4th Year Even Semester

ETE 400: Project and Thesis
Credits: 1.50 Contact Hours: 3 Hours/Week
A detailed theoretical study of some problems in Telecommunications. This may be of investigative research nature or it may be laboratory research oriented. The report may be purely economic, technical or both and may include the comparative study of different choices for the solution of the problems.

ETE 415: Radio and TV Engg.
Credits: 3.00 Contact Hours: 3 Hours/Week
Introduction to radio communication, History, Frequency management. Design of radio transmitter and receiver circuits using scattering-parameter methods. Circuits include oscillators, radio frequency amplifiers and matching networks, mixers and detectors. Design of amplitude, frequency, and pulse-modulated communication systems, including modulators, detectors, and the effects of noise.
Television: Introduction, principle of operation, transmitter and receiver, Receiving and transmitting antenna. Camera tube, Picture tube, Electron beam scanning, T-lines, balun, duplexer, Vestigial side-band filters. Introduction to 58
color TV, VCR, CCTV, CATV, MATV, TV Booster.

ETE 416: Sessional Based on ETE 415
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Radio and TV Engg. (ETE 415)

ETE 417: Fiber Optic Communication
Credits: 3.00 Contact Hours: 3 Hours/Week
Characteristics of optical transmission media, optical fibres - preparation and transmission characteristics, loss and dispersion mechanisms, optical sources - principles of operation, modulation characteristics and driver circuits, photo detectors – principles of operation, circuits and performance, post detection amplifiers, fibre optic communication systems and link budget using direct detection, fibre optic connectors, couplers, multiplexers and splices, wavelength converters, routers, optical amplifiers, coherent and WDM systems.

ETE 418: Sessional Based on ETE 417
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Fiber Optic Communication (ETE 417)

ETE 419: Satellite Communication and Radar
Credits: 3.00 Contact Hours: 3 Hours/Week
Satellite :
Introduction to Satellite Communication : Overview of Satellite System Engineering.
Spacecraft, Introduction, to Spacecraft Subsystem. (AOCS), Telemetry, Tracking and command (TT&C). Spacecraft Antennas, Basic Antenna Types and Relationships Spacecraft, Antennas in Practice, Frequency Reuse

Equipment Reliability and Space Qualification, Reliability redundancy.
Multiple Access

Earth station Technology. : Earth Station Design. Earth Station Design for Low System Noise Temperature. Large Earth Station Antennas. Satellite Television Broadcasting Networks, VSAT technology.

RADAR :
Introduction to Radar, Radar Equation CZ, Operating Principle of Radar with Block Diagram, CW and FM Radar, Tracking Radar, Antennas for Radar, Radar Receivers, Radar Transmitting System, Duplexer, Usable Frequencies for Radar, Radar Applications.

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ELECTIVE COURSES
ETE 407: Adaptive Filters
Credits: 3.00 Contact Hours: 3 Hours/Week
Basics of minimum mean-square and least-squares estimation. Lattice orthogonalization. Stochastic gradient adaptive filters: derivations, performance analyses and variations. Recursive least-squares adaptive filters: fast algorithms, least-squares lattice filters, numerical issues, and performance comparisons with stochastic gradient adaptive filters. Adaptive IIR filters. Fundamentals of adaptive nonlinear filtering. Selected applications.

ETE 409: Random Signal Processing
Credits: 3.00 Contact Hours: 3 Hours/Week
Probability and random variables. Distribution and density functions and conditional probability. Expectation: moments and characteristic functions. Transformation of a random variable. Vector random variables. Joint distribution and density. Independence. Sums of random variables. Random Processes. Correlation functions. Process measurements. Gaussian and Poisson random processes. Noise models. Stationary and Ergodicity. Spectral Estimation. Correlation and power spectrum. Cross spectral densities. Response of linear systems to random inputs. Introduction to discrete time processes, Mean-square error estimation, Detection and linear filtering.

ETE 423: Radio Wave Propagation
Credits: 3.00 Contact Hours: 3 Hours/Week
The effects of the earth and its atmosphere on the propagation of electromagnetic waves at radio frequencies: ground waves, sky waves, ducting, reflection, refraction, diffraction, scattering, attenuation, and fading. Determination of the transmission loss between transmitting and receiving antennas.

