

# IMAGING AND APPLIED TECHNOLOGY

Harrigan Hall, Room 227  
 (616) 471-3450 or (800) 909-8812  
 FAX: (616) 471-6655  
 launr@andrews.edu  
 http://www.andrews.edu/COT/

## Faculty

Laun L. Reinholtz, *Chair*  
 Rodrick A. Church  
 Murray H. Lofthouse  
 Arturo S. Maxwell  
 Donald L. May  
 James R. Newkirk  
 Sharon J. Prest  
 David B. Sherwin  
 Renee A. Skeete  
 Dustin J. Thorne  
 Marc G. Ullom  
 William D. Wolfer

Academic Programs	Credits
BT: Automotive Technology	60
Auto Body	
Auto Mechanics	
AT: Automotive Technology	40
Auto Body	
Auto Mechanics	
BT: Construction Management	65
BT: Digital Multimedia Technology	62
BT: Graphic Imaging Technology	63-66
Electronic Publishing	
Web Development	
AT: Graphic Imaging Technology	40
BS: Photographic Imaging	66
BS: Technology Education	64-69
Secondary Teaching Certification	
Minor in Automotive Technology	20
Minor in Construction	20
Minor in Imaging Technology	22
Minor in Photography	20
Minor in Web Development	21

## SEQUENCE OF TWO-YEAR AND FOUR-YEAR PROGRAMS

The Department of Imaging and Applied Technology plans programs using the "ladder concept," allowing a student to complete as much education as desired before entering the work force. Two- and four-year programs are available. Students completing the two-year program may go directly into a four-year program in the same area. The ladder concept allows students to reach the educational goal that best fits their specific needs.

## ANCILLARY OPERATIONS

Screen Graphics and LithoTech are ancillary operations of the Department of Imaging and Applied Technology providing students with experience in graphic arts unavailable elsewhere on campus.

## Programs

### AUTOMOTIVE TECHNOLOGY

Two options are available in the automotive field—auto body and auto mechanics. Auto body provides the training needed to repair auto damage incurred in accidents and to restore vehicles to their original appearance and correct body alignment. Auto mechanics provides the training needed to maintain and repair automobile engines and systems.

#### BT: Automotive Technology

##### Major requirements—40

AUTO135, 140, 150, 330, 380, 425; TCED140, 250, 254, 456, plus 7 credits of electives.

##### Emphasis in Auto Body—20

AUTO120, 130, 345, 355, plus 4 credits of electives chosen from auto technology.

or

##### Emphasis in Auto Mechanics—20

AUTO325, 340, 350, 425, plus 5 credits of electives chosen from auto technology.

#### AT: Automotive Technology

##### Major requirements—20

AUTO135, 140, 150; INDT315; TCED456, plus 3 credits of electives.

##### Emphasis in Auto Body—20

AUTO120, 130, 345, plus 8 credits of electives chosen from AUTO355, 380; TCED140 and other auto technology courses.

or

##### Emphasis in Auto Mechanics—20

AUTO325, 330, 340, plus 9 credits of electives chosen from AUTO350, 380 and other auto technology courses.

All students in these two program options must have written two ASE exams by the end of their first year. By the end of the second year, they must have passed a minimum of five ASE tests in their respective option.

## CONSTRUCTION MANAGEMENT

This program is directed toward residential and light commercial construction. Management and job entry level skills in basic trades are stressed.

#### BT: Construction Management

##### Major requirements—48

CNST105, 115, 120, 135; MECT120; TCED180, 9 credits minimum chosen from INDT320, 410, 440, 460; TCED254, 6 credits minimum chosen from ACCT121, 122; BSAD210, 341, 355, 436; ECON225, 226; FNCE387; MKTG310, 320, plus 12 credits of electives chosen from upper division courses in consultation with advisor.

##### Cognate requirements—17

ARCH201, 202, 205, 230, 305; MATH168.

