COMMUNICATION SYSTEMS ENGINEERING PROGRAM

PROGRAM GOALS AND OBJECTIVES

The program aims at generating a graduate who is well trained in modern telecommunication industry as well as having a background in communication systems that enables him/her to fit easily within a modern telecommunication work environment and be able to identify market needs in this fast moving segment of business. The graduate is exposed to a wide variety of courses to build an open scope to telecommunication engineering which is interdisciplinary in nature. The graduate acquires his/her degree by taking a balanced curriculum that is predominantly concerned with communication systems on different levels and which does not neglect required basic sciences used in this field. This fills the gap in many telecommunication companies in Egypt nowadays.

DEPARTMENT REQUIREMENT COURSE LIST (APPLIED ENGINEERING)

Code	Course Title	Credits
EMAT 232	Complex and Fourier Analysis	4
EMAT 350	Numerical Techniques	3
EPHS 230	Optical and Thermal Physics	3
EPHS 240	Modern physics and quantum mechanics	3
COMM 230	Electronic Technology	2
COMM 240	Computer Hardware	3
COMM 241	Electrostatics and Magneto statics	3
COMM 242	Electrical Circuits	3
COMM 350	Signals and Systems	4
COMM 351	Electronic Materials	3
COMM 352	Electromagnetic Fields	3
COMM 353	Logic Design	3
COMM 354	Electronic Measurements	2
COMM 360	Solid State Electronic devices	3
COMM 361	Electronic circuits	3
COMM 362	Waves and Transmission Lines	3
COMM 363	Computer Architecture	3
COMM 471	Digital Circuit Design	3
COMM 473	Analog Communication Systems	3
COMM 474	Project Management	3
COMM 480	Organizational Behaviour	3
COMM 481	Communication Networks	3
COMM 482	Control systems	3
COMM 590	Digital Communications	3
COMM 591	Computer Networks	3
COMM 592	Quality Engineering	3
COMM 593	Project (1)	3
COMM 594	Project (2)	6
COMM 595	Information Theory and Coding	3
COMM 596	Industrial Accounting	3
COMM 597	Introduction to Decision Analysis	3
	Total Hours	96

TECHNICAL ELECTIVE LIST OF COURSES

7 Elective courses with a total of 21 Credit Hours

Code	Course title	Credits
COMM 410	Optoelectronic Devices	3
COMM 411	Microwave Circuits	3
COMM 412	Data Analysis and Algorithms	3
COMM 420	Digital Signal Processing	3
COMM 421	Distributed systems	3
COMM 422	Analog Circuits	3
COMM 430	Microwave Devices	3
COMM 431	VLSI Design	3
COMM 432	Statistical Signal Processing	3
COMM 440	Antenna Engineering and Propagation	3
COMM 441	Digital Circuit Design	3
COMM 442	Image Processing	3
COMM 510	Optical Communication Systems	3
COMM 511	Wireless and Mobile Communications	3
COMM 512	CAD for Digital circuits	3
COMM 513	Multimedia Engineering	3
COMM 520	Network Security	3
COMM 521	Acoustics	3
COMM 522	Analog Integrated Circuit Design	3
COMM 523	Satellite communications	3
COMM 530	Integrated Optics and Optical MEMS	3
COMM 531	Audio and Video Encoding	3
COMM 532	Microwave Measurements	3
COMM 533	RF Circuit Design	3

COMMUNICATION SYSTEMS ENGINEERING COURSE DESCRIPTIONS

EMAT 232 Vector, Complex and Fourier Analysis (4 credits:4-2-0)

Prerequisite: EMAT 120

Vector differential calculus, The gradient field, Divergence and curl, Vector Integral calculus, Green's theorem, Divergence theorem of Gauss, Stockes' theorem. Complex numbers and complex planes, Complex functions and their derivatives, Integration of complex functions, The Cauchy integral theorem, Singularities and the residue theorem, Sequences z transform, Conformal mapping Periodic functions, Fourier series expansion and its applications, Fourier transform.

Lectures: 4 hours per week. Tutorial: 2 hours per week.

EMAT 350 Numerical Techniques (3 credits:3-2-0)

Prerequisite: EMAT 231.

Roots of algebraic and transcendental equations; function approximation; numerical differentiation; numerical integration; solution of simultaneous algebraic equations, Finite difference techniques, Finite element techniques.

