**E N T C 2 4 1 4  C i r c u i t  A n a l y s i s  I  
4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)  
Fundamental aspects of DC circuit analysis: charge, voltage, resistance, current, and power; Ohm's Law; methods of analysis; series and parallel circuits; Kirchhoff's voltage and current laws; Thevenin and Norton Theorems; electrical measurement instruments; and use of analysis software. Offered: Fall/Spring.  
Prerequisite: MATH 2413.  
Co-requisite: PHYS 2426, SMTE 0099.  
TCCNS: ENGT 1401

**E N T C 2 4 9 0  S p e c i a l  T o p i c s  
1-4 Semester Credit Hours (1-4 Lecture Hours, 3 Lab Hours)  
Subject material variable. May be repeated for different topics.

**E N T C 3 2 2 0  T h e r m a l - F l u i d s  L a b o r a t o r y  
2 Semester Credit Hours (4 Lab Hours)  
Application of measurement instrumentation and experimental techniques utilized in thermodynamics and fluid mechanics. Experiments and project in hydrostatics, hydrodynamics, and thermodynamics. Offered in Spring.  
Prerequisite: (ENTC 3306 and 3320).  
* May be taken concurrently.  
Co-requisite: SMTE 0099.

**E N T C 3 3 0 2  M a n u f a c t u r i n g  P r o c e s s e s  
3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)  
Introduction to metal and non-metallic manufacturing processes; casting, forging, rolling, extrusion, sheet metal forming, cutting tools turning and milling operations, abrasive machining, welding and joining, powder compaction, molding, forming of plastics, surface treatment, human factors and safety. Offered: Fall/Spring.  
Prerequisite: ENGR 1312 and 3322.  
Co-requisite: SMTE 0099.

**E N T C 3 3 0 6  F l u i d  M e c h a n i c s  
3 Semester Credit Hours (3 Lecture Hours)  
Fluid properties, fluid statics, dynamics, and kinematics, conservation of energy and momentum incompressible, laminar and turbulent flow. Similitude and dimensional analysis, and viscous flow. Offered: Fall (Spring as needed).  
Prerequisite: (ENTC 2326 or ENGR 2326).

**E N T C 3 3 0 8  S t r e n g t h  o f  M a t e r i a l s  
3 Semester Credit Hours (3 Lecture Hours)  
Concepts in strength of materials, stress, strain, torsion; deformation under load; direct, shear, and combined stresses; shear and moment diagrams; Mohr's circle; stress concentrations, bending stresses and torsional shear stresses, deflection in beams and shafts; columns, connections, and pressure vessels. Offered: Fall (Spring as needed).  
Prerequisite: (ENTC 2325 or ENGR 2325) and (ENTC 3410).

**E N T C 3 3 2 3  R o b o t i c s  a n d  A u t o m a t i o n  
3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)  
Automation in a manufacturing and assembly setting, material handling systems, remote guided vehicles, automated storage and retrieval systems, computer numerical machine tools, robotics. Offered: Spring.  
Prerequisite: ENTC 3415.  
Co-requisite: SMTE 0099.

**E N T C 3 3 5 0  H u m a n  F a c t o r s  E n g i n e e r i n g  
3 Semester Credit Hours (3 Lecture Hours)  
Application of human factors engineering principles utilized in mechanical and product design. Overview of human characteristics and research and design techniques.  
Prerequisite: (ENTC 3302 or 3302*).  
* May be taken concurrently.

**E N T C 3 4 5 5  S o l i d  M o d e l i n g  a n d  F i n i t e  E l e m e n t s  
4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)  
Use of computer aided design and solid modeling tools in engineering design and manufacturing including: solid modeling, stress, flow and heat transfer analysis using finite element methods, and rapid prototyping. Offered: Spring.  
Prerequisite: ENTC 3308.  
Prerequisite: (ENTC 3306 and 3320).

**E N T C 4 2 1 0  S o l i d  M e c h a n i c s  L a b o r a t o r y  
2 Semester Credit Hours (4 Lab Hours)  
Prerequisite: (ENTC 4330).  
* May be taken concurrently.  
Co-requisite: SMTE 0099.