## DIGITAL MULTIMEDIA TECHNOLOGY

Digital Multimedia is a very exciting field which utilizes the computer as its main work tool in developing projects needed by clients.

Students learn skills such as digital image manipulation and enhancement, 3-D modeling and animation, digital sound mixing and enhancement, digital video editing, interactive webpage design, interactive multimedia, and CD authoring.

## **BT: Digital Multimedia Technology**

### **Major requirements—57**

DGME130, 175, 185, 215, 216, 225, 250, 335, 340, 360, 370; TCED275, 495 plus 12 credits of electives chosen from ART214; COMM320; CPTR125; DGME305, 345, 385; PHTO115, 300, 365.

### **Cognate requirements—9**

ART104, 207; JOUR140.

Students are accepted into the Digital Multimedia program on a provisional basis until they demonstrate their skills and abilities. By the end of the students' sophomore year they need to have completed ART104, 207; DGME130, 175, 215, 225; and PHTO115 with a cumulative GPA of at least 3.00. They must also submit a portfolio of their work to the department along with a formal application to the Digital Multimedia program.

Applications and portfolios are reviewed by the department during the month of May and the applicant is notified no later than June 30 of acceptance into the program.

## **GRAPHIC IMAGING TECHNOLOGY**

Revolutionized by the introduction of computer technology into the industry, the term "graphic imaging" is no longer limited to the field of printing. The industry now emphasizes online publishing and interactive multimedia. Students work extensively with computer applications. Two options are available.

**Electronic Publishing** helps students develop skills in the use of computer applications to produce materials for the printed page as well as for Web and CD-ROM publishing and interactive media.

**Web Development.** In today's economy almost everyone has a webpage to help advertise or market a product. This is one of the rapidly growing areas of the job market. Students taking this emphasis will have the needed background to find good paying jobs.

## **BT: Graphic Imaging Technology**

### **Major requirements—25**

ART207; DGME130, 175, 215, 225, 250, 335

### **Emphasis in Electronic Publishing—32**

DGME185, 305; GRPH125, 145; PHTO365; TCED495 plus 10 credits of electives chosen in consultation with advisor.

### **Cognate requirements—9**

ART104, 214; JOUR140

or

### **Emphasis in Web Development—32**

CPTR125, 151, 152, 416; DGME350 plus 17 credits of electives chosen from ART104; DGME216; PHTO115, 130, 300, 365 and other courses from ART, CPTR and DGME.

### **Cognate requirements—6**

COMM454; EDTE476.

## **AT: Graphic Imaging Technology**

### **Major requirements—40**

DGME130, 175, 185, 225; GRPH125; INDT315 plus 18 credits of electives chosen from DGME305; GRPH145 and others in consultation with advisor.

## **PHOTOGRAPHIC IMAGING**

Photographic imaging fosters creativity in the production of visual images. The subject of these images and the method used to create them vary.

*Commercial imaging* develops skills required by the commercial industry through the use of studio work and on-location shooting in medium- and large-format photography.

*Digital imaging* utilizes computer technology to create, enhance, or modify photographic images.

*Photography* encompasses elements of digital and commercial imaging, and adds individual creativity and photojournalism.

## **BS: Photographic Imaging**

### **Major requirements—40**

DGME130, 175; PHTO115, 200, 220, 285, 300, 365, 410 plus 5 credits of electives chosen from DGME340; GTEC395; PHTO210, 320, 375, 385, 400, 425; TCED495.

### **Cognate requirements—26**

ART104, 207, 214, 414; BSAD210; COMM405, 475; JOUR375.

## **TECHNOLOGY EDUCATION**

Students learn skills for teaching technology education at the secondary level.

## **BS: Teaching Endorsement (Secondary Education)**

### **Professional requirements—8**

TCED254, 350, 456.

### **Communication Systems\*—9**

TCED465, plus 6 credits of electives chosen from ARCH125; DGME130; MECT120; PHTO115.