Lectures: 3 hours per week. Tutorial: 2 hours per week.

EPHS 230: Optical and Thermal Physics (3 credits:2-2-2)

Prerequisite: EMAT 120.

Heat and thermodynamics: Heat transfer, Kinetic theory of gases, First law of thermodynamics. Geometrical optics: Refraction of light, Prisms, Reflection of light, Lenses, Lens aberration.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

EPHS 240: Modern physics and Quantum Mechanics (3 credits:3-2-0)

Prerequisite: EMAT 231, EMAT 232
Modern physics: Plank's theory of quantization of energy of radiation, Photo-electric effect, x-rays and Compton's effect, Wave properties of matter and wave function, Principles of quantum mechanics and Schrödinger equation, Atomic structure and study of the tunnelling phenomenon. Solution of Schrödinger equations in Quantum well, quantum dot and periodic structures. Bloch function, Kronig-Penny model. Quantum theory of free electrons in metals, Statistical distribution laws. Fermi-Dirac Distribution.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 230: Electronic Technology (2 credits:2-2-0)

Clean Rooms and Clean Room Technology – Bulk Crystal growth – Epitaxial growth – Photolithography – Etching – Oxidation process – Diffusion process – Chemical vapour deposition CVD – Evaporation and multilayer coating – Ionic exchange process.
Lectures: 2 hours per week. Tutorial: 2 hours per week.

COMM 240: Computer Hardware (3 credits:3-2-0)

Computer architecture, Computer systems, Operating systems, File systems, Computer networks, Internet network, Logical design of programs, Problem solving methods, Types of programming languages, Application on a structured or visual computer programming language for solving engineering problems, Database systems and information technology and decision support systems, Computer graphics and computer systems needed for graphics and image display, Multimedia systems.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 241: Electrostatics and Magneto statics (3 credits:3-2-0)

Coulomb's law, Electric field intensity, Field of point charge, line charge, surface charge, and continuous volume charge, Electric flux, Gauss's law, Divergence, Electric energy and potential, Electric conductors, Principle of images, Electrical capacitance, Dielectric materials, Dipoles, Dielectric permittivity, Poisson's equation, Laplace's equation. Steady magnetic fields, Ampere's law, Magnetic forces, Magnetic materials, Magnetic circuits, Inductance.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 242: Electrical Circuits (3 credits:2-2-2)

Electrical circuit variables and elements, Simple resistive circuits, Analysis of electrical circuits, Source transformation, Network theorems, Star-delta transformation, Sinusoidal steady state analysis, Phasor diagram representation, Application of network theorems on alternating current circuits, Electric power in alternating current circuits, Complex power calculations, Power factor, Circuits with nonlinear resistance. Transients in electrical circuits, Mutual inductance, Resonance in electrical circuits, Electric filters, Two-port networks, Locus of phasor diagrams at variable frequency, Analysis of electrical circuits with non-sinusoidal alternating currents.
Lab: A set of Lab experiments applied to the fundamentals of electrical testing courses studied by the students in the first and second year: Electrical circuits: Applications of network theorems, Magnetically coupled circuits, Electric filters,

Transients in electrical circuits, Operation with variable frequency. Electrical measurements and measuring instruments. Calibration of ammeters, Voltmeters and watt-meters, Oscilloscopes and their applications. Electronic and logic circuits: Tests on some integrated electronic circuits and chips.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 350: Signals and Systems (4 credits:3-2-2)
Prerequisite: EMAT 240
Signals and systems: Continuous time and discrete-time signals, The unit Impulse and unit step functions, Basic system properties. Linear time-invariant systems: Discrete-time LTI systems: The convolution sum. Continuous-time LTI systems. System properties and description, Fourier series representation of periodic signals: Fourier representation of continuous time periodic signals, Fourier series representation of discrete time periodic signals, Filters described by differential equations and filters described by difference equations. The continuous-time Fourier transform and its properties, The discrete-time Fourier transform and its properties, The Z-transform, Region of convergence, The Inverse Z-transform, Properties of the Z-transform, Analysis and characterization of LTI systems using Z-transform, System function algebra, The unilateral Z-transform
Lectures: 3 hours per week. Tutorial: 2 hour per week. Lab: 2 hours per week.

