Department of Electrical Engineering

The department of Electrical Engineering offers the following programs:

1. Graduate Diplomas

1.1 Specialized Graduate Diploma in Electrical Power and Machines Engineering

The student must complete 30 credit hours.
Compulsory courses: The student must pass six courses with a total of 18 credit hours from the list of diploma courses in Electrical Power and Machines (BB=15).
Elective courses: The student can choose the remaining credit hours from any other courses that are specified as "Diploma courses"

2. Master Degrees

2.1 Master of Engineering in Electrical Engineering (Electronics and Communications)

The student must complete 30 credit hours in the form of courses and an additional 3 credit hours in the form of a scientific report.
Compulsory courses: The student must pass six courses with a sum of 18 credit hours from the list of Master courses in Electronics and Communications (BB=14).
Elective courses: The student can choose the remaining credit hours from any other courses that are specified as "Master courses". The student is allowed to choose 2 courses from another major.

2.2 Master of Engineering in Electrical Engineering (Electrical Power and Machines)

The student must complete 30 credit hours in the form of courses and an additional 3 credit hours in the form of a scientific report.
Compulsory courses: The student must pass six courses with a sum of 18 credit hours from the list of Master courses in Electrical Power and Machines (BB=15).
Elective courses: The student can choose the remaining credit hours from any other courses that are specified as "Master courses". The student is allowed to choose 2 courses from another major.

2.3 Master of Science in Electrical Engineering (Electronics and Communications)

The student must complete 24 credit hours in the form of courses and an additional 8 credit hours in the form of a thesis.

Compulsory courses: The student must pass six courses with a sum of 18 credit hours from the list of Master courses in Electronics and Communications (BB=14).

Elective courses: The student can choose the remaining credit hours from any other courses that are specified as "Master courses". The student is allowed to choose 2 courses from another major.

2.4 Master of Science in Electrical Engineering (Electrical Power and Machines)

The student must complete 24 credit hours in the form of courses and an additional 8 credit hours in the form of a thesis.

Compulsory courses: The student must pass six courses with a sum of 18 credit hours from the list of Master courses in Electrical Power and Machines (BB=15).

Elective courses: The student can choose the remaining credit hours from any other courses that are specified as "Master courses". The student is allowed to choose 2 courses from another major.

3. Doctor of Philosophy- Ph.D. Degree

3.1 Ph.D. in Electrical Engineering (Electronics and Communications)

The student must complete 18 credit hours in the form of courses and an additional 24 credit hours in the form of a dissertation.

The student can choose his/her courses from courses that are specified as "Doctoral courses". The student is allowed to choose 3 courses from another major.

3.2 Ph.D. in Electrical Engineering (Electrical Power and Machines)

The student must complete 18 credit hours in the form of courses and an additional 24 credit hours in the form of a dissertation.

The student can choose his/her courses from courses that are specified as "Ph.D. courses". The student is allowed to choose 3 courses from another major.

List of Diploma, Master and Ph.D. courses

No.	Course Code	Course Name	Credit hours	Exam Duration	Pre-requisites
1.	07 14 610	Computer Networks	3	3	
2.	07 14 611	Introduction to Digital Signal Processing	3	3	
3.	07 14 612	Introduction to Statistical Communications and Information Theory	3	3	
4.	07 14 631	Propagation of Electromagnetic Waves	3	3	
5.	07 14 632	Wave Propagation in the Earth's Atmosphere	3	3	
6.	07 14 660	Stochastic Systems	3	3	
7.	07 14 664	Mobile Communications	3	3	
8.	07 14 667	Digital Telephony and Switching Engineering	3	3	
9.	07 14 670	Principles of Pulse and Timing Circuits	3	3	
10.	07 14 671	Advanced Analog Integrated Circuits	3	3	
11.	07 14 672	Electrical and Magnetic Properties of Solids	3	3	
12.	07 14 673	Advanced Digital Integrated Circuits	3	3	
13.	07 14 674	Analog MOS Integrated Circuits	3	3	
14.	07 14 675	Advanced IC Processing and Layout	3	3	
15.	07 14 676	Computer-Aided Design of Integrated Circuits	3	3	
16.	07 14 677	Microwave Measurements	3	3	
17.	07 14 678	Communications Electronics	3	3	
18.	07 14 680	Electro-Optics and Lasers	3	3	
19.	07 14 690	Optical WDM Networks	3	3	
20.	07 15 611	Electrical Power Engineering	3	3	
21.	07 15 612	Design of Electrical Power Systems and Their Equipment	3	3	
22.	07 15 613	International Standards and Technical Specification of Electrical Power Equipment	3	3	

23.	07 15 614	Computer Applications in Electrical Power Engineering	3	3	
24.	07 15 615	Protection of Electrical Power Systems	3	3	
25.	07 15 620	Automatic Control	3	3	
26.	07 15 621	Linear Control Systems	3	3	
27.	07 15 622	Digital Control Systems	3	3	
28.	07 15 623	Programmable Logic Control	3	3	
29.	07 15 624	Applications of Microprocessors in Control and Instrumentation	3	3	
30.	07 15 625	Systems Identification	3	3	
31.	07 15 626	Control Methods Used in Electrical Systems	3	3	
32.	07 15 627	International Standards and Technical Specification for Control and Measuring Equipment	3	3	
33.	07 15 628	Digital Control Fundamentals	3	3	
34.	07 15 631	Electrical Machines & Automatic Control	3	3	
35.	07 15 632	Advanced Electrical Machines	3	3	
36.	07 15 641	Industrial Electronics (a)	3	3	
37.	07 15 651	Electrical Drives	3	3	
38.	07 15 652	Solid State Drives	3	3	
39.	07 15 653	International Standards and Technical Specification for Drive Equipment	3	3	
40.	07 14 710	Signal Detection	3	3	
41.	07 14 711	Teletraffic Engineering	3	3	
42.	07 14 712	Digital Signal Processing Architecture and Circuits	3	3	
43.	07 14 713	Adaptive Signal Processing	3	3	
44.	07 14 714	Fast Algorithms for Signal Processing	3	3	
45.	07 14 715	Image Processing	3	3	
46.	07 14 730	Numerical Methods for Electromagnetic Fields	3	3	
47.	07 14 731	Numerical Methods for Antennas	3	3	
48.	07 14 732	Electromagnetics	3	3	
49.	07 14 735	Wave Propagation in Biological Media	3	3	