### **Construction Systems\*—7**

CNST105, plus 3 credits of electives chosen from ARCH201; CNST115, 120, 135.

### **Energy Systems\*—6**

TCED466, plus 3 credits of electives chosen from ELCT151, 171, 205.

### **Manufacturing Systems\*—6**

TCED470, plus 3 credits of electives chosen from TCED140, 180, 250.

### **Transportation Systems\*—6**

TCED464, plus 3 credits of electives chosen from AUTO130, 140, 150.

### **Cognate requirements—10**

ENGR370; PHYS131, 132 or 151, 152.

\*Students must fulfill elective requirements for four of the five systems listed above.

## **Minors**

### **Automotive Technology—20**

AUTO120, 130, 345, or 135, 140, 150; TCED140 plus 6-7 credits of electives chosen from auto technology.

### **Construction—20**

CNST105, 115, 120, 135; MECT120 plus 3 credits of electives chosen in consultation with advisor.

**Imaging Technology—22**

ART207; DGME130, 175, 185; GRPH145 plus 3 credits of electives chosen from DGME, GRPH, and PHTO.

**Photography—20**

DGME175; PHTO115, 200, 220, 285.

**Web Development—21**

CPTR125; DGME130, 175, 250, 350 plus one cognate chosen from ART207; COMM454; EDTE476.

**Courses****(Credits)**

See inside front cover for symbol code.

**AUTOMOTIVE TECHNOLOGY****AUTO104****\$ 2****Personal Auto Care**

Stresses the need for proper procedures in routine automobile maintenance. Helps the automobile owner become a wise consumer with emphasis on how to do simple tune-up, maintenance, and minor repairs. Not applicable to a major or minor. *Fall*

**AUTO105****(1)****Automotive Consumerism**

Consumer knowledge for the everyday challenges and decisions involved in automobile ownership. Topics include purchasing a new vehicle, how to choose a good repair facility, buying auto insurance, leasing, financing your purchase as well as how to deal with salespeople. When to sell or trade a vehicle along with how to protect your investment is also covered. Not applicable to a major or minor. *Fall*

**AUTO115****\$ (2)****General Auto Body Repair**

Basic auto body repair procedures are emphasized using individual projects. Helps the individual be a better consumer. Not applicable to a major or minor. *Spring*

**AUTO120****\$ (4)****Auto Body Repair I**

Theory and skill development for metal control in auto body sheet metal repair procedures. Welding, hand tool and power tool skills are developed on mock-ups and selected damage on automobiles. Component alignment and minor panel sectioning will be covered on both unitized body and conventional frame style vehicles. *Fall*

**AUTO130****\$ (4)****Auto Body Repair II**

Fundamentals of spray equipment, its usage and care. Emphasis in finishing materials, procedures and techniques for spot finishing and complete paint jobs. Course covers the preparation of substrata and final finishing using automotive urethane finishes. Study will also be made of body component systems and their diagnosis and repair. Prerequisite: AUTO120 or instructor's permission. *Spring*

**AUTO135****\$ (4)****Engine Performance I**

A course dealing with general engine diagnosis emphasizing ignition, fuel, air intake, emission and computer controls. *Fall*

**AUTO140****\$ (3)****Brakes, Suspension and Steering I**

A study of the hydraulic brake system including drum and disc diagnosis and repair. Steering and suspension along with basic wheel alignment will be covered. *Spring*

**AUTO150****\$ (4)****Automotive Electrical Systems I**

A course dealing with general electrical diagnosis and service procedures which covers: starting, charging, lighting, accessories and gauges. *Spring*

**AUTO325****\$ (4)****Engine Repair**

Includes general engine diagnosis and repair covering cylinder heads, block repair, lubrication and exhaust systems. *Fall*

**AUTO330****\$ (4)****Engine Performance II**

An in-depth study of engine diagnosis as it relates to ignition, fuel air induction, emission and computer controls. Use of diagnostic tools will be emphasized. Prerequisite: AUTO135. *Spring*