COMM 351: Electronic Materials (3 credits:3-2-0)
Crystals, Bonding, Basic elements of material science, electronic conduction in metals, electron in a periodic potential, energy bands and energy gaps in solids, Semiconductors, the Fermi level, electrons and holes, Intrinsic and extrinsic semiconductors, n-type and p-type, Diffusion and Drift Current, Excess carriers in semiconductors, Optical generation and recombination, the continuity equation, non homogenous doping,
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 352: Electromagnetic Fields (3 credits:3-2-0)
Prerequisite: COMM 241
Guided waves between two conducting parallel plates, TE and TM waves and their characteristics, Velocities of propagation, Attenuation and quality factor, Wave impedance, Basic closed waveguides, TE and TM waves and their characteristics in rectangular wave guides, Waves solution in cylindrical coordinates, Micro strip transmission line, Attenuation and quality factor of a waveguide, Symmetric and asymmetric dielectric planar waveguide, effective index and normalized parameters, Hybrid modes in step index optical fibres, Propagation in multimode waveguide.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 353: Logic Design (3 credits:2-2-2)
Review on number systems, Binary number systems, Number base conversion, Octal and hexadecimal, Negative numbers, Coded number systems. Switching functions: Main operators, Postulates and theorems, Analysis and synthesis of switching functions, incompletely specified functions. Design using NAND and NOR gates. Storage devices:1-bit storage, Set-reset FF, Clocked SR-FF, Positive and negative-edge triggered SR-FF, JK-FF, Race-around condition, Master-slave JK-FF, D-FF, T-FF, Excitation table. Sequential circuits: State table and transition diagram, Design of digital systems, Incompletely specified states, Counters, Shift registers. Miscellaneous topics: Adders, Subtracters, Decoders, Coders, Multiplexer/demultiplexer, Memories (ROM, PLA, RAM).
Lectures: 2 hours per week. Tutorial: 2 hours per week, Lab: 2 hours per week.

COMM 354: Electronic Measurements (2 credits:0-0-4)

Analog Instruments, Precautions, Data converters, Digital Instruments, Testing of linear systems, Wave analyzers, Transducers, Noise effects, Electronic and communication experiments to support the theoretical aspects of the course material.
Lab: 4 hours per week.

COMM 360: Solid State Electronic Devices (3 credits:3-2-0)
Prerequisite: COMM 230
Pn-junction: I-V characteristics, Reverse saturation current depletion layer capacitance, Diffusion capacitance. Diode applications half- and full-wave rectifier, Zener diodes, Schottky barrier diodes, Light emitting diodes (LED), Bipolar junction transistor (BJT): Ebermoll model, Static and dynamics characteristics, Field effect transistors. (linear and nonlinear and pinch off regions), JFETs model and biasing. Insulated gate FETs: Types, Regions of operation, MOSFETs model and biasing. FETs applications: MOSFET as a resistance, JFET as a constant current source, Metal semiconductor contacts, MOS capacitors, Power devices, Device simulators.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 361: Electronic Circuits (3 credits:3-2-0)
Prerequisite: COMM 242
Transistor small signal models: Z-, y- and h- parameters. Analysis of audio frequency (AF) amplifiers: RC-coupled, Frequency response. AF power amplifiers: Class-A, push-pull operation (Class-A, Class-B). Operational amplifiers (OPAMPs): Difference amplifier, OPAMP specifications and frequency characteristics. OPAMP applications: Inverting, non-inverting, Adder, Subtracter, Integrator, Differentiator. Oscillators: Concept of stability and oscillations, OPAMP oscillators (rectangular, sinusoidal, Wien bridge, phase shift, and tuned circuits). Analog-to-digital (A/D) and digital-to-analog (D/A) converters.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 362: Waves and Transmission Lines (3 credits:2-2-2)
Prerequisite: COMM 352
Time varying magnetic fields, Maxwell's equations, Plane electromagnetic waves in free space, Gaussian Beams in Free space, Propagation of electromagnetic waves in matter, Reflection and refraction, Multiple reflections, Field polarization, Phase velocity and group velocity, Coaxial transmission line, Transverse Electro-Magnetic TEM Waves, Power flow on TL, Power and energy relations, Smith chart and impedance matching, Fundamentals and definitions of antennas, Dipole Antenna.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 363: Computer Architecture (3 credits:3-2-0)
Fundamentals of computer architecture and organization, Basic computer organization and design: Information format, Instruction formats. Computer instructions, Timing and control execution, Register transfer, Micro operations, Control functions, Memory organization, CPU structure and function, Processor organization, Register organization, ALU, Instruction execution cycles, Control memory, Microinstruction sequencing and execution. Bus organization: Bus timing analysis, Memory devices and systems. I/O systems. Hardware implementation of data path and memory systems: Control signalling and interrupts, Programmed I/O, interrupt priority, Bidirectional bus interfaces, Programmable peripherals devices, Interface design issues.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 410: Optoelectronic Devices (3 credits:2-2-2)
Prerequisite: COMM 351, COMM 360