50.	07 14 736	Microwave Antennas	3	3	
51.	07 14 737	Wave Propagation Theory	3	3	
52.	07 14 738	Antenna Arrays Theory	3	3	
53.	07 14 739	Advanced Electromagnetic Field Theory	3	3	
54.	07 14 740	Biomedical Instrumentation	3	3	
55.	07 14 741	Medical Imaging Systems	3	3	
56.	07 14 751	Acoustical Devices and Applications	3	3	
57.	07 14 760	Coding Theory	3	3	
58.	07 14 761	Digital Communication Theory	3	3	
59.	07 14 762	Spread Spectrum Communications	3	3	
60.	07 14 770	Quantum Mechanics	3	3	
61.	07 14 771	Quantum and Optical Electronics	3	3	
62.	07 14 772	Solid State Electronics	3	3	
63.	07 14 773	Super-conductive Devices and Circuits	3	3	
64.	07 14 774	Circuit Theory and Computer-Aided Analysis	3	3	
65.	07 14 775	Characterization and Computer Modeling of Semiconductor Devices	3	3	
66.	07 14 777	Solid States Devices	3	3	
67.	07 14 778	Solid State Microwave Circuits and Devices	3	3	
68.	07 14 780	Optical and Opt. Electronic Devices	3	3	
69.	07 14 810	Special Topics in Signal Processing	3	3	
70.	07 14 811	High Resolution Image Processing	3	3	
71.	07 14 820	Smart Antennas and MIMO Techniques	3	3	
72.	07 14 841	Advanced VLSI Design	3	3	
73.	07 14 842	Radio Frequency Integrated Circuit (RFIC) Technology and Design	3	3	
74.	07 14 843	Software Radios: Modern Radio Engineering	3	3	
75.	07 14 844	Advanced DSP & Filter Design	3	3	
76.	07 14 861	Advanced Wireless Communications	3	3	
77.	07 14 862	Special Topics in Communication Engineering	3	3	
78.	07 14 863	Optical Access Networks	3	3	
79.	07 14 864	Advanced Optical Communications Systems	3	3	

80.	07 14 870	Semiconductor Materials	3	3	
81.	07 14 871	Semiconductor Devices	3	3	
82.	07 14 881	Elementary Number Theory	3	3	
83.	07 14 882	Cryptography and Network Security	3	3	
84.	07 14 891	Nanotechnologies	3	3	
85.	07 15 711	Special Topics in Power System Engineering	3	3	
86.	07 15 712	New Topics in Power Systems Control	3	3	
87.	07 15 713	Renewable Energy Sources	3	3	
88.	07 15 714	Sustainable Energy Utilization	3	3	
89.	07 15 715	Smart Grids	3	3	
90.	07 15 717	Electrical Materials	3	3	
91.	07 15 720	Linear Control Systems	3	3	
92.	07 15 721	Non-Linear Control Systems	3	3	
93.	07 15 722	Digital Control Systems	3	3	
94.	07 15 723	Optimal Control Systems	3	3	
95.	07 15 724	Advanced Course in Control	3	3	
96.	07 15 725	Adaptive Systems and Identification Techniques	3	3	
97.	07 15 726	Control Systems Design and Simulation	3	3	
98.	07 15 728	Neural Networks	3	3	
99.	07 15 731	General Theory of Electrical Machines	3	3	
100.	07 15 732	Special Types of Electrical Machines	3	3	
101.	07 15 733	Dynamic and Simulation of Electrical Machines	3	3	
102.	07 15 741	Industrial Electronics (B)	3	3	
103.	07 15 751	Solid State Drives	3	3	
104.	07 15 752	Control of AC Drives	3	3	
105.	07 15 753	Microprocessor Control of Electric Drives	3	3	
106.	07 15 754	Digital and Logic Circuits for Solid State Drives	3	3	
107.	07 15 761	Selected Topics in Electrical Measurements	3	3	
108.	07 15 762	Phasor Measurement Units and Applications	3	3	
109.	07 15 771	Application of Mathematical	3	3	

		Methods in Electrical Engineering			
110.	07 15 811	Power System Analysis	3	3	
111.	07 15 812	Power System Planning	3	3	
112.	07 15 813	Optimal Operation of Power Systems	3	3	
113.	07 15 814	Transients in Power Systems	3	3	
114.	07 15 815	High Voltage Engineering	3	3	
115.	07 15 816	Static and Digital Protection Relays	3	3	
116.	07 15 818	Advanced Electrical Engineering Materials and Applications	3	3	
117.	07 15 819	Renewable Energy Utilization	3	3	
118.	07 15 820	Advanced Topics in Control of Electrical Systems	3	3	
119.	07 15 821	Advanced Course in Linear Control	3	3	
120.	07 15 822	Advanced Course in Nonlinear Control	3	3	
121.	07 15 823	Digital Control Systems	3	3	
122.	07 15 824	Optimal Control Techniques	3	3	
123.	07 15 825	Identification Methods and Adaptive Systems	3	3	
124.	07 15 826	Neural Network Control Systems	3	3	
125.	07 15 827	Artificial Intelligence and Applications	3	3	
126.	07 15 828	Fuzzy Control Systems and Applications	3	3	
127.	07 15 834	New Trends in Electrical Machines	3	3	
128.	07 15 835	Dynamic Modeling of Electrical Machines	3	3	
129.	07 15 841	Power Electronic Interface of Renewable Energy Sources	3	3	
130.	07 15 842	Design for Power Electronic Converters	3	3	
131.	07 15 843	Power Electronic-Based Control of Electric Power Systems	3	3	
132.	07 15 844	Advanced Industrial Automation	3	3	
133.	07 15 845	Advanced Industrial Electronics	3	3	
134.	07 15 846	Active Harmonic Filtering	3	3	
135.	07 15 891	High Voltage DC Transmission	3	3	
136.	07 15 601	Diploma Project in Power Engineering and Electrical Machines	3	Presentation	
137.	07 15 701	Scientific Report for Master of	3	Defense	

		Engineering (Electrical Machines and Power Engineering)			
138.	07 14 701	Scientific Report for Master of Engineering (Electronics and Communications)	3	Defense	
139.	07 15 705	M.Sc. Thesis in Electrical Engineering (Electrical Machines and Power Engineering)	8	Defense	
140.	07 14 705	M.Sc. Thesis in Electrical Engineering (Electronics and Communications)	8	Defense	
141.	07 15 801	Ph. D. Dissertation in Electrical Engineering (Electrical Machines and Power Engineering)	24	Defense	
142.	07 14 801	Ph. D. Dissertation in Electrical Engineering (Electronics and Communications)	24	Defense	

Description of Courses for Graduate Programs (Diploma- Master- Doctor of Philosophy)

07 14 610 Computer Networks

Architectures and protocols. Objective of computer networks, computer structure and components, switching techniques, network functions, layered network architectures, data link protocols, network control, transport and session protocols, presentation layer protocols. Specific examples and standard protocols are cited for point-to-point, satellite, packet radio, and local area networks.