**AUTO340****\$ (3)****Brakes, Suspension and Steering II**

An advanced study of the hydraulic braking system including ABS diagnosis and repair. In-depth investigation of alignment, steering and suspension will be covered. Prerequisite: AUTO140. *Spring*

**AUTO345****\$ (4)****Auto Body Repair III**

Frame and body alignment theory and techniques with emphasis in the use of frame and body measuring devices, heavy duty floor or rack-pulling equipment. Skill in the repair and replacement of sections and complete structural panels will also be developed. Prerequisite: AUTO130. *Fall*

**AUTO350****\$ (4)****Automotive Electrical Systems II**

In-depth study of the starting, charging, lighting systems along with accessories and gauges. Emphasis in computer application and control of the automobile operation. Prerequisite: AUTO150. *Spring*

**AUTO355****\$ (4)****Auto Body Repair IV**

Study in advanced finishing systems and spray gun technique for three stage color systems and custom finishes including stripping, taping, airbrush, and metal flake. Study and practice will also be made of estimating the cost of repairs of collision damage. Prerequisite: AUTO345 or by permission of instructor. *Spring*

**AUTO380****\$ (2)****Heating and Air Conditioning**

A study of refrigeration theory and repair. Refrigerant recovery and recycling methods, heating and cooling principles are stressed. *Spring*

**AUTO425****(1-4)****Automotive Services**

Designed to provide experience in automotive diagnosis, estimating, and repair. Students will work on assigned projects. Prerequisites: 20 credits of auto courses with a 3.00 GPA and listed in at least one specialty area by ASE. Repeatable to 8 credits. *Fall, Spring*

**CONSTRUCTION****CNST105** \$ (4)***Residential Construction***

Emphasis in house-framing. The use of the steel square as it relates to rafter and stairway construction. Reading of prints, safe and proper use of hand and power tools will be covered. Energy efficient houses and other modern methods of construction are introduced. *Spring*

**CNST115** \$ (3)***Masonry Construction***

Emphasizes the proper use of the trowel, laying block and brick to the line and building of corner leads. Vocabulary, theory, safety, and practical applications are stressed. *Fall*

**CNST120** \$ (3)***Electrical Construction***

Includes code requirements, design and layout of electrical circuits, wiring methods, and commercial applications. *Fall*

**CNST135** \$ (4)***Plumbing Construction***

Includes design and layout of waste and water systems, rough-in methods, and trim. Print reading will be covered. *Spring*

**DIGITAL MULTIMEDIA TECHNOLOGY****DGME130** \$ (4)***Introduction to Digital Graphics***

An introductory survey of professional digital and conventional graphics covering understanding the Macintosh computer, electronic publishing, basic printing principles, sound digitizing, vector and raster graphics, interactive multimedia, image acquisition and output, web publishing and e-mail. *Fall, Spring*

**DGME175** \$ (4)***Digital Imaging***

A study of raster graphic fundamentals as they apply to scanned images. Emphasis on image manipulation, restoration, tonal enhancement, on-screen graphics and image acquisition and output. Visual and procedural problems relating to digital imaging will be covered, along with techniques of aesthetic and efficient image enhancement. Prerequisite: DGME130 with a C or better. ART207; PHTO115 recommended. *Fall, Spring*

**DGME185** \$ (4)***Desktop Publishing I***

Students learn to produce publications on desktop computers, including: brochures, magazine covers, corporate stationery, book covers, etc. Course topics incorporate: effective page layout, basic color theory, monitor calibration, gray balance, tone compression, GCR and UCR, digital proofing, image acquisition, and final output. Applications of color theories and color separation are stressed. Prerequisite: DGME175. *Fall*