ETE 427: Neural and Fuzzy Systems in Communications
Credits: 3.00 Contact Hours: 3 Hours/Week
Introduction: Human Brain Mechanism, Neural Machine Intelligence. Neural Dynamics: Activation and Signals, Activation Models, Synaptic Dynamics: Learning Strategies, Single and Multilayer Perception, Kohonen's SOM, Hopfield Network, Associative Memory, Vector Quantization, Adaptive

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Resonance Theory (ART), Boltzman Machine. Equilibrium of Learning

System. Concept of Neuro-Fuzzy and Neuro-GA Network.
Fuzziness Vs. Probability, Fuzzy Associative Memory, Comparison of Fuzzy and Neural Backerupper Control Systems, Fuzzy Image Transform Coding, Comparison of Fuzzy and Filter, Target Tracking Control Systems. *Genetic* Algorithm: Basic Concepts, Offspring, Encoding, Reproduction, Crossover, Mutation Operator, Application of GA.

ETE 429: Spread Spectrum and CDMA Technology
Credits: 3.00 Contact Hours: 3 Hours/Week
Spread spectrum communication systems including direct-sequence; multicarrier, and frequency hopped spread spectrum, pseudo-random sequences, code acquisition and tracking; CDMA, multi-user detection; RAKE receivers, and CDMA standards.

ETE 435: Discrete Mathematics
Credits: 3.00 Contact Hours: 3 Hours/Week
Sets and its operations, Relations: relations and their properties, n-ary relations, Partial Ordering, lattice. Logic: logic, propositional equivalence, predicate and Quantifiers. Function: function, growth of a function, sequences and summations. Properties of integers: introduction, algorithm of division and multiplication, primes, GCD, LCM, Euclidean algorithm, congruence relation. Mathematical reasoning: proof techniques, induction, recursive definitions and algorithms.
Graph theory: Graph, Paths, Trees .Counting and Advanced counting Techniques: permutations and combinations, pigeonhole principle, generating functions. Algebraic Systems: Introduction, operations, Semi-groups, Groups, Rings and Fields. Introduction to language and grammars.

ETE 441: Graph Theory
Credits: 3.00 Contact Hours: 3 Hours/Week
Fundamental concepts; eulerian graphs; adjacency and incidence matrices; trees; planar graphs; graph embeddings; connectivity; hamiltonian graphs; matchings; factorization; graphs and groups; Cayley color graphs; line graphs; the Reconstruction Problem; spectra of graphs; graph and map colorings; extremal graph theory; ramsey theory.

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ETE 431: Statistical Theory of Communication
Credits: 3.00 Contact Hours: 3 Hours/Week
Concepts of probability and random process theory necessary for advanced study of communications, stochastic control and other electrical engineering problems involving uncertainty; applications to elementary detection and estimation problems.

ETE 421: Microwave Devices
Credits: 3.00 Contact Hours: 3 Hours/Week
Microwave tubes: Klystron amplifier- two cavity – multi cavity – description – operating characteristics – performance characteristics – pulse modulation – bandwidth, Travelling wave tube amplifier – construction – operation- crossed field amplifier – grid controlled tube, Magnetron oscillator- conventional magnetron –coaxial magnetron – mode jumping- frequency pushing and

pulling – performance chart and rieke diagram.

ETE 422: Sessional Based on ETE 421

Credit: 0.75 Contact Hours: 1.50 Hours/Week

Laboratory based on Microwave Devices (ETE 421)

ETE 425: Microwave Solid State Devices

Credits: 3.00 Contact Hours: 3 Hours/Week

Microwave transistors, tunnel diodes and FETs.

Transferred electron devices: Gunn effects, RWH theory, LSA diodes, InP diodes CdTe diodes and their applications in microwave generation and amplification.

Avalanche transit time devices: IMPATT diodes, TRAPATT diodes, BARITT diodes and Parametric devices.