07 14 611 Introduction to Digital Signal Processing

Discrete-time signals and systems. Z-transform. Discrete Fourier transform and Fast Fourier transform. Digital filter and implementation. Quantization affects. Random signal processing. Correlation canceling, prediction autoregressive processes. Two-dimensional signal processing. Nonlinear processing techniques. Spectrum estimation computer implementation of some of the considered techniques.

07 14 612 Introduction to Statistical Communications and Information Theory

Random processes and spectral densities, random signals through linear and nonlinear systems. Wide-sense stationary process and filtering, white noise, non-Gaussian

distributions. The concepts of source, channel, and rate of transmission of information. Entropy, mutual information, and channel capacity. Source coding. Rate distortion theory. Noisy channels; the coding theorem for finite state memory less channels. Markov chains. Applications.

07 14 631 Propagation of Electromagnetic Waves
Basic electromagnetic theory. Uniqueness theorem and boundary conditions. Electromagnetic potentials and Hertz vectors. Wave equation in different kinds of media including inhomogeneous, an isotropic and time varying. Plane wave in lossy dielectric media. Reflection and transmission. Surface waves. Propagation in ionized media. Propagation in layered media.

07 14 660 Stochastic Systems
Mathematics of control and estimation. Optimal filtering and prediction. Parameter estimation for stochastic dynamic systems. Control of stochastic systems. Filter design synthesis. RC active networks.

07 14 664 Mobile Communications
Introduction to cellular mobile systems, frequency reuse. Mobile radio environment. Signal propagation in urban and suburban environment. Models for path loss. Rayleigh fading and lognormal shadowing. Co-channel interference reduction. Mobile communication protocols. Messaging and capacity. Spread-spectrum and CDMA. Paging.

07 14 667 Digital Telephony and Switching
Network hierarchy. Voice digitization. Different types of speech coding. Standard CCITT regulations. Circuit switching. Space-division switching. Time-division switching. Packet switching. Fast packet switching. Different protocols. Performance analysis of switched systems.

07 14 670 Principles of Pulse and Timing Circuits
Switching, timing, wave shaping, and logic circuits to generate the diversity of waveform and functions used in pulse systems, instrumentation, and computers. Emphasis on techniques of analysis and obtaining appropriate circuit models for solid state devices and IC's in these highly nonlinear circuits.

07 14 671 Advanced Analog Integrated Circuits
Analysis and design of bipolar analog IC's emphasizing quantitative study of circuit performance, figure of merit, limitations, and recent techniques for optimization. Linear IC's, operational amplifiers, wide-band, high frequency and low noise amplifiers; quasi-

linear circuits for signal processing multipliers and trans linear circuits, phase locked loops.

07 14 672 Electrical and Magnetic Properties of Solids

Electrical and magnetic properties of solids from a fundamental point of view. Introduction to band theory, surface states, dielectric and ferromagnetic materials, magnetic materials, ferrites ferromagnetism, and superconductivity.

07 14 673 Advanced Digital Integrated Circuits

Analysis and design of MOS and bipolar large-scale integrated circuits at the circuit level. Fabrication processes, device characteristics, parasitic effects and dynamic digital circuits for logic and memory functions. Calculation of speed and power consumption from layout and fabrication parameters, ROM, RAM, EPROM circuits design. Use of SPICE and other computer aids.

07 14 674 Analog MOS Integrated Circuits

Fundamentals of analog MOS integrated circuit design. Small-signal device and circuits models. Design of amplifiers, analog switches, sample and hold circuits, comparators and voltage reference. Analog subsystems, including A/D and D/A converters and switched capacitor filters.

07 14 675 Advanced IC Processing and Layout

In depth treatment of device structures, fabrication technologies and circuit design issues in Integrated circuits Optical, X-ray and e-beam lithograph, in implementation, oxidation and diffusion. Thin film deposition. Wet and dry etching and ion milling. Effect of phase and defect equilibria on process control.

07 14 676 Computer-Aided Design of Integrated Circuits

This course covers a wide variety of topics relating to the development of computer aids for integrated circuit design. It will emphasize the state-of the-art techniques and both the theoretical basis for the methods as well as the application of results to practical problems, including details of implementation. Topics to be covered include simulation, layout techniques, synthesis, verification, testing, and integrated design systems.

07 14 677 Microwave Measurements

Manual and automatic microwave network analyzer measurements. Power, power spectrum, and noise measurements. Characterization of devices and systems. Special topics will include design and construction of microwave devices, RCS and antenna measurements, micro strip measurements, and microwave circuit measurements. Laboratory experiments dealing with the above topics.

07 14 678 Communications Electronics
General electronic circuitry used in communication systems. Mixers, up & down converters, PLL, filter design, attenuators, phase shifters, Hilbert transformers, hybrids. Carrier and clock recovery circuits. Pulse and timing circuits. Signal processing circuits.

07 14 680 Electro-Optics and Lasers
Propagation of laser beams: Gaussian wave optics and the ABCD law. Crystal properties and the dielectric tensor. Electro optic effects and devices. Acousto-optic diffraction and devices. Introduction to nonlinear optics: coupled mode theory and second harmonic generation. Phase matching. Laser resonators, eigen modes, and stability analysis. Rate equation analysis. Homogeneous and inhomogeneous broadening mechanisms. Laser gain and gain saturation. Q-switching and mode locking. Special topics: laser pulse compression, Raman and Brillouin scattering, phase conjugation.