**DGME215/DGME216** \$ (2+3)***Introduction to Digital Sound/Digital Video Editing I***

A study of digital sound and video acquisition, manipulation, and storage techniques. Students learn sound and video terminology, audio digitizing, video capture, nonlinear audio and video editing, audio and video applications for interactive and web applications, and creative audio and video conceptualization. Prerequisite: DGME175. *Fall, Spring*

**DGME225** \$ (4)***Digital Vector Graphics***

A study of digital vector graphic imaging emphasizing graphic production for print, digital multimedia, and web publishing. Prerequisite: DGME130 or equivalent. *Fall*

**DGME250** \$ (4)***Web Publishing I***

Exploration of the design, storage, retrieval, and delivery of electronic information using text and graphic images. Emphasis on publishing via the Web, kiosks, HTML authoring, and digital formats. Effective organization and planning of data for delivery, efficient design, and ethics are examined. Prerequisite: DGME130 or INSY104. *Fall, Spring*

**DGME305** \$ (4)***Desktop Publishing II***

An advanced study of desktop publishing principles including: grid based layout, typographic applications, layout techniques for printing and web publications, effective electronic file preparation, preflighting, and tips for consistent color reproduction. Prerequisite: DGME185. *Spring*

**DGME335** \$ (4)***Web Animation***

A course of study designed to develop the skills necessary for producing effective animation for the Web. Prerequisites: ART104; DGME130 or equivalent. *Fall, Spring*

**DGME340** \$ (4)***Interactive Multimedia I***

A survey of leading multimedia techniques using state of the art software and covering principles of effective digital multimedia production, interactive new media concepts, basic scripting, animation, digital imaging, and sound manipulation. Students produce digital interactive presentations, kiosks, and web-ready programs. Prerequisites: DGME175, 215, 216. *Fall*

**DGME345** \$ (3)***Digital Video Editing II***

An emphasis on nonlinear video editing, implementing modern video editing suites. Students learn video composition, the use of filters, transitions, alpha channels, video formats and their application, video recording/capturing, broadcasting techniques, and the advantages and limitations of this medium. Prerequisites: DGME175, 215, 216. *Spring*

**DGME350** \$ (3)***Web Publishing II***

Advanced study of current web development technologies with emphasis in Java scripting, animation, site quality and efficiency. The class will also stress meeting customer needs and new methods of web development. *Fall, Spring*

**DGME360** \$ (4)***3-D Modeling***

A study of basic 3-D modeling principles and techniques. Students learn 3-D modeling terminology, points and polygonal manipulation, model construction, and surfacing. Students also implement geometric manipulation tools such as: lathe, extrude, boolean effects, metanurbs, text manipulation and more. Prerequisites: ART104; DGME175, 225. *Fall*

**DGME370** \$ (4)**3-D Animation**

Basic 3-dimensional animation and rendering. Students learn to work with splines, keyframes, and to manipulate object geometry on the computer as they animate and texture 3-D objects. Basic lighting, compositing and other effects also implemented.

Prerequisites: DGME175, 215, 216, 225, 360. *Spring*

**DGME385** \$ (4)**Interactive Multimedia II**

An intermediate multimedia production course using leading industry software. 2-D and 3-D image manipulation and animation are implemented. Topics include interactive new media presentations, television commercials, digital video, kiosks, animation for web pages, and other computer-based presentations. Moderate Lingo scripting is also covered. Prerequisite: DGME340. *Spring*

**GRAPHIC IMAGING TECHNOLOGY****GRPH125** \$ (3)**Principles of Printing**

A study of the graphic arts industry including prepress concepts, color science, digital printing, digital image capture and color management. Also more traditional methods in design, layout, text and page composition, film assembly, imposition, and many different printing techniques to produce images on a substrate. Some business aspects and career possibilities will be explored. Open to all students. *Fall*

**GRPH145** \$ (4)**Screen Graphics I**

Basic screen printing principles and practices with emphasis on stencils, fabric selection, frames, inks, squeegees, screen reclamation, photography, digital and conventional artwork to produce screened projects. The sign industry, large format digital printing, UV and curved printing sequences will be explored. Open to all students. *Fall*