interaction of radiation and atomic systems, Theory of laser oscillation: Fabry-perot laser, Oscillation frequency and output power, Some laser systems, Semiconductor laser, DC and AC characteristics, Semiconductor laser modulation, Opto-electronic semiconductor devices,, PIN and avalanche photodiodes, Applications, Optoelectronic circuit applications, External modulators, Solar cells, LCD's.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 411: Microwave Circuits (3 credits:2-2-2)
Prerequisite: COMM 362
Equivalent circuit of waveguides, N-port circuit, Circuit description, Scattering parameters, Excitation of wave guides, Waveguides coupling by aperture Passive devices: Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid junctions, resonators, micro strip circuits.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 412: Data Analysis and Algorithms (3 credits:2-2-2)
Prerequisite: COMM 353, ENGR 120
Introduction to database systems and users, Architecture for a database system, Relational model: Domain, Relations and relational integrity, SQL: The relational database language standard, Database management system and examples such as oracle and access, Database design theory and methodology. Functional dependency and normalization for relational database, Entity/Relationship model (ERM) and enhanced Entity/Relationship model (EERM), Mapping from ER-EER to relational database model, Data protection: Recovery, Concurrency, Security and integrity, Object oriented database. Advanced application in database: Multimedia databases, Distributed database and data mining, Database project: Different applications on database design and manipulation
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 420: Digital Signal Processing (3 credits:3-2-0)
Prerequisite: COMM 350, COMM 353
Digital signal convolution, Digital filter design: Finite impulse response, Infinite impulse response. Adaptive digital filters: Concepts, Algorithms, Applications.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 421: Distributed Systems (3 credits:3-2-0)
Prerequisite: COMM 363
Architecture of distributed systems, Distributed operating systems for computer networks, Distributed data bases, Distributed problem solving. Foundations of coordinated computing models: Shared variables, Exchange functions, Concurrent processes, Data flow, Communicating sequential processes, Processor management and scheduling techniques, Languages for distributed computing: ADA, examples of distributed systems
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 422: Analog Circuits (3 credits:3-2-0)
Prerequisite: COMM 360, COMM 361
Elementary transistor stages, Common source, Common gate, Source follower, feedback amplifiers, stability, root locus analysis, poles and zeros, multivibrators, pulse circuits, switched circuits.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 430: Microwave devices (3 credits:2-2-2)
Prerequisite: COMM 360, COMM 362
Microwave tubes: Reflex klystron, Traveling wave tube amplifiers, Backward wave oscillator, Magnetron oscillators, Gyratron, Microwave solid state devices: Schottky

barrier mixer diodes, Tunnel diodes, Transferred electron devices, IMPATT, TRAPATT, BARITT, Varactors. Parametric devices: Manley- Rowe relations, Parametric up converters, Negative resistance parametric amplifiers, Microwave transistors.
Lectures: 2 hours per week. Tutorial: 2 hour per week. Lab: 2 hours per week.

COMM 431: VLSI Design (3 credits:2-2-2)
Prerequisite: COMM 353
IC Processing, Fabrication of passive and active components, Process integration and standard technologies, Layout design rules, Layout parasitics, Layout techniques, Interconnect modeling, Design of basic digital IC building blocks, NMOS Inverter, NMOS and CMOS gate circuits, GaAs digital circuits, IIL, TTL, ECL gates, BiCMOS digital circuits, Memory cores: ROM, EPROM, EEPROM, Flash ROM, SRAM, DRAM, Memory peripheral Circuitry: Row and column decoders, Array structures.
Lectures: 2 hours per week. Tutorial: 2 hour per week. Lab: 2 hours per week.