07 14 690 Optical WDM Networks
Review on light sources, light detectors, optical fibers, WDM concepts and components: operational principles of WDM, spectral width and optical bandwidth, implementation of WDM networks, design challenges. WDM multiplexers: 2 x 2 fiber coupler, star couplers, Mach-Zehnder interferometer multiplexers, diffraction gratings, fiber bragg gratings, waveguide grating router (WGR). Tunable optical filters: tunable fiber fabry-perot filters, tunable mach-zehnder interferometers, tunable multi-grating filters, acoustooptic tunable filter. Single-hop WDMA optical networking: broadcast-and-select WDMA networks, wavelength-routing WDMA networks, transmission protocols, fixed and semi-fixed assignment protocols. Random access protocols with no pre-transmission coordination: random access protocols with slotted aloha, protection against collision. Random access protocols with pre-transmission coordination: Aloha/Aloha protocol, slotted Aloha/Aloha protocol, Aloha/CSMA protocol, CSMA/Aloha protocol.

07 15 611 Electrical Power Engineering
High voltage technology. Insulation coordination. Distribution and power transformers; applications and testing. Power capacitors. Grounding of power systems; methods and devices.

07 15 612 Design of Electrical Power Systems and Their Equipment
Development in power equipment and related international standards, its specification and testing. Design of complete power systems applying computer aided design and use of modern power equipment.

07 15 613 International Standards and Technical Specification of Electrical Power Equipment

Covering the international standards e.g. IEC standards regarding the main specifications, testing, inspection and commissioning of power equipment.

07 15 614 Computer Applications in Electrical Power Engineering

Computer techniques for solving power engineering problems. The use of computer packages. Applications of numerical methods in power engineering.

07 15 615 Protection of Electrical Power Systems

Special types of electromagnetic relays. Back up protection system stability and out of step relaying. Reclosing and synchronizing. Protection of complete power systems. Relays coordination and tripping plans. Testing and calibration of relays. Tripping circuits and auxiliary relays. Commissioning tests of protection systems.

07 15 620 Automatic control

Review of linear systems classical methods of analysis. State space representation. Controllability and observability. Controller design. Observers. Introduction to digital system. State space representation of digital systems.

07 15 621 Linear Control Systems

Revision of single i/p single o/p systems. Multi i/p multi o/p systems. Controllability and observability of multi i/p multi o/p systems. Application to the design of optimal controllers. Stability of linear systems using different techniques.

07 15 622 Digital Control Systems

Revision of system analysis. Design using Z transformation. Static space discrete model. Controllability. Observability of discrete data control systems. Design of digital controllers. Stability of digital systems using different techniques.

07 15 623 Programmable Logic Control

Introduction on closed loop control systems as analog controllers. On/off controllers. Proportional, integral, derivative, and PID controllers. Digital controllers. Examples of industrial systems. Programmable controllers as industrial controllers. General characteristics and system layout. Operational procedures. Direct and digital logic. Addresses and registers timers and counters. Discrete functions. The sequencer analog operation. Loop and PID control. Sensing for PLC.

07 15 624 Applications of Microprocessors in Control & Instrumentation

Microprocessor interfacing; definitions, interfacing layers, interfacing considerations, bus interfacing; synchronous and asynchronous. Memory and peripheral interfacing; memory mapped and PIO. Analog interfacing to microprocessors. Analog-to-digital converters. (approach, method, applications). Digital-to-analog converters; approach, methods, applications. Interfacing A/D and D/A converters. Configurations of microprocessor based control and instrumentation systems.

07 15 625 Systems Identifications

Statistical and optimization fundamentals. Parameter tracking in self-optimizing systems. Impulse response identification. Parameter estimation with statistics. Parameter estimation without a priori statistics. Distributed parameter estimation. Frequency response estimation. Identification via inverse Laplace transform. Experimental methods. Luenberger optimal observer.

07 15 626 Control Methods used in Electrical Systems

Introduction to identification of electrical systems. The suitable system model. Conventional controllers. Hardware to generate sum and difference data, electrical methods, mechanical methods. Development of complete systems and construction of schematic diagrams. Examples of position control systems. Speed control systems. Voltage and frequency control systems. Programmable controllers. Interfacing techniques.

07 15 627 International Standards and Technical Specification of Electrical Power Equipment

Covering the international standards e.g. IEC standards regarding the main specifications, testing, inspection and commissioning of power equipment.

07 15 628 Digital Control Fundamentals

The digital computer in feedback control sampling. Z transforms. Digital filters. Discretization of continuous compensation. Discrete compensation design. Quantization errors. State variable design of digital controllers and observes. Laboratory experimental work to power systems. Modern nonlinear control of synchronous machines.

07 15 631 Electrical Machines & Automatic Control

D-Q model of synchronous machines. Per unit system. Simulation of synchronous machine. Linear models. Excitation systems. Effect of excitation on stability. Multi machines systems. Automatic voltage regulators. Excitation control.

07 15 632 Advanced Electrical Machines

Basic concepts of energy conversion. Electromagnetic fields in electrical machines. Special types of electrical machines (linear types, stepper motors, PM motors, and pole mixed type). Self-excited generators (stand-alone type).

07 15 641 Industrial Electronics (a)
Inverters (voltage and current commutated inverters). Methods of harmonic reduction. Cycloconverter. Four quadrant chopper. Firing circuits.

07 15 651 Electrical Drives
Concept and classification of electrical drives. Dynamics of electrical drives. Types of loads steady state and transient. Stability. Speed control of AC and DC motors. Starting of electric motors. Electric braking of electric motors. Rating and heating of motors. Load cycles. Thermal rating.

07 15 652 Solid State Drives
Four quadrant DC converters. Analysis of separately excited DC machine using speed. Current feedback loops. Slip energy recovery systems (constant torque, constant power systems). Soft starters for AC squirrel cage machines.

07 15 653 International Standards and Technical Specification for Drive Equipment
Covering the international standards e.g. IEC standards regarding the main specifications, testing, inspection and commissioning of electrical machines and drive equipment.

07 14 710 Signal Detection
Binary decisions. Bayes and Neymann-Pearson criteria. Reduction of uncertainty. Grahm-Schmitt orthogonalization. Likelihood ratios and detection criteria. Generalized matched filters. Wiener and Kalman filters. Optimum detectors. Signal parameter estimations. Applications in radar and communication systems.

07 14 711 Teletraffic Engineering
Elements of tele-traffic theory. Traffic units and variations. Dimensioning. Statistical description; traffic distributions, availability. Loss and delay systems. Loss system overflow. Grading. Link systems. Routing networks. Composite delay systems. Over-loading sensitivity.

07 14 712 Digital Signal Processing Architecture and Circuits
The architecture system design and hardware implementation real time signal processors and digital filters processing operations including the discrete Fourier transform. Discrete convolution. Cosine transform. Hartley transform and the estimation of power spectra.

