

*The below are the concentration requirements as they should be presented in the Course Catalog. This is all new language, and should be inserted at the end of the current Electrical and Computer Engineering Course Catalog entry.*

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## Concentrations

Students in all Electrical and Computer Engineering graduate degree programs may elect to choose a concentration area of study. Concentrations are available in *Computer Systems & Networking, Signal Processing, Communications, and Controls, Materials and Devices, Electromagnetics and Photonics, and Biomedical Engineering*. Students selecting a concentration must meet the concentration requirements detailed below, in addition to meeting their general degree requirements. Concentrations are voluntary, and students selecting multidisciplinary or other specialized studies need not declare a concentration.

### Concentration in Computer Systems & Networking

Students in the Computer Systems & Networking (CSN) concentration focus on research and coursework in computer architecture and parallel systems, optimizing and parallelizing compilers, design and test of high-performance digital and analog VLSI circuits, wired and mobile wireless networking, computer program optimization, as well as emerging CSN theories and applications.

#### Required Courses

ELEG 651 – Computer Networking Communications	3 Credits
ELEG 652 – Principles of Parallel Computer Architecture	3 Credits
ELEG 662 – Digital System Seminar (each semester)	0 Credits

#### A minimum of two courses from the following:

CPEG 621 – Compiler Design	3 Credits
CPEG 622 – Computer Systems Design II	3 Credits
CPEG 660 – Introduction to VLSI systems	3 Credits
ELEG 653 – Computer System Security	3 Credits
ELEG 667-011 – Sensor Networks	3 Credits
ELEG 667-012 – High-Performance Computing w/ Commodity Hardware	3 Credits
ELEG 819 – Topics in Networking I	3 Credits
ELEG 820 – Topics in Networking II	3 Credits

## Concentration in Signal Processing, Communications, and Controls

Students in the Signal Processing, Communications, and Controls (SPCC) concentration focus on research and coursework in multimedia signal processing, statistical and nonlinear signal processing, image processing, time-frequency analysis, wireless communications, information theory, coding, as well as emerging SPCC theories and applications. Students in the SPCC concentration must complete the following:

### A minimum of two courses from the following:

ELEG 630 – Information Theory	3 Credits
ELEG 631 – Digital Signal Processing	3 Credits
ELEG 635 – Digital Communications	3 Credits
ELEG 636 – Statistical Signal Processing	3 Credits

### A minimum of two courses from the following:

ELEG 611 – Linear Systems Theory	3 Credits
ELEG 619 – Multimedia Communications	3 Credits
ELEG 633 – Image Processing	3 Credits
ELEG 654 – Sensor and Data Wireless Networks	3 Credits
ELEG 677 – Biosignal Processing	3 Credits
ELEG 675 – Image Processing With Biomedical Applications	3 Credits
ELEG 811 – Channel Coding Theory and Practice	3 Credits
ELEG 812 – Wireless Digital Communications	3 Credits
ELEG 832 – Wavelets and Filter Banks	3 Credits
ELEG 833 – Nonlinear Signal Processing	3 Credits

### Required Courses

ELEG 663 – Signal Processing Seminar (each semester)	0 Credits
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## Concentration in Materials and Devices

Students in the Materials & Devices (MD) concentration focus on research and coursework in solid-state physics, semiconductor growth, device fabrication, and electro-magnetic measurement & characterization.

### Required Courses

ELEG 646 – Nanoelectronic Device Principles	3 Credits
ELEG 622 – Electronic Materials Processing	3 Credits
ELEG 661 – Materials and Devices Seminar (each semester)	0 Credits

**A minimum of two courses from the following:**

ELEG 640 – Opto-Electronics	3 Credits
ELEG 648 – Advanced Engineering Electromagnetics	3 Credits
ELEG 639 – Magnetism & Spintronics	3 Credits
ELEG 627 – THz and MMW light generation and detection	3 Credits
ELEG 647 – Optical Properties of Solids	3 Credits
ELEG 650 – Semiconductor Device Design and Fabrication	3 Credits

**Concentration in Electromagnetics and Photonics**

Students in the Electromagnetics & Photonics (EP) concentration focus on research and coursework in optics and electromagnetics; optoelectronic, microwave, millimeter-wave and terahertz devices and systems, device fabrication, and electro-magnetic measurement & characterization.

**Required Courses**

ELEG 648 – Advanced Engineering Electromagnetics	3 Credits
ELEG 667 – Optics and Photonics	3 Credits
ELEG 661 – Materials and Devices Seminar (each semester)	0 Credits

**A minimum of two courses from the following:**

ELEG 638 – Theory and Design of Diffractive Optics	3 Credits
ELEG 640 – Opto-Electronics	3 Credits
ELEG 641 – Antenna Theory and Design	3 Credits
ELEG 646 – Nanoelectronic Device Principles	3 Credits
ELEG 627 – THz and MMW light generation and detection	3 Credits
ELEG 622 – Electronic Materials Processing	3 Credits
ELEG 842 – RF and Microwave Technology	3 Credits
ELEG 853 – Integrated Optics	3 Credits
ELEG 855 – Microwave and Millimeter-Wave Technology	3 Credits

**Concentration in Biomedical Engineering**

Students in the Biomedical Engineering (BME) concentration focus on research and coursework in biomedical applications of signal and image processing, imaging systems, biophotonics, biochemical detection, cardiovascular and respiratory control, electrophysiology, computational biology, and

bioinformatics. The BME concentration is available to students in the MSECE and Ph.D. degree programs.

### **Required Courses**

ELEG 671 – Introduction to Biomedical Engineering	3 Credits
ELEG 679 – Introduction to Medical Imaging Systems	3 Credits
ELEG 664 – Biomedical Engineering Seminar (each semester)	0 Credits

### **A minimum of two courses from the following:**

ELEG 670 – Biophysics of Excitable Membranes	3 Credits
ELEG 673 – Signal Processing in Neural Systems	3 Credits
ELEG 675 – Image Processing with Biomedical Applications	3 Credits
ELEG 676 – Bioinformatics and Biosystems Analysis I	3 Credits
ELEG 678 – Introduction to Nano and Biophotonics	3 Credits
ELEG 680 – Immunology for Engineers	3 Credits