

## COMMUNICATIONS & SIGNAL PROCESSING

Option Supervisor: Professor Ravi Sankar

**FOCUS AREAS: Communications (Wireless / Networking / Communication Systems)  
Signal Processing (Speech / Biomedical / Digital Video and Multimedia)**

**30 hours M.S. Program (Course Only Option: 10 courses; Thesis Option: 8 courses and 6 hours Thesis) -- Choose the courses from the Communications and Signal Processing areas)**

### A. GENERAL CORE COURSES (MATH)

**Engineering Analysis (Course Only Option: 6 to 9 hours; Thesis Option: 6 hours)**

EEL 6545 Random Processes in Electrical Engineering  
and **ANY** of the following  
EGN 5423 Neural Networks and Mathematics of Communication  
EGN 5424 Engineering Applications of Complex Analysis  
EGN 5425 Engineering Applications of Advanced Matrix Computations

### B. FOCUS AREA CORE COURSES (Course Only Option: Minimum 12 hours; Thesis Option: Minimum 9 hours)

**Communications** EEL 6534 Digital Communication Systems  
EEL 6593 Mobile and Personal Communication  
EEL 6597 Wireless Network Architectures and Protocols  
EEL 693x Wireless Communications Lab

**Signal Processing** EEL 6502 Digital Signal Processing I  
EEL 6752 Digital Signal Processing II  
EEL 6586 Speech Signal Processing  
EEL 693x DSP/FPGA Lab

### C. ELECTIVES (Course Only Option: 3 to 9 hours; Thesis Option: Minimum 3 hours)

**Communications** EEL 6506 Broadband Communication Networks  
EEL 693x Advanced Topics in Wireless Communications  
EEL 693x Cognitive and Software Defined Radio  
EEL 6846 Coding Theory  
EEL 7931 Selected Topics in Communications

**Signal Processing** EEL 6753 Digital Signal Processing III  
EEL 693x Biomedical Image Processing  
EEL 6547 Pattern Recognition Theory and Applications  
EEL 6592 Digital Video and Multimedia  
CAP 5400 Digital Image Processing

**Digital Design** EEL 5344 Digital CMOS/VLSI Design  
EEL 693x System on a Chip  
EEL 693x Rapid System Prototyping  
EEL 693X Advanced RFIC Design

**Interdisciplinary** EEL 5462 Antenna Theory  
EEL 6426 RF & MW Circuits  
EEL 693x MEMS

EEL 693x Introduction to Nanotechnology  
 EEL 693x Personal Health Systems and User Interfaces  
 EEL 693x Digital Control Theory  
 STA 6876 Time Series Analysis  
 MAT 5932 Algebraic Graph Theory  
 CNT 6215 Computer Networks  
 CAP 6638 Statistical Pattern Recognition Theory  
 CAP 5682 Expert and Intelligent Systems  
 CAP 6615 Neural Networks  
 COT 6405 Introduction to Theory of Algorithms  
 CAP 6415 Computer Vision  
 CAP 5772 Data Mining  
 CGS 5420 Introduction to UNIX and C

#### D. M.S. THESIS/PROJECT/COURSE ONLY OPTIONS

- Thesis** Total: *30 credit hours* of course work (*24 credit hours*) including independent study and directed research (*maximum of 6 credit hours*) and thesis (*6 credit hours*)  
 EEL 6971-0xx Communications and Signal Processing Topic (*6 credit hours*)  
 (Register in the section for your Major Professor/Thesis Advisor)
- Project** Total: *30 credit hours* of course work (*27 credit hours*) including independent study and directed research (*maximum of 6 credit hours*) and project (*3 credit hours*)  
 EEL 6908-0xx Independent Study/Project (*3 credit hours*)  
 (Register in the section for your Major Professor/Project Advisor)
- Course Only** Total: *30 credit hours* of course work only including independent study and directed research (*maximum of 6 credit hours*)

All general rules for the MSEE degree apply.