Applications in speech processing; image processing, communication, sonar, and radar signal processing.

07 14 713 Adaptive Signal Processing
Theory and applications of adaptive filtering in system and signal processing. Iterative methods of optimization and their convergence properties; transversal filters; LMS algorithms. Adaptive Kalman filtering and least-squares algorithms. Applications to detection, noise canceling, speech processing. Computer implementations of some of the considered techniques.

07 14 714 Fast Algorithms for Signal Processing
Fast algorithms for short convolutions and the discrete Fourier transform. Number theoretic transforms. Multi-dimensional transforms and convolutions. Filter architectures. Computer implementations of some of the considered algorithms.

07 14 715 Image Processing
Theory and application of digital image processing. Multi dimensional signal processing. Random, quantization, image compression, enhancement, restoration, segmentation, shape description, reconstruction of pictures from their projections, pattern recognition.

07 14 730 Numerical Methods for Electromagnetic Fields
Mathematical methods in electrostatics. The canonical forms of partial differential equations. Finite difference approximations. Boundary and initial value problems. Interpolation and approximation. Finite element methods. Method of moments and applications. Computer implementations of some of the considered numerical methods.

07 14 731 Numerical Methods for Antennas
Numerical techniques for antennas - Solution of integral equations. Method of moments. Conjugate gradient, Fast Fourier Transform and finite element boundary integral methods. High frequency methods. Applications including planar antennas; strip dipoles and patches, arrays, apertures antenna synthesis and design. Computer implementations of some of the considered numerical methods.

07 14 732 Electromagnetic
Boundary value problems. Approximate solution. Analytical solution of boundary value problems. Electric fields and currents. Static and quasi-static magnetic fields. Interaction of charged particles with electric and magnetic fields. Special methods in field analysis. Applications.

07 14 735 Wave Propagation in Biological Media

Medical terminology. Dielectric behavior of biological molecules. Measurement of the electrical constants of the human body. Radiative signals in human body. Microwave components used for human body.

07 14 736 Microwave Antennas

Equivalence principle and radiation potentials. Uniform and non-uniform illuminated apertures. Horn antennas. Curved surface reflector antennas; paraboloid, spherical surfaces, shaped paraboloid and doubly curved surface reflector antennas. Ray optic methods and asymptotic techniques. Lens antennas. Micro strip antennas. Laboratory measurements of the parameters of some of the considered antennas.

07 14 737 Wave Propagation Theory

Wave propagation in an isotropic media; double refraction; ferrite, magnetized plasma media. Wave propagation in inhomogeneous media. Asymptotic and ray techniques; WKB method. Pulse propagation in dispersive media. Optimum design of signals for propagation in dispersive and inhomogeneous media. Scattering principles; scattering cross section, scattering from perfect conducting spheres and cylinders.

07 14 738 Antenna Arrays Theory

Linear and planar uniform arrays. Circular and elliptical arrays. Non-uniformly fed arrays. Array synthesis techniques. Phased arrays. Omni directional arrays. Adaptive arrays and beam forming. Random arrays and aperture thinning. Signal processing arrays.

07 14 739 Advanced Electromagnetic Field Theory

Guided waves, plane, cylindrical, spherical. Radiation, scattering and identification as boundary value problems. Introduction to tensor analysis. Propagation in multi-stream ionized and isotropic media. Propagation in moving media. Relativistic effects. Propagation in inhomogeneous and random media.

07 14 740 Biomedical Instrumentation

Nuclear Magnetic Resonance imaging and blood flow measurement principles. State-of-the-art techniques in medical instrumentation to measure parameters of direct clinical significance, NMR, electron spin resonance, viscosity determinations. Measurement and analysis of biopotentials and biomedical transducer characteristics; electrical safety, operational amplifiers for signal processing and computer interfacing. Signal analysis and display on the laboratory minicomputer.

07 14 741 Medical Imaging Systems

Basic modalities used for imaging internal structures within the volume of the body from a systems viewpoint: x-ray radiography, computerized tomography, magnetic resonance,

nuclear medicine, and ultrasound. Analysis of exciting proposed systems in terms of resolution, modulation transfer function, detection sensitivity, noise ability to visualize disease processes, arid potential for improving diagnosis.

07 14 751 Acoustical Devices and Applications

Electro acoustical transducers; definitions, analysis of different models, piezoelectric transducers, SAW devices and applications, acoustical filters, acoustical resonators, acoustical radiators. Beam forming methods, applications communication systems, applications in ultrasonic imaging.

07 14 760 Coding Theory

Introduction to variety of source coding techniques such as quantization, block quantization; and differential, predictive, transform and tree coding. Introduction to rate distortion theory. Channel coding; linear, cyclic, convolution and trellis coding. Encoding and decoding algorithms. Performance evaluation for s on a variety of communication channels.

07 14 761 Digital Communication Theory

Optimum receivers in Gaussian noise, maximum likelihood detection. Fundamental limits in coding and modulation, capacity and cutoff rates. Block, convolution and trellis coding. Continuous phase modulation. Viterbi detection. Coding for channels with interference, combined equalization and coding. Filtered channels and inter-symbol interference equalization. Fading channels.

07 14 762 Spread Spectrum Communications

Introduction to direct sequence, frequency hopping, chirp and hybrid systems. Processing gain. Interference and jamming signals. Bit error rate performance. Pseudo-noise generation. Synchronization and tracking techniques for DS and FH. Division multiple access. Applications in military, satellite, indoor wireless and fading channels.

07 14 770 Quantum Mechanics

Introduction to the methods of quantum mechanics with applications to atomic, molecular, solid state, nuclear and elementary practice physics.

07 14 771 Quantum and Optical Electronics

The laser principles; analysis of specific laser systems such as gas lasers, semiconductor lasers, and other solid-state lasers; laser dynamics, noise phenomena, nonlinear optics, guided wave optics, selected applications of coherent optics.

07 14 772 Solid State Electronics

Crystals structure and symmetries. Energy-band theory Cyclotron resonance. Tensor effective mass. Statistics of electronics state population. Recombination theory. Carrier transport theory. Interface properties. Optical processes and properties.