**GRPH345** \$ (4)**Screen Graphics II**

In-depth study on making process, simulated process, index and spot separations for screen printing. Other decorating methods will be explored such as transfers, foil, athletic numbering, glow in the dark, puff and UV. Non-textile applications will also be explored, decorating substrates such as plastics (binders, CDs, etc.) and glass (simulated etch, etc.) and many other substrates. Prerequisite: GRPH145. *Spring*

**PHOTOGRAPHY****PHTO115** \$ (4)**Introduction to Photography**

Basic introduction to the principles of the camera and darkroom techniques with consideration toward composition, psychological, and aesthetic attitudes in black-and-white photography. *Fall, Spring*

**PHTO130** \$ (3)**Fundamentals of Video**

An introductory course in videography emphasizing the terminology, aesthetics, and methods of video production. Prerequisite: PHTO115 or concurrently. *Fall*

**PHTO200** \$ (4)**Advanced Photography I**

Develops the art of photographic perception and use of photography

as a visual language. Emphasizes craftsmanship and awareness of tools available, as well as aesthetics, and the art of seeing creatively. Developing skills beyond introductory camera usage is emphasized. Prerequisite: PHTO115. *Fall, Spring*

**PHTO210** (3)**History of Photography**

Historical study of significant contributors in the development of photography and their influence on art and society. *Fall, Spring*

**PHTO220** (4)**Color Photography I**

Designed to acquaint students with color materials, their handling and exposure. Aesthetic and communicative aspects of color photography stressed in producing visually effective color transparencies. Prerequisites: PHTO115 or by permission of instructor. *Fall*

**PHTO285** \$ (4)**Studio**

Study of lighting techniques in standard-equipped studio, emphasizing portraiture, commercial illustration, and experimental techniques in both black-and-white color mediums. Prerequisite: PHTO200. *Spring*

**PHTO300** (3)**Media Ethics**

Understanding the influence and role of the media in who we are and what we value. Provides a language and a forum for discussion on the media and how they influence our lives. *Spring*

**PHTO320** (4)**Color Photography II**

An image-oriented course, drawing on the student's background in the use of color comprehension, photographic technical and aesthetic understanding, and working knowledge of emulsion and digital photography. Information in this class is for the sole purpose of comprehensive color image. Prerequisites: DGME175; PHTO220. *Fall*

**PHTO365** \$ (4)**Advanced Digital Imaging**

In-depth manipulation using leading industry software, emphasizing high quality image acquisition and output. Students learn to produce duotones, create raster graphic collages, perform critical image enhancement, create custom palettes, and alpha channels for image compositing. Repeatable to 8 credits. Prerequisites: ART207; DGME175 (with a B- or better); PHTO115. *Fall, Spring*

**PHTO385** \$ (4)**Advanced Studio**

An individual approach to an advanced level of studio photography. The student will be able to choose a concentration in the following areas: Portraiture, People/Fashion, Still-Life, Advertising/Illustration, and Location Photography. This course is designed specifically to learn visual concepts and solve visual problems of the commercial photo industry. Repeatable to 12 credits. Prerequisite: PHTO285. *Fall, Spring*

**PHTO390** (1-4)**Independent Study in Photography**

Further study of photography under direction of instructor. May be repeated. Prerequisites: PHTO115 or equivalent and approval of the instructor. *Fall, Spring*

**PHTO400** \$ (4)  
**Digital Photographic Printing**  
 Study in color printing using traditional emulsion based processes and digital color output. Prerequisites: PHTO220, 365. *Fall*

**PHTO410** \$ (4)  
**Advanced Photography II**  
 A course designed for the advanced photographer to investigate personal potential in visual exploration, experimentation, and technical excellence. Discussion involves expanding personal vision and exploring new techniques to achieve goals. Repeatable to 8 credits. Prerequisite: PHTO285. *Spring*

**PHTO425** (4)  
**Travel Photography**  
 Designed to be done in conjunction with on-location photography, and provides a background in the specific needs related to travel. Photographing people and their land in foreign environments is emphasized. Unique materials and equipment are discussed as they relate to travel photography. Repeatable to 8 credits. Prerequisite: PHTO115.