COMM 432: Statistical Signal Processing (3 credits:2-2-2)
Prerequisite: EMAT 240, COMM 350
Signal Detection and Classification, Hypothesis, Testing, Detection of Signals in Noise, Detection in the Presence of Unknowns, Signal Estimation Theory, Estimation of Signal Parameters, Mean-Squared Error, Maximum-Likelihood, Bayesian, Minimax, Signal Waveform Estimation, Least Squares Estimation, Wiener and Kalman Filters, Adaptive Filtering, Iterative Minimization and Gradient Descent.
Lectures: 2 hours per week. Tutorial: 2 hour per week. Lab: 2 hours per week.

COMM 440: Antenna Engineering and Propagation (3 credits:3-2-0)
Prerequisite: COMM 360
Fundamentals and definitions, Dipoles array synthesis and antenna arrays, Line sources, Folded dipole antennas, Micro strip antennas, Broadband antennas: Traveling wave wire antennas, Helical antennas, Biconical antennas, Sleeve antennas, Rectangular and circular aperture antenna, Reflector antennas. Feeding networks for wire antennas, Arrays and reflectors, Antennas in communication systems, noise temperature, Atmospheric and ground effects.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 441: Digital Circuit Design (3 credits:3-2-0)
Prerequisite: COMM 353, COMM 361
Adders, multipliers, barrel shifters, technology scaling, interconnects, substrate and package models.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 442: Image Processing (3 credits:3-2-0)
Prerequisite: COMM 350, COMM 371
Image representation, Spatial frequency domain, Descriptions of line and shape, Perspective transformations, Projective invariant, Descriptive methods in scene analysis. Feature analysis: Pre-processing, Feature extraction. Classification: the bays classifier, Discrimination function and decision surfaces, Clustering application in image field.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 471: Digital Circuit design (3 credits:2-2-2)
Prerequisite: COMM 353, COMM 361
CMOS Inverter: Noise margin, Propagation delay, Power dissipation, CMOS combinational circuits: Static design, Pass transistors and transmission gates, Dynamic design, CMOS sequential circuits: Latches, Flip- flops, Counters,

Monostable Ring oscillator, Random Access Memory RAM, Read Only Memory ROM, Emitter Coupled Logic ECL, Bi CMOS circuits.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 473: Analog communication systems (3 credits:2-2-2)
Prerequisite: COMM 350, COMM 360
Introduction to communication systems, Analysis of amplitude modulation, Frequency modulation, Phase modulation, Pulse modulation systems, Heterodyne Radio Transmitters and receivers, AGC and AFC, TV broadcasting system, Random Processes: Stationary process, Mean, covariance and correlation functions, Ergodic process, Transmission of Random Process through Linear time invariant filter, Power spectral Density. Noise: Gaussian process and central limit theorem, white noise, Narrow band noise, Noise effect on CW modulation Systems: DSB-SC, AM envelope, FM. Baseband, Noise Figure, Signal to noise ration in Analog systems.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 474: Project Management (3 credits:3-2-0)
Project phases, project scheduling, monitoring, team work evaluation, team work skills, communication in groups, leading a group, negotiating.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 480: Organizational Behaviour (3 credits:3-2-0)
Survey of classical and contemporary organization theory, covering the behaviour of the individuals, groups, and organizations. IT components, architecture, and transformation; the effect of IT on competition; real-time enterprise; leadership; and outsourcing.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 481: Communication Networks (3 credits:3-2-0)
Introduction to telecommunication networks, Network topology, Switching: Telegraph, Telephone, Telex, Data, Signalling, ISDN, Broad band, Private switching. Management network multiplexing: Analog, Digital, Wavelength division. Data transmission interface equipment: Modems, Digital data interface equipment. Codecs: Audio, Video. Copper lines: Open wire, Twisted pair cable, Coaxial cable. Optical fibre technology: Types of optical fibres, Cables, Wavelength Division Multiplexing in optical networks, Applications, Radio relay technology, Systems. Mobile radio: Service mode technology. Satellites: Services, Technology, Digital subscriber lines
Lectures: 3 hours per week. Tutorial: 2 hour per week.