07 14 773 Superconductive Devices and Circuits
Introduction to superconductivity. Electron pairing. BCS and Ginzburg-Landu theories. Single-particle and Josephson tunneling. Electrodynamics of superconductors and Josephson junctions. Proximity effect. Mixed state in type II superconductors. Thin film. Applications in analog and digital circuits. Fabrication technology.

07 14 774 Circuit Theory and Computer-Aided Analysis
Device modeling formulation of network equations. Casualty, reciprocity, losslessness, passivity, stability, gain-bandwidth. Algorithms for computing linear, piecewise linear, And nonlinear resistive and dynamic circuits. Sparse materials. Explicit, implicit and stiff integration formulas and circuit interpretations. Sensitivity analysis. Nonlinear distortion.

07 14 775 Characterization and Computer Modeling of Semiconductor Devices
Computer simulation techniques for integrated circuit process and device modeling, such as bipolar current gain and MOS threshold voltage. Use of computer packages.

07 14 777 Solid States Devices
Physical principles and operational characteristics of semiconductor devices. Mechanics of carrier transport in solids and at interfaces, high field and hot carrier effect. Advanced discussion of bipolar and field-effect transistors with emphasis on the behavior dictated by present and probable future technologies.

07 14 778 Solid State Microwave Circuits and Devices
General properties of nonlinear solid-state microwave circuits. Negative resistance oscillators and amplifiers. Frequency converters and resistive mixers. Transistor amplifiers S-parameters design, power combiners and harmonic generators. Laboratory investigation of the properties of some of the considered circuits and devices.

07 14 780 Optical and Opt. Electronic Devices
Visible and infrared photo detectors, including PIN and avalanche photodiodes, photon counting devices and image intensifiers. Imaging detectors; including vidicons and Charge Coupled Devices. Display devices. Semiconductor lasers, acousto-optic, electro-optics and wave guide modulators; nonlinear optics, including second harmonic generation and optical bistability.

07 14 810 Special Topics in Signal Processing

This course introduces recent research topics in the area of signal processing algorithm design. Due to the continuous and the fast development nature in the area, the course mainly targets recent research papers in the field. This includes but not limited to the following topics: numerical linear algebra, convex optimization, inverse problems and regularization techniques, integer programming and relaxation methods, sparse signal representations.

07 14 811 High Resolution Image Processing

The fusion of low resolution images to obtain a high resolution image is a very exciting and challenging image processing technique. It has many applications such as remote sensing, medical imaging, pattern recognition and person identification. The course will cover: image processing techniques, image compression and interpolation techniques, image fusion techniques, applications to remote sensing and medical imaging. The uses of some modern signal processing techniques such as the wavelet transform and evolutionary algorithms will be considered.

07 14 820 Smart Antennas and MIMO Techniques

Smart antennas and multi-input-multi-output (MIMO) antennae systems are among the main techniques used in3G and 4Gmodern wireless communication systems. In addition to increasing the capacity and improving the spectral efficiency, these systems also provide good solutions to the mitigation of interference and multi-path fading effects. The course will cover: antenna array and diversity principals, adaptive array techniques, interference cancellation, direction of arrival (DOA) estimation, MIMO principles, space-time coding (STC), advances approaches for smart antenna design including evolutionary algorithms and artificial intelligence, spread spectrum CDMA and OFDM based smart antenna and MIMO systems.

07 14 841 Advanced VLSI Design

Advanced concepts in CMOS-based digital system design are studied. The topics include implementation of special purpose structures for complex digital systems, automation and verification of the design process, and design for testability; and design techniques for low-power design, power dissipation estimation, and application of low-power techniques in the different levels of the design hierarchy.

07 14 842 Radio Frequency Integrated Circuit (RFIC) Technology and Design

Integrated circuit (IC) implementation of RF circuits for wireless communications applications. Transceiver architectures for current wireless communications standards; active/passive device technologies for RFIC implementations; low noise amplifiers; mixers; frequency sources; power amplifiers; single-chip radios; and RFIC packaging and testing. Case studies of modern RFIC chip sets for current wireless communications standards are examined. The course involves circuit design at the IC level; modern

RF/microwave CAD software will be used in conjunction with the course. Design of a wireless transceiver functional block component RFIC chip.

07 14 843 Software Radios: Modern Radio Engineering
An introduction to software radios, devices that can be programmed to work with a variety of different radios. The course will cover the following topics: software radio architectures, existing software radio efforts, a review of basic principles, an analysis of receiver operation.

07 14 844 Advanced DSP & Filter Design
Advanced analysis, design, and realization of digital filters. Efficient Discrete Fourier Transform algorithm implementations, finite wordlength arithmetic, fixed point implementation, limit cycles, noise shaping, decimation and interpolation, multi-rate digital filter design, Hilbert transformers, analytic signal generation, basic adaptive filtering.

07 14 861 Advanced Wireless Communications
Cellular networks, fading and interference problems, signal detection of un-coded transmission over a narrowband fading channel, basic information theory of wireless channels, channel capacity, multiple access over fading channels ,orthogonal frequency division multiple access (OFDM), opportunistic communication and space-time multiple antenna communication, multi-input multi-output (MIMO) systems and multiuser detection.

07 14 862 Special Topics in Communication Engineering
New trends in Communication Engineering

07 14 863 Optical Access Networks
The course starts with an introduction to various access network technologies including DSL, cable networks and fiber-to-the-home (FTTH) networks. The advantages of FTTH using a passive optical network (PON) infrastructure as well as the different PON standards are addressed. The requirements and challenges of the different multiple-access techniques for PONs are also studied extensively. Finally, different next generation PON solutions are covered through state of the art PON research.

07 14 864 Advanced Optical Communications Systems
Introduction to optical communication systems; evolution of lightwave systems; components of a lightwave system; WDM systems; basic WDM multiplexers; advanced lightwave systems; receiver noise and direct detection; optical SNR; electrical SNR; receiver sensitivity and Q factor; coherent detection; demodulation schemes; signal propagation in fibers; impact of nonlinear effects; optical amplifiers; noise in optical

amplifiers; periodically amplified lightwave systems; OFDM principles; optical OFDM systems; various types of optical OFDM; signal propagation in fibers; dispersion impairments; MIMO-OFDM perspective.

07 14 870 Semiconductor Materials
Basics of statistical mechanics and applications. Fundamentals of wave mechanics with some applications to microwave devices. Crystallography and specific types related to semiconductors. One and 3-dimensional band structure. The effect on phonon-photon, phonon-electron, photon-electron interaction. Cases of electron-electron ,photon-photon and phonon-phonon interactions. Hole and conduction electron concept in semiconductors. Mobility and diffusion concepts and their relation.