ETE 426: Sessional Based on ETE 425

Credit: 0.75 Contact Hours: 1.50 Hours/Week

Laboratory based on Microwave Solid State Devices (ETE 425)

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ETE 433: Numerical Techniques in Electromagnetics

Credits: 3.00 Contact Hours: 3 Hours/Week

The numerical solution of electromagnetic problems using Method of moments (MoM). Finite Deference (FD) method, Finite Deference Time Domain (FDTD) method, Transmission Line Method (TLM), Finite Element method (FEM). Application of RF CAD software's.

ETE 434: Sessional Based on ETE 433

Credit: 0.75 Contact Hours: 1.50 Hours/Week

Laboratory based on Numerical Techniques in Electromagnetic (ETE 433)

ETE 443: Multimedia Communication

Credits: 3.00 Contact Hours: 3 Hours/Week

Media and data streams. Medium properties of multimedia system.

Basic sound concepts, Music, MIDI devices and standards, Speech generation, Speech analysis and transmission. Image manipulation and storage: File formats for BMP, GIF, TIFF, JPEG, MPEG-II etc. Introduction to animation techniques. Multimedia applications: Tele conferencing, Virtual reality and others.

ETE 444: Sessional Based on ETE 443

Credit: 0.75 Contact Hours: 1.50 Hours/Week

Laboratory based on Multimedia Communication (ETE 443)

ETE 445: Digital Filter Design

Credits: 3.00 Contact Hours: 3 Hours/Week

Introduction to digital signal processing. Discrete time signals, linear systems. Z-transform, H- transform. Frequency domain representation of discrete time systems and signals, discrete Fourier series and discrete Fourier transform (DFT), Convolution and Correlation, computation of the DFT.

Signal flow graph representation of digital networks. Tellegen's theorem. Digital filters: IIR and FIR filters, filter design. Digital signal processors.

Probability and stochastic process, a discrete- time random process, spectrum representation of infinite energy signals, response of linear systems to random

signal. Adaptation algorithm, all-zero and lattice adaptive filters, application of adaptive filtering. Model-based signal processing.

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ETE 446: Sessional Based on ETE 445
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Digital Filter Design (ETE 445)

ETE 447: Digital Image Processing
Credits: 3.00 Contact Hours: 3 Hours/Week
Basic Image Processing Systems: Image Sources, Characteristics, Image Representation, Hardware and Software Requirements.
Two-dimensional systems: Properties of two Dimensional Sequences and Systems, 2D Fourier Transform, 2D Z-Transform, 2D Sampling Theory. Image Quantization, Image Perception, Quality Measures.
Image Transforms: 2D DFT, 2D DCT, Sine transform, Hadamard, Slant and KL Transforms.
Image Compression Algorithms: Pixel Coding-PCM, Run Length Coding, Predictive Technique DPCM, Transform Coding-DCT, Vector Quantization, VQ in Image Coding, Wavelet Based Compression, Interframe Coding, Standards for Image Compression-JPEG, MPEG.
Image Segmentation: Feature Extraction, Edge Detection, Boundary Extraction, Region Representation, Moment Representation, Shape Features, Scene Matching Image Segmentation, Classification Techniques Supervised and Nonsupervised Learning.
Image Enhancement and Restoration: Point Operations, Histogram Modeling, Spatial Operations, Transform Operations, Image Filtering and Restoration, De blurring Colour Image Processing.
Application in Character Recognition, Biomedical Imaging, Remote Sensing, Digital TV and Multimedia.

ETE 448: Sessional Based on ETE 447
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Digital Image Processing (ETE 447)

ETE 449: Digital Speech Processing
Credits: 3.00 Contact Hours: 3 Hours/Week
Application of digital signal processing to speech signals. Acoustic and aeroacoustic theories of speech production leading to linear and nonlinear timefrequency models. Speech analysis-synthesis based on spectrogram, linear prediction, homomorphic, filter bank, and AM/FM sinusoidal representations.

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Extensions to wavelet, auditory-like, and other multiresolution analysis. Waveform and model-based speech coding using scalar and vector quantization. Time-scale and pitch modification; speech restoration; speaker separation; pitch estimation; and speaker recognition. Application to music analysis-synthesis.