## TECHNOLOGY EDUCATION

**TCED140** \$ (2)  
**Welding Technology**  
 Oxyacetylene and electric welding processes including oxyacetylene welding, cutting, and brazing; basic shielded metal arc welding and basic gas metal arc welding. A limited amount of out-of-position welding will be stressed. *Fall*

**TCED179** \$ (2)  
**Woodturning**  
 Instruction and practice on the wood lathe covering safety and the basic operations used in spindle and face-plate turnings. Projects are of a useful and artistic nature. *Spring*

**TCED180** \$ (3-4)  
**Fundamentals of Woodworking**  
 Emphasis in design, wood identification, and the construction of appropriate projects from drawings. Safety and proper use of wood-working machines and common hand tools stressed. *Spring*

**TCED194/494** (1-3)  
**Project Course**  
 Development of a skill in a given area by working independently under the supervision of the instructor. Repeatable to 12 credits. Prerequisite: Permission of instructor. *Fall, Spring*

**TCED250** \$ (3-4)  
**Machine Shop**  
 Basic set-up and operation of lathes, milling machines, grinders, drilling machines, and shapers; safety, machine maintenance, off-hand grinding, drill sharpening, layout, and inspection emphasized. *Spring*

**TCED254** (3)  
**Technical Space Utilization**  
 Acquaints students with the planning and organization of technical facilities. Consideration given to space requirements, building structure, material flow, equipment needs, site location, and environment control of such facilities. *Spring*

**TCED350** (2)  
**Teaching of Technology Education**  
 Teaching methods and strategies applicable to the teaching of technology education at the secondary level. The developing of specific learning experiences and learning through problem-solving is covered. Prerequisite: Permission of instructor.

**TCED390** (1-4)  
**Internship**  
 On-the-job internship experience for those students seeking industrial experience which cannot be simulated in a classroom setting. A range of 120 clock hours of work are required for each credit. Selected in consultation with the student's advisor. May be repeated.

**TCED456** (3)  
**Safety and Loss Control**  
 Safety and the fundamentals of accident prevention with emphasis on schools, school laboratories, and industrial applications. Introduction to the total program of loss control in industry, including the legal implications for both school and industry. Emphasis on the problem of accident prevention and control. *Spring*

**TCED464** (3)  
**Transportation Technology**  
 The field of transportation as related to technology education at the secondary level. Material handling, transportation involving space and atmospheric, marine, and terrestrial modes included.

**TCED465** (3)  
**Communication Technology**  
 Study in the field of communications as related to the secondary level in technology education. Emphasis on broadcasting, computers, drafting, photography, graphic arts, telecommunications, and their effect on society.

**TCED466** (3)  
**Energy Utilization**  
 Study of different types of energies used by modern society, how they have changed society, and implications for the future.

**TCED470** (3)  
**Manufacturing Technology**  
 Study of the manufacturing process as it relates to the teaching of technology education at the secondary level. Emphasizes materials and processes, research and development, management, marketing, and sales.

**TCED275/485** (1-3)  
**Topics in \_\_\_\_\_**  
 Repeatable in various areas.

**TCED495** (1-3)  
**Portfolio Development**  
 Helps the student develop a traditional or electronic portfolio for employment or continuing educational purposes. Emphasis in direction, development, and refinement of the individual portfolio. Repeatable to 12 credits. Prerequisites: minimum of 30 credits in a major and permission of the instructor. *Fall*

**TCED597** (1-3)  
**Independent Study**  
 Individual study or research under the direction of a staff member. Repeatable to 6 credits. Prerequisite: Permission of department chair.