07 14 871 Semiconductor Devices
Diffusion and drift in a p-n junction. Equation of continuity and built-in voltage under no bias. Solution under forward and reverse bias. D.C. and small signal A.C. case. Equivalent circuit: diffusion capacitance and switching. Breakdown types in the junction. Bipolar transistor current-voltage equations under d.c. and small signal a.c. Approximate equivalent circuit. Junction field effect transistor, thyristor, silicon controlled rectifier, switching diode, and tunnel diode. Types of field effect transistor with p-n channel and short channel. Selected topics in microwave semiconductor devices.

07 14 881 Elementary Number Theory
Integers. Numbers. Sequences. Sums. Induction computer representation. Prime number. Euclidean Algorithm. Factorization. Chinese Reminder Theorem. Application. Wilson, Fermat and Euler's Theorems. Cryptology. Primitive Roots. Order of integer. Pseudorandom integers. Quadratic residues.

07 14 882 Cryptography and Network Security
Character ciphers. Block and stream ciphers. Exponential ciphers. Public. Key Cryptography Knapsack ciphers. Application and Algamal ciphers key cryptography. The RSA and Algamal ciphers. Data encryption standard. Advanced encryption standard. Applications.

07 14 891 Nanotechnologies
Introduction to nanotechnology (importance and challenges, concepts and scopes, types of nanostructures). Fabrication of nanostructures (nanoparticles sensitization, Layer-by-Layer (LbL) self-assembly, E-beam evaporation, Spin coating, Focused Ion Beam (FIB), Atomic force microscopy (AFM) for nanografting and nanolithography. Beam lithography, electro-spinning, Physical Vapor Deposition (PVD), Chemical Vapor Deposition (CVD). Atomic Layer Deposition (ALD). Characterization of nanostructures (optical techniques, imaging techniques, applications, nano-patterning.

07 15 711 Special Topics in Power System Engineering

Fault Analysis: general background: equivalent circuit (modeling) of different parts of power system, different methods of S.C. calculations. Zero sequence impedance for multi-parallel line with and without mutual coupling and its action on calculations. Uses of computer for 3-phase unbalance faults (short and open line or-simultaneously). Response of H.V.D.C. system to: D.C. line fault, A.C. line fault, by studying characteristics, modeling and detection. Rectifiers A.C. system fault. Inverters A.C. system fault distribution system: distribution system planning, load estimating, rating, choice of voltage, cost. Rural distribution system, choice of system line construction, substations, consumer connections. Urban distribution system; network layout, design of minimum cost networks. Interactive calculation for medium and low voltage distribution systems.

07 15 712 New Topics in Power Systems Control

New trends in controlling the power systems such as: large-scale power system control. Adaptive and optimal estimation (Kalman filtering) applied to power systems. Modern non-linear control of synchronous machines.

07 15 713 Renewable Energy Sources

Different types of energy available. What is renewable energy. Types of renewable energy; photovoltaic, wind, tidal wave, geo-thermal, biomass storage of energy. Economics of renewable energy systems. Management of renewable energy systems. Design of renewable energy systems. Hybrid energy sources. Applications and worked examples.

07 15 714 Sustainable Energy Utilization

Introduction and pineapples of sustainable energy. Essentials of fluid dynamics. Heat transfer. Solar radiation. Solar water heating. Green buildings and other solar thermal applications. Photovoltaic generation. Hydropower and artificial reservoirs. Power from the wind. The photosynthetic process. Biomass and biofuels. Wave power. Tidal power. Ocean thermal energy. Energy systems storage and transmission. Institutional and economic factors.

07 15 715 Smart Grids

Concepts of Smart Grids. Components of Smart Grids. Impact of Smart Grids on power industry, including renewable energy. Impact of Smart Grids on energy management and load management systems. Smart Grids and Green House energy and emission control. Polices of energy economics in view of Smart Grids.

07 15 717 Electrical Materials
Dielectric materials: polarization, frequency response, breakdown, piezoelectricity, ferroelectrics. Magnetic materials: domains and hysteresis curve. Review of microscopic theory. Stern Gerlach experiment. Magnetic resonance. Superconductivity.

07 15 720 Linear Control Systems
State-space representation of linear systems. Linearization techniques. Similarity transformations. Stability of linear multivariable systems. Controllability and design of different controllers. Observability and observer design. Design through separation property.

07 15 721 Non-Linear Control Systems
Linearization of nonlinear systems. Nonlinear control systems using relays. Types of nonlinear elements in control systems describing functions analysis of control systems. Phase plane analysis of control systems. Examples of nonlinear control systems. Stability analysis of nonlinear control systems. Examples from inertial instruments. Motor control. Fluid actuators. Spacecraft control. Missile and aircraft autopilots.

07 15 722 Digital Control Systems
Introduction to sampling theory and signal reconstruction. Z-transformation. Composite signal flow graph for digital systems. Time response and noise in digital systems. Frequency response. Synthesis of digital controllers. Statistical analysis and design of digital control systems. Nonlinear control systems.

07 15 723 Optimal Control Systems
Definition of optimal control problems. Formulation of discrete time optimal control problems as constrained mathematical programming problems. Formulation of continuous time optimal control problems as variational problems. The portraying necessary condition. Applications to a variety of specific optimal control problems from diverse disciplines Introduction to computational methods in optimal control.

07 15 724 Advanced Course in Control
Neural networks modeling and control. Large-scale systems control. Intelligent control. Adaptive prediction and filtering. Adaptive control of stochastic systems.

07 15 725 Adaptive Systems and Identification Techniques
Real time parameter identification. Model reference adaptive systems. Self-tuning regulator design. Gain scheduling technique. A unified approach for adaptive control. Stability convergence and robustness issues. Applications.

07 15 726 Control Systems Design and Simulation

Analog computers are used for simulation and troubleshooting techniques. Design of differential actuators and sensors. Model instruction techniques. Teams design, build, and test a miniature control system. Emphasis on the qualitative aspects of synthesis, generation of candidate design, and engineering tradeoffs in system selection.

07 15 728 Neural Networks

Anatomical and physiological properties of neural networks. Mathematical modeling. Information capacity. Network adaptation, learning, and self-organization. Applications to pattern recognition, associative memory, and classes of optimization problems. Algorithmic approaches; single and multi-layered, deterministic and stochastic. The problem of connectivity and implementation approaches.