COMM 482: Control Systems (3 credits:2-2-2)
Prerequisite: COMM 350
Introduction to feedback control systems, Advantages and disadvantages of feedback, Standard test signals, Transient response, Response of first and second order systems, Properties of transient response. Stability of linear systems, The root locus method. Frequency response plots: Bode plots, Polar plots, Systems with transportation lag, Estimation of transfer functions from bode plots. Stability from frequency response: Nyquist criterion, Relative stability, the closed loop frequency response.
Lectures: 2 hours per week. Tutorial: 2 hours per week, Lab: 2 hours per week.

COMM 510: Optical Communication Systems (3 credits:3-2-0)
Prerequisite: COMM 473, COMM 481
Overview of optical fiber communications, Optical fibre power launching and coupling, Optical receiver operation, Digital and analog detectors and preamplifiers, Digital transmission systems, Point to point links, Systems considerations, Power

and rise time budgets, Analog systems, Carrier to noise ratio, Multichannel transmission techniques, Coherent optical fibber communication, WDM multiplexing, Optical amplifiers.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 511: Wireless and Mobile Communications (3 credits:3-2-0)
Prerequisite: COMM 473, COMM 481
Basic concepts of mobile communications, Cell site planning, Traffic engineering, RF propagation characteristics, Fading and Path loss phenomena, Noise in cellular systems, Frequency planning, Frequency reuse, Types of interference. GSM system, Multiple access techniques, GSM architecture, TDMA frame structure, Types of bursts, Mapping of logical channels on physical channels, Bit interleaving, Modulation, Frequency hopping, Power control, Carrier and burst synchronization, CDMA spread spectrum systems, Types of codes and power control in CDMA.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 512: CAD for Digital Circuit Design (3 credits:3-2-0)
Prerequisite: ENGR 120, COMM 353
Delay models, simulated annealing, Logic synthesis, placement, routing, delay models
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 513: Multimedia Engineering (3 credits:3-2-0)
Prerequisite: COMM 350
Speech coders: Speech signal analysis, Waveform coders, Voice coders, Hybrid coders. Voice over IP techniques, Video Encoding, MPEG, Video Over IP,
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 520: Network Security (3 credits:3-2-0)
Prerequisite: COMM 350, COMM 481
Overview of computer and network security and methods of defence, Secure encryption systems (symmetric and public key encryption schemes, AES (advanced encryption standard), RSA standard, Security protocols (key distribution, authentication, and digital signature schemes, Software security (protection from viruses and similar programs, design of secure operating systems, database security), Network security (IP security and the IPSec protocol, firewalls, web security, electronic mail security, network management security aspects).
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 521: Acoustics (3 credits:3-2-0)
Prerequisite: COMM 350
Parameters and definitions, Acoustic wave propagation in free space, Acoustic Impedance, Acoustic transmitters and receivers, Speech analysis, Biomedical Applications.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 522: Analog Integrated Circuit Design (3 credits:3-2-0)
Prerequisite: COMM 361, COMM 422
Introduction to analog VLSI, device modeling – basic analog building blocks (current mirrors, common- source, common- drain, common- gate, cascode- differential pair), Frequency response, Stability and frequency compensation, Operational amplifiers (basic, two-stage, Miller, symmetrical, telescopic, folded, cascode), Noise, Voltage and current references.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 523: Satellite Communications (3 credits:3-2-0)
Prerequisite: COMM 473