#### COURSE STUDY PLAN RECOMMENDATIONS:

- **Thesis Option**

Design your course program which includes: (1) general core courses in engineering analysis (maximum of 6 hours), (2) at least 2 or 3 core courses from the primary focus area (based on your thesis topic), (3) at least 1 or 2 core courses from a secondary focus area, and (4) others selected from the electives (minimum of 3 hours). Seek advice and approval of your thesis advisor or the option supervisor.

- **Project and Course Only Options**

Design your course program to include: (1) general core courses in engineering analysis (minimum of 6 hours and maximum of 9 hours), (2) core courses from the two focus areas (minimum of 12 hours), (3) others selected from the electives (maximum 9 hours). Seek the advice and approval of the option supervisor if there is any deviation to the approved plan.

- To satisfy the course requirements set for categories (2) and (3) above, select a major and a minor area of concentration. For example, take 12 to 15 hours of course work from the major area and 6 to 9 hours in the minor area. The rest of the course work (3 to 6 hours) can be from outside the area of concentration (if these are from outside the EE department, they must be pre-approved by the option supervisor and/or the graduate program coordinator).
- Design your own study-plan for any interdisciplinary program (combining courses from two different tracks) or if the above recommendations do not meet your goals. This must be approved by the option supervisor and/or the graduate program coordinator.

## SEQUENCE REQUIREMENT:

In the communications area: Communication Systems will form sequences with Wireless Networks Architectures and Protocols or Advanced Topics in Wireless Communications; Mobile and Personal Communications will form sequences with Wireless Network Architectures and Protocols or Advanced Topics in Wireless Communications.

In the signal processing area: DSP-I will form sequences with DSP-II or Speech Signal Processing or any advanced signal processing courses.

Any elective listed above will also form a sequence with its prerequisite as long as it is a graduate level course. There is no specific requirement but it is recommended that students form at least two sequences.

## E. PH. D. PROGRAM

Design your program with the advice and approval of your Major Professor / Advisor (See the EE Graduate Handbook for the Ph.D. degree program requirements).

Ph.D. program requires 39 hours of course work (30 hours in the major area of concentration and 9 hours of Math/Statistics) and 20 hours Dissertation beyond B.S.E.E. By transferring 30 credit hours for M.S. degree, total course work beyond M.S. is 9 hours. Students who transfer up to 9 hours beyond M.S. are recommended to take at least one regularly scheduled graduate course work. Total of 72 hours minimum past the B.S. degree including course work, independent study, and directed research.

## COMMUNICATIONS & SIGNAL PROCESSING OPTION

### FOCUS AREA DESCRIPTIONS:

**Communication Systems** deals with all aspects of information transmission over wired (telephone/cable/optical-fiber) and wireless (satellite/digital radio/cellular) channels. Communication plays such a big role in everyday life and one can fully realize the impact of this technology on society. Just imagine living a day without your telephone, television, fax, or cell phone/pager.

**Signal Processing** deals with the operation of extracting, enhancing, storing, and transmitting useful information. This is probably second only to mathematics in terms of the number of areas it is applied to from acoustics, audio, biomedical, communication, geophysics, image, sonar, speech, radar, terrestrial, to others including mechanical vibrations, material flaws, transportation, and financial data analyses.

**Digital Video and Multimedia** concentrates on the representation, analysis, and manipulation (in hardware or software) of audio, and 2-D and 3-D video signals, both from a computational and communications point of view. Typical applications are video conferencing, videophones, video on PCs, digital television, HDTV, medical imaging, and automatic object recognition by industrial robots.

**Wireless Communications** emphasize the design and analysis of communication systems employing wireless media, including cellular telephony, wireless LANs, and mobile satellite communication. Topics are often cross-disciplinary in nature, such as waveform and equalizer design for wide-band CDMA, wireless ATM multimedia networks, handover in cellular systems, and implementation using digital signal processors.

**Communication Networks** focus on transportation of multimedia between interconnected group of hosts/computers, switches, routers, and host of other input-output devices/sensors. The explosive growth of Internet explains the reason why email has replaced the telephone as the primary source of communication. Truly this century will be the age of the Information revolution.