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 Advanced Topics in Wireless Communications

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

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

Digital Design
EEL 5344 Digital CMOS/VLSI Design
EEL 6935 Introduction to VHDL
EEL 6935 System on a Chip
EEL 6936 Low Power VLSI Design
EEL 693x Rapid System Prototyping

Communications
EEL 693x Wireless Communications Lab
EEL 693x Cognitive and Software Defined Radio
EEL 6506 Broadband Communication Networks
EEL 6535 Communication Systems II
EEL 6846 Coding Theory
EEL 5572 Local and Metropolitan Area Networks
EEL 7931 Selected Topics in Communications

Signal Processing
EEL 693x Biomedical Image Processing
EEL 6592 Digital Video and Multimedia
EEL 6935 Digital Medical Imaging
EEL 6753 Digital Signal Processing III
EEL 6820 Image Processing
EEL 6547 Pattern Recognition Theory and Applications

Interdisciplinary

EEL 5462 Antenna Theory
EEL 693x RF & MW Circuits I
EEL 693x RF & MW Circuits II
EEL 6935 MEMS
EEL 693x Biosensors
EEL 6935 Digital Control Theory
EEL 6936 Introduction to Nanotechnology
ESI 6336 Queuing Theory
MAS 5215 Number Theory
STA 6876 Time Series Analysis
CAP 5682 Expert and Intelligent Systems
CAP 6615 Neural Networks
COT 6405 Introduction to Theory of Algorithms
CAP 6415 Computer Vision
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.

- 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 43 hours of course work (27 hours in the major area of concentration, 8 hours of Math/Statistics, and 8 hours in outside the area of concentration) 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 13 hours which include independent study and directed research credit hours.

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.