**E N T C 4 3 2 0  H e a t  T r a n s f e r  
3 Semester Credit Hours (3 Lecture Hours)  
Fundamental study of convection, conduction and radiation as applied to heat transfer, heat exchangers, boilers, other heat transfer equipment. Offered: Spring.  
Prerequisite: ENTC 3306 and 3320.

**E N T C 4 3 2 2  P r o g r a m m a b l e  L o g i c  C o n t r o l l e r s  
3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)  
Introduction to PLCs and their use in industrial automation. Topics include programming, counters, timers, interrupts, and process control applications. Offered: As needed.  
Prerequisite: ENTC 3416.  
Co-requisite: SMTE 0099.

**E N T C 4 3 3 0  D e s i g n  o f  M a c h i n e  E l e m e n t s  
3 Semester Credit Hours (3 Lecture Hours)  
Stress analysis of deformable bodies and mechanical elements; stress transformation; combined loading; failure modes; material failure theories; fracture and fatigue; deflections and instabilities; thick cylinders; curved beams; design of structural/mechanical members; design processes for shafts, bearings, springs, fasteners, and mechanical joints.  
Prerequisite: ENTC 3308.

**E N T C 4 3 3 1  U n i t  P r o c e s s e s  
3 Semester Credit Hours (3 Lecture Hours)  
Principles and methods for staged separation processes including distillation, absorption and stripping, extraction, and adsorption systems. Offered in Fall and Spring  
Prerequisite: ENTC 4320.
ENTC 4332  Process Modeling and Control
3 Semester Credit Hours (3 Lecture Hours)
Prerequisite: ENTC 3306.

ENTC 4333  Chemical Reaction Engineering
3 Semester Credit Hours (3 Lecture Hours)
Fundamental principles of chemical reaction engineering and application to design and analysis of basic chemical reactors containing both homogeneous and heterogeneous reactions. Offered Fall and Spring.
Prerequisite: ENTC 4331 and 4332.

ENTC 4335  Energy Conversion
3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)
Installation, design characteristics, operational performance, and maintenance of motors, turbines, pumps and compressors. Introduction to global energy concerns; fossil and nuclear fuels; energy consumption analysis; energy management and conservation techniques; renewable and alternative energy sources. Modern energy conversion devices such as fuel cells, photovoltaic cells, and micro-power turbines.
Prerequisite: ENTC 3320.

ENTC 4350  Capstone Projects
3 Semester Credit Hours (1 Lecture Hour, 5 Lab Hours)
This course allows students to employ the knowledge attained in other courses to implement (including building, testing, and documenting) the project approved in ENTC 4415 - Project Justification and Management, within budget and on schedule. Course requirements include a written report and oral presentations. Normally taken in the student's last semester.
Prerequisite: ENTC 4415.
Co-requisite: SMTE 0099.

ENTC 4360  Mechanical System Design
3 Semester Credit Hours (3 Lecture Hours)
Analysis, management and cost, team work, optimal design, and computer simulation of mechanical systems and components; Applications in fluid flow and heat transfer, machine elements, and stress analysis. Selected course topics are assigned as projects.
Prerequisite: ENTC 4330.

ENTC 4415  Project Justification and Management
4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)
Foundations of engineering economy, cash flow and equivalence, and project justification. Introduction to project management, planning, scheduling, and control, use of project management software, GANTT charts, PERT charts, critical path. Students prepare proposals, including specifications, timelines, schedule, and budget, for projects to be implemented in ENTC 4350 - Capstone Projects.
Co-requisite: SMTE 0099.

ENTC 4446  Control Systems I
4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)
Introduction to control systems; open and feedback; Laplace transform and frequency response; control valves; electric motors; P, PI, and PID modes of control; analog and digital controllers Process characteristics; analysis of control systems; gain and phase margin; stability.
Prerequisite: ENTC 2414.

ENTC 4490  Selected Topics
1-4 Semester Credit Hours (1-4 Lecture Hours)
Subject material variable. May be repeated for different topics.

ENTC 4496  Directed Independent Study
1-4 Semester Credit Hours
Requires a formal proposal of study to be completed in advance of registration, approval of supervising faculty and chairperson.