, and/or Development of appropriate me-
tal apparatus and computer systems to typical engineering
problems; application of subroutines; application
of standard computer systems to typical engi-
norning surveys and trends in the field of human resource
development.

7201 Advanced Engineering Economy (3) Prereq.: IE 4362 or equivalent. Random variables and their functions; trans-
formation of random variables; sets of random variables and random sequences; expectation, special
distributions, random processes, discrete and continuous
Markov processes, birth and death processes, and waiting
line theory.

7303 Industrial Systems Simulation (3) Prereq.: IE 4530 or
equivalent. Design and analysis of simulation models for
industrial systems including advanced techniques for random number generation, random variate
generation, design and analysis of simulation experiments, and
variation reduction techniques.

7402 Information Systems Engineering (3) Prereq.: IE 4425 or equivalent. 2 hrs. lecture; 3 hrs. lab. Advanced concepts of information systems engineering with focus on middleware and software technologies for integrating databases; design issues and methodology for
developing and implementing distributed information
systems, design and implementation of data warehouses and online analytical processing (OLAP) systems.

7455 Lean Process Improvement (3) Philosophy and
concepts of quality and process improvement, organization
for quality, quality improvement (QI) tools and techniques, advanced QI techniques, and quality improvement projects. Application of advanced Six Sigma and Lean tools and techniques to case studies related to the construction
industry. Investigation, learning, and application of current
research related to the course topics.

7461 Ergonomics in Work Design (3) Prereq.: IE 4461 or
equivalent. 2 hrs. lecture; 3 hrs. lab. Introduction to
anthropometry, functional anatomy and physiology, and
their application in work design and task assessment.

7463 Industrial Hygiene Engineering (3) Prereq.: IE 4461
or equivalent or consent of instructor. Evaluation and
control of industrial environments; noise and vibration,
industrial illumination, radiological hazards, chemical
and biological hazards, air contamination, ionizing and
nonionizing radiation and thermal hazards; design of safety
programs; cost analysis; application of current
research related to the course topics.