Communication satellite system, Orbiting satellites, The satellite channel, Link calculation, Satellite electronics, Frequency division multiple access, Time division multiple access and code division multiple access, On board processing.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 530 Integrated Optics and Optical MEMS (3 credits:3-2-0)
Prerequisite: ENGR 230, COMM 360
Symmetric and asymmetric single mode dielectric waveguide, 2D waveguide and the effective index method, propagation in Multimode guide, the Multimode interference MMI structures, Integrated optics IO splitters and directional couplers, IO filters and multiplexers, MEMS technology, Micro-mirrors and micro-lenses, Optical MEMS switches, Fibre lens, Variable optical attenuators, Multilayer filter design, Tuneable MEMS filters.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 531: Audio and Video Encoding (3 credits:3-2-0)
Prerequisite: COMM 350
The creation of digital music and audio. Digital image formation and representation; filtering, enhancement and restoration; edge detection; discrete image transforms; encoding and compression; segmentation; recognition and interpretation; 3D imagery.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 532: Microwave Measurements (3 credits:3-2-0)
Prerequisite: COMM 430
Detection and measurement of microwave power, Impedance measurements, frequency and wavelength measurements. N-port microwave network analyzer, Calibration techniques.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 533: RF Circuit Design (3 credits:3-2-0)
Prerequisite: COMM 361, COMM 422
RF transceivers, Noise figure, harmonic distortion, Low Noise Amplifiers, Mixers, LC Oscillators, phase noise, RF frequency synthesis, RF Power Amplifiers (class A, class B, class C, class AB), Integration artifacts.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 590: Digital Communications (3 credits:2-2-2)
Prerequisite: COMM 473
Sampling Process, Pulse amplitude Modulation, Quantization Process, Quantization noise, Pulse Code modulation, time division Multiplexing. Digital multiplexers, Pulse. Transmission: Line Codes, Equalizers, Filter, probability of Errors in baseband, Intersymbol Interference, Nyquist criterion for distortionless baseband transmission, Raised Cosine spectrum. M-Ary Probability of error, Regenerative repeaters, Eye Pattern, Power spectrum of pulse amplitude modulation. Signal space analysis, correlation receiver. Passband data transmission, BPSK, QPSK, QPSK, Pe, Spectrum, generation. M-ary PSK, Hybrid Amplitude-phase modulation, Coherent Frequency shift keying, M-Ary FSK, Noncoherent binary FSK. Differential phase shift Keying, Multiple a Spread Spectrum techniques.
Lectures: 2 hours per week. Tutorial: 2 hours per week. Lab: 2 hours per week.

COMM 591: Computer Networks (3 credits:3-2-0)
Prerequisite: COMM 482
Introduction to computer networks, Network architecture, ISO/OSI reference model, TCP/IP model, Examples of networks, Network topology, Physical layer, Data communication networks, Telephone system, Integrated services digital network,

Asynchronous transfer mode, Data link layer design issues, Error handling, Elementary data link protocols, Medium access control protocols, Local area networks, Carrier sense multiple access with collision detection protocol, Ethernet like local area networks, High speed local area networks.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 592: Quality Engineering (3 credits:3-2-0)
Strategic quality planning, quality in design and processes, tools for quality improvement and control, standards, and total quality management.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 593: Project (1) (3 credits:1-0-4)
A single or group project performed under the supervision of a faculty member and an industrial entity
Lectures: 1 hour per week. Lab: 4 hours per week.

COMM 594: Project (II) (6 credits)
A single or group project performed under the supervision of a faculty member and an industrial entity
Lectures: 2 hour per week. Lab: 12 hours per week.

COMM 595: Information Theory and Coding (3 credits:3-2-0)
Prerequisite: COMM 350, COMM 471
Introduction: Uncertainty, Information, Entropy and its properties. Source coding: Shannon coding Prefix coding, First Shannon theorem, Huffman coding, discrete memoryless channels, Binary symmetric channel, Mutual information and its properties. Channel capacity, Channel coding, Second Shannon theorem, Mutual information. Channel capacity, Compression of information. Linear block codes, Cyclic codes, Well-Known Block codes, Convolution codes: Code tree, Trellis and state diagram, Maximum likelihood decoding of convolution codes.
Lectures: 3 hours per week. Tutorial: 2 hours per week.

COMM 596: Industrial Accounting (3 credits:3-2-0)
Introduction to accounting concepts and the operating characteristics of accounting systems. The principles of financial and cost accounting, design of accounting systems, techniques of analysis, and cost control. Interpretation and use of accounting information for decision making.
Lectures: 3 hours per week. Tutorial: 2 hours per week

COMM 597: Introduction to Decision Analysis (3 credits:3-2-0)
Distinctions, possibilities and probabilities, relevance, value of information and experimentation, relevance and decision diagrams, risk attitude. What makes a good decision, how decisions can be made better, framing and structuring techniques, modeling and analysis tools, biases and probability assessment, evaluation and appraisal methods, and effective presentation styles.
Lectures: 3 hours per week. Tutorial: 2 hours per week.