

TS 2220	Introduction to Circuits and Electronics	3 credits
---------	------------------------------------------	-----------

Prerequisite:	CT 1201 Physics
---------------	-----------------

Fundamental principles of electric circuits, practical electronics, digital logic and instrumentation systems; measurement of circuit phenomena, construction of amplifiers and filters, logic circuits, D/A and A/D converters and the use of sensors and transducers.

TS 2220	Introduction to Circuits and Electronics Laboratory	1 credits
---------	-----------------------------------------------------	-----------

Prerequisite :	CT 1201 Physics
----------------	-----------------

This course covers measurements of voltage, current, resistance, power, and transient response; applications of Ohm's law; series and parallel DC circuits; voltage divider circuits; Kirchoff's voltage and current laws; superposition and network theorems; Thevenin's and Norton's theorems; maximum power transfer; resistors, inductors, and capacitors in an AC circuits; R-L, R-C, R-L-C in series and in parallel in AC circuits; low, high, and band-pass filter circuits; transistor characteristics; NOT, AND, OR, NAND, NOR, and XOR logic gates with diodes and transistors.

TS 2240	Communication Signal and Systems	3 credits
---------	----------------------------------	-----------

Prerequisite:	ST 2102 Calculus II
---------------	---------------------

To study about signal and noise in communication model and its application to differentiate signals and types of various communication systems. Fourier analysis. Frequency and time domain. Stochastic processes in modulation theory and various types of transmission media i.e. radio wave, optical fiber, laser, microwave, and satellite communication.

TS 2240	Communication Signal and Systems Laboratory	1 credits
---------	---------------------------------------------	-----------

Prerequisite:	ST 2102 Calculus II
---------------	---------------------

This course covers measurements and computational experiments of continuous- and discrete-time signals and systems in time and frequency domains, analysis of signals utilizing the Fourier transform and the Laplace transform; continuous and discrete convolutions in analog and digital filters; system design is also included in this course

to provide the general concepts on causality and stability in designing linear time-invariant systems.

TS 3230	Telecommunications System and Technology	3 Credits
Prerequisite:	IT2231 Information Technology	

Telecommunication system, radio transmission and cable transmission. Voice, video and digital switching for cable communication. Radio and television broadcasting. Point connecting and multipoint distributing. Tape recording, video text display and satellite broadcasting.

TS 3231	Switching and Signaling Systems	3 Credits
Prerequisite:	TS 3230 Telecommunication System and Technology	

To present the principles and history of the public switched telephone network. The course describes signaling and the Intelligent Network, and how they inter-operate to provide telephone service, it compares switching paradigms and the evolving infrastructure, and it discusses the future of telephony.

TS 3250	Analog Communications	3 Credits
Prerequisite:	TS 2240 Communication Signal and Systems	

Frequency domain and time domain response of linear systems; analog modulation methods including amplitude modulation, frequency modulation and phase modulation; signal and noise modeling using probabilistic descriptions; narrow band random processes and the performance of analog modulation techniques in the presence of noise; design of communication links.

TS 3251	Digital Communications	3 Credits
Prerequisite:	ST 2102 Calculus II	

Sample and time-division multiplexing baseband digital signals and systems. Coded pulse modulation, error control coding, digital modulation systems, information measure and source encoding, introduction to spread spectrum communications.

TS 3251	Digital Communications Laboratory	1 Credits
Prerequisite:	ST 2102 Calculus II	

This course covers measurements and computational experiments of pulse code modulation and digital modulation; the effect of noise on digital modulation signals and performance evaluation of digital modulation techniques based on bit error rate vs. signal-to-noise ratio graphs; introductory experiments on error-control coding and decoding; digital multiple-access techniques.

TS 3253	Computer Networks and Open Systems	3 Credits
Prerequisite:	IT 2231 Information Technology	

Layers in ISO-OSI model. Study of various network media and topologies. Protocol basics. Discussion of prevailing network types, standards and routing protocols. Comparison of network connectivity devices, repeaters, bridges, routers, gateways. Inter-operability issues and open system standards.

TS 3259	Probability and Queuing Theory	3 Credits
Prerequisites:	ST 2102 Calculus I and ST 2203 Probability and Statistical Interferences	

An overview of queuing theory. Queuing system, relate random processes, classification of queue. Priority queuing. Computer time sharing and multi-access systems.