ETE 450: Sessional Based on ETE 449
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Digital Speech Processing (ETE 449)

ETE 451: Voice Communication Techniques
Credits: 3.00 Contact Hours: 3 Hours/Week
Fundamentals of speech processing. The acoustic theory of speech signals. Short-time Fourier analysis. Analysis-synthesis systems; the phase and channel vocoder. Homomorphic speech processing; the complex cepstrum of speech; pitch detection; and format estimation. Linear predictive coding of speech. Synthesis of speech from linear predictive parameters. Speech recognition systems. Man-machine communication by voice. Voice entry systems to integrated digital networks.

ETE 452: Sessional Based on ETE 451
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Voice Communication Techniques (ETE 451)

ETE 453: Microprocessor Based System Design
Credits: 3.00 Contact Hours: 3 Hours/Week
Interface design and programming, A speech synthesizer interface, Parallel printer interface, Interfacing Keyboards, Interfacing microcomputer ports to high power devices, LCD interfacing, D/A converter operation and interfacing to microcomputer. A/D converter operation and interfacing. 8086 based process control system. Microcontroller and interfacing. Interfacing with IBM PC bus. Using a logic analyzer to trouble-shoot a microcomputer system.

ETE 454: Sessional Based on ETE 453
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Microprocessor Based System Design (ETE 453)
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ETE 455: Industrial Drives
Credits: 3.00 Contact Hours: 3 Hours/Week
Motor load dynamics, starting, braking and speed control of dc and ac motors. DC drives: converter and chopper control. AC Drives: Operation of induction and synchronous motors from voltage and current inverters, slip power recovery, pump drives using ac line controllers and self controlled synchronous motor drives.

ETE 456: Sessional Based on ETE 455
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Industrial Drives (ETE 455)

ETE 457: Electronic Instrumentation
Credits: 3.00 Contact Hours: 3 Hours/Week
Introduction: Classification of variables and analogies- Generalized approach to a measuring system- Performance characteristics of instruments- Analysis of errors- Units.
Passive transducers- Active transducers- Resistive, Inductive, Capacitive types, Electromagnetic, Thermo electric, Photovoltaic and piezoelectric transducers and digital transducers. Theory of LED, LCD, LCD EPID display devices and applications. Transducer bridges- Instrumentation amplifiers.
Signal generators: Block schematics and principles of operation of audio generators- Function generators- Pulse generators- RF generators and Frequency synthesizers. Frequency counters- Periodic counters, counting

errors, digital voltmeters, auto ranging, Digital LCR meters. Power meters: Block schematic and principles of operation of AF power meter, RF power meter, Microwave power meter, VSWR meter, measurement using above. The cathode ray tube deflection amplifier, wave form display, oscilloscope time base, automatic time base, dual trace oscilloscope, dual beam & split beam CRTs. Oscilloscope controls, measurement of voltage, frequency and phase. Lissajous figures. Pulse measurement- Oscilloscope probe. Digital Oscilloscope. A/D Conversion, storage, digital memory, D/A conversion, Recovery from memory and digital oscilloscopes. Principles of operation of spectrum analyzers, logic state analyzers.

ETE 458: Sessional Based on ETE 457
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Electronic Instrumentation (ETE 457)

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ETE 459: Optoelectronics
Credits: 3.00 Contact Hours: 3 Hours/Week
Light: Nature of light, Polarization, superposition, interference, diffraction, sources, blackbody radiation.
Modulation of Light: Elliptical polarization, Birefringence, quarter wave plate, optical activity, electro-optic effect, Kerr modulators, scanning and switching, magneto-optic devices, acousto-optical effect, nonlinear optics.
Display Devices: Luminescence, photoluminescence, cathodoluminescent, LED materials, LED construction, response time, plasma displays, LCD, numerical display.
Lasers: Emission and absorption, Einstein relation, optical feedback, laser losses, line shape function, modes, classes of laser, laser applications, distance measurements, holography.
Photo Detectors: Thermal detectors, photon devices, vacuum photodiodes, Noise, Image intensifier, junction detectors, detector arrays.
Optical Communication System: Fiber optic communication, integrated optics.
Non-communication Applications: Optical fiber sensors, Light guiding fiber.
ETE 460: Sessional Based on ETE 459
Credit: 0.75 Contact Hours: 1.50 Hours/Week
Laboratory based on Optoelectronics (ETE 459)