TS 3338	Cryptography and Data Security	3 Credits
Prerequisites: ST 2102 Calculus II and ST 2203 Probability and Statistical Interferences		

A rigorous introduction to modern cryptography. Emphasis on fundamental cryptographic primitives of public key encryption, digital signatures, authentication, identification, pseudo-random number generation.

TS 3357	Computer Application in Telecommunications	3 Credits
Prerequisite: TS 3230 Telecommunication System and Technology		

Telecommunications applications for computer hardware and software. Includes consideration of human factors, policy and application in consumer, business and research sectors of telecommunications industry.

TS 4232	Economics in Telecommunications Systems	3 Credits
---------	-----------------------------------------	-----------

Inventory concepts, asset amortization. Liabilities. Consolidated statements, cost accounting. Capital budgeting, investment decisions.

TS 4233	Telecommunications Policy, Law, Regulation and Standard	3 Credits
---------	---------------------------------------------------------	-----------

Systematic interdisciplinary analysis of major public and private telecommunications policies applying tenets from law, political science, economics, communication, general social science and technology. Domestic and international regulation.

TS 4252	Satellite Communication Systems	3 Credits
Prerequisite: TS 3230 Telecommunication System and Technology		

Study basic satellite communication, structure of satellite, equipment and elements of earth and space station. Orbital ring of communication satellite; Design of transmitting and receiving of communication signal with satellite; signal efficiency; propagation delay of signal and interference of noise; Decoding and recovering the signal; example of various types of communication satellite.

TS 4299	Senior Projects	3 Credits
Prerequisite: fourth-year student status with at least 100 credits completed		

Students must do a specific project in which they will apply knowledge they have studied to design and develop as well as to conduct research in telecommunications system. Students must apply their analytical skills, decision making based on scientific methodology and creativity in developing telecommunications projects. The instructors will advise them throughout the project development. The students must have oral examination on their projects.

TS 4335	Network Management and Controls	3 Credits
Prerequisite: TS 3253 Computer Networks and Open System		

Standard-based protocols for the management of telecommunications networks, including the simple network management protocol and the common management information protocol. Extensions of present protocols to optimize network performance.

TS 4336	Operation Research	3 Credits
Prerequisite:	ST 2102 Calculus II	

The linear programming problem and its dual; the simplex method; transportation and warehouse problems; computer algorithms and applications to various fields. Optimization theory. Integer programming; Pert (CPM), non-linear programming; dynamic programming; game theory.

TS 4353	Voice and Data Integration	3 Credits
Prerequisite:	TS 3230 Telecommunication System and Technology	

Method for data transmission and switching over Wide Area Network telecommunications facilities. Alternate voice digitization techniques. Structure and evolution of the digital telecommunications network.

TS 4355	Multimedia for Communications	3 Credits
Prerequisite:	TS 3230 Telecommunication System and Technology	

Study of basic idea, theory, practical uses of multimedia for conveying information through telecommunications, network. Transmission of sound, image, animation, video data. Comparison of availability and restrictions of current technologies and products.

TS 4356	Network Design and Analysis	3 Credits
Prerequisite:	TS 3253 Computer Networks and Open System	

Description of various LAN types. Study of media and medium access control methods. Analysis of user requirements and restrictions. Comparison of different network topologies and technologies. Inter-connectivity issues among different types of LAN. Conceptualization and evaluation of designing.

TS 4357	Cellular Mobile Systems	3 Credits
Prerequisite:	TS 3230 Telecommunication System and Technology	

Introduction to cellular mobile radio systems. Propagation effects and spectral considerations. Cellular mobile systems technologies. Cellular network architecture. Cellular radio technology

TS 4358	Basic Internetworking Technique	3 credits
Prerequisite:	Junior and Senior Students	

A study of the functions of each layer of the OSI reference model, MAC address, IP address, and TCP/IP protocols. The fundamentals of network design, connection-oriented and connectionless network, flow control, multi-layer protocols, and routing protocols are discussed.

TS 4359	Advanced Internetworking Techniques	3 credits
Prerequisite:	TS 4358 Basic Internetworking Technique	

A study of advanced networking applications from basic to broadband on LANs, Fast Ethernet and WANs Internet-working with bridges, routers, and switches, spanning tree protocol. Fundamentals of virtual LANs, Frame Relay and ATM networks are discussed.

TS 4361	Internetworking Workshop I	3 Credits
---------	----------------------------	-----------

To introduce the fundamental knowledge in networking. Study the functions of each layer of the OSI reference model. The fundamental of connection-oriented and connectionless network, flow control, routing protocols, multi-layer protocols including network design. To provide basic practical knowledge in router configuration.

TS 4362	Internetworking Workshop II	3 Credits
Pre-requisite:	TS4361 Internetworking Workshop I	

Study of advanced networking application from basic to broadband on LANs, Fast Ethernet and WANs. Internetworking with bridges, switches, and routers. Introduction to security in networking. Fundamental of virtual LANs, Frame Relay, ISDN and ATM network. To provide advanced practical knowledge in router configuration.

TS 4363	Optical Fiber Communications	3 Credits
Pre-requisite:	CT1201 Physics	

Introduction to optical communication systems. Optical fibers: step and graded index, multi-mode and single-mode fibers, attenuation and dispersion. Fiber cables. Connectors, splices and couplers. Optical sources: LED and laser. Optical transmitters. Optical detectors: PIN and APD, optical receivers. Noise in optical fiber communication systems. Digital optical fiber systems: BER performance. Digital optical fiber link design. High-speed optical networks (FDDI, SONET/SDH)

TS 4364	Wireless Communication Systems	3 Credits
Pre-requisite:	None	

Various aspects of physical layer and medium access design for wireless communications systems. Topics include wireless signal propagation and channel modeling, single carrier and spread spectrum modulation for wireless systems, diversity techniques, multiple-access schemes, dynamic resource allocation, handoff and mobility management, channel assignment and packet radio network.

TS 4365	Antenna Systems and Design	3 Credits
Pre-requisite:	TS4368 Introduction to Electromagnetic Field	

Basic properties of transmitting and receiving antennas. Antenna parameters; polarization of electromagnetic waves; basic antenna types; antenna arrays; adaptive antenna; broadband antenna design; and antenna measurements.

TS 4366	Information Theory and Coding	3 Credits
---------	-------------------------------	-----------

Introduction to basic principles and fundamental concept in information theory in the context of digital communication system. Topics include source coding and channel coding for reliable transmission of digital information, basic compression and error-control coding technique.

TS 4367	Introduction to Simulation for Telecommunications System	3 Credits
Pre-requisite:	TS3259 Probability and Queuing Theory	

Introduction to methods of computer simulation and computer modeling. Design and simulation of telecommunications system with simulation software.

TS4368	Introduction to Electromagnetic Field	3 Credits
Pre-requisite:	ST 2102 Calculus II	

Introduction to electric and magnetic fields, electric charge and current, Maxwell's equation, wave equations and characteristics of waves in various media. Study the principles of antenna and guided wave.

TS 4369	Wireless Communication Systems Laboratory	1 Credits
Pre-requisite:	None	

This course covers measurements and computational experiments of wireless networks; physical and data link layers of wireless networks; bit error rate performance of modulation techniques for wireless communications; implementation of OFDM in wireless networks; packet analysis and throughput calculations in wireless networks; multi-hop connectivity of ad hoc networks.

TS 4370	Performance Evaluation of Telecommunication Systems	3 Credits
Pre-requisite:	ST2203 Probability and Statistical Interference	

Performance measurement and tools, workload characterization, Markov models, Queuing theory, simulation used to evaluate telecommunications system, benchmarks for testing telecommunication networks, data analysis, systems performance analysis.

TS 4379	Seminar in Information and Communication Technology	2 Credits
Pre-requisite:	Fourth-year student and by consent of instructor	

To build professional skills in the use of ICT, develop an understanding of the principles of problem solving using ICT and of the range of applications of ICT and the effects of their use and to apply this understanding when developing ICT solutions to problems. To develop an understanding of the entrepreneurship, regarding to various applications in ICT. Seminar is also focusing on the advancement in telecommunication and ICT research that may affect information society. Experts in specialized areas from governmental or private sectors are invited to lecture on specialized topics. Since ICT is a growing and rapidly changing, this course will allow investigation into topics at the forefront of the discipline.

TS 4380-7	Selected Topics	3 Credits
Prerequisite:	Senior Student.	

Special topics that the department and instructors think appropriate for students further development in study and research.

TS 4390	Seminar in Telecommunications	3 Credits
Prerequisite:	Senior Student.	

Seminar in the advancement of Telecommunications science or new researches that may affect Telecommunications theory. There may be experts in specialized areas from governmental or private sectors lecturing on specialized topics. Students may be organized into groups for special activities on interesting topics.