07 15 731 Generalized Theory of Electrical Machines

Basic coordinates. Energy state functions and Lagrange's equation. Formulation of equilibrium equations for electromechanical systems. D-Q model of electrical machines and their applications to cross field machines. Unified theory of electrical machines. Application of matrix techniques.

07 15 732 Special Types of Electrical Machines

Review of torque production in electromechanical energy conversion devices. Stepper motors; types, step angle and types of drive circuits, stability and states of equilibrium. Reluctance motors; types and performance. Switched reluctance motors; types, performance and drive circuits. Permanent magnet machines; types of PM, constructions, performance and control. Switched mode machines.

07 15 733 Dynamics and Simulation of Electric Machines

Direct current machines; circuit model, dynamic characteristic of different types. Induction machines; circuit model, steady state and dynamic representation, simulation of different types, transients. Synchronous machines; effect of saliency, inductances, circuit model, equations, steady state characteristics, transient performance of synchronous machines.

07 15 741 Industrial Electronics (B)

Programmable logic controllers. Data loggers. Telemetry. Static frequency changers.

07 15 751 Solid State Drives

Four quadrant DC converters. Analysis of separately excited DC machine using speed. Current feedback loops. Slip energy recovery systems (constant torque, constant power systems). Soft starters for AC squirrel cage machines.

07 15 752 Control of AC Drives

Characteristics of inverter fed induction motors (single and three phases). Vector control of 3-phase I.M. Adaptive control of I.M. Microprocessor as controllers. Types of brushless DC drives.

07 15 753 Microprocessor Control of Electric Drives

Revision on microprocessor structure. Interface. Assembly language. Generation of gating signals for: 3-phase 6-pulse converter, 3-phase inverter, choppers, 3-phase AC voltage regulators. Use of microprocessor as PID controllers.

07 15 754 Digital and Logic Circuits for Solid State Drives

Control and driver circuits for stepper motor. Reluctance motor. Switched reluctance motors. PM machines.

07 15 761 Selected Topics in Electrical Measurements

Generalized approach to measuring systems. General functioning diagram. Input and output configuration. Input devices to measuring systems. Sensing elements; passive, active and digital transducers. Signal conditioning and data acquisition: DC and AC systems instrument amplifiers, A/D system sampling, A/D and D/A converters. Feedback measuring systems:; types of systems, inverse transducers.

07 15 762 Phasor Measurement Units and Applications

Synchronized Measurement Technology (SMT). Phasor Measurements Units (PMU). Installation of PMU's. Applications of various wide area monitoring, protection and control schemes (WAMPAC). Experiences of using WAM systems. Real time monitoring of a Power Plant Control System.

07 15 771 Application of Mathematical Methods in Electrical Engineering

Introduction to stochastic processes: probability, random variables, mean square estimation, stochastic processes and spectral analysis. Optimization methods: mathematical bases, unconstrained minimization, and minimization with constraints. Mathematical programming: linear programming, dynamic programming.

07 15 811 Power System Analysis

Modeling of power system elements. Steady state analysis of power system. Steady state sensitivity analysis. Power system data error detection and identification. Stochastic load flow. State estimation theory and applications.

07 15 812 Power System Planning

General planning: deterministic and probabilistic models. Transmission system planning: deterministic and probabilistic models. Automated transmission system expansion planning. Tellegen's theorem. Network sensitivity. Design of automated network including practical considerations. Automated planning using interactive graphics. Composite generation. Transmission reliability. Load forecasting.

07 15 813 Optimal Operation of Power Systems

Exact power system loss equation - Economic dispatch of thermal and hydrothermal units. Optimal power flow. Unit commitment; aspects and solution methods. Power system security monitoring. Steady state contingency analysis.

07 15 814 Transients in Power Systems

Review of traveling waves. Other transients on T.Ls. Transient modeling of power systems and components. Computing aids to the calculation of electrical transients. Insulation coordination. Case studies in electrical transients. Measuring techniques and surge testing.

07 15 815 High Voltage Engineering

Development in high voltage generation and measuring equipment. Latest research work and publications in the fields of liquid, solid and gas dielectrics. Development in high voltage power equipment. Specifications related to international standard and testing of high voltage power equipment.

07 15 816 Static & Digital Protection Relays

Static relays: types, design, characteristics and applications. Digital relays: theories, design, types and applications. Testing and calibration of the two types of relays.

07 15 818 Advanced Electrical Engineering Materials And Applications

Polarization and magnetization. Piezoelectricity and ferro-electricity. Dielectric materials and their application. Dielectrics in power equipment. Dielectrics in electronic equipment. Capacitors. Cables. Rectifiers. Memory devices and piezoelectric transducers. Magnetic storage. Superconducting material. Vast applications. Requirements of the armed services.

07 15 819 Renewable Energy Utilization

Heat engines. Ocean thermal energy conversion (OTEC). Ocean wave energy conversion (AWEC). Geothermal energy. Tidal energy thermoelectricity. Fuel cells. Hydrogen production and storage systems. Biomass. Photovoltaic solar cells. Solar tracking and control systems. Solar concentrators. Solar satellite systems. Wind Energy.

07 15 820 Advanced Topics in Control of Electrical Systems
Electrical networks representation in control systems. Electrical machines representation in control systems. Different servomotors in control systems. Representation and modeling of renewable energy power station. Control theories for different electrical systems.

07 15 821 Advanced Course in Linear Control
Linearization techniques. State space representation methods. Similarity transformations. Linearization by feedback. Stability analysis and optimization. Linear control systems theories. Separation property and design. Controllers and design.

07 15 822 Advanced Course in Nonlinear Control
Behavior of nonlinear system. Phase plane analysis. Describing function approach. Lyapunov stability theory. Feedback linearization. Sliding mode control. Case studies.

07 15 823 Digital Control Systems
Stability, controllability and observability of digital systems Analysis and design of digital control system. Configuration of direct digital control (DDC) systems in process control. Digital PID controllers. Case study: performance analysis and simulation using Matlab/Simulink of a selected practical process.

07 15 824 Optimal Control Techniques
Analytical solution of the general optimization problem for both continuous and discrete control systems. Linear quadratic regulators. Constrained input and state problems. Case study: particle, particle swarm optimization (PSO) technique and its application in a selected control process.

07 15 825 Identification Methods and Adaptive Systems
Introduction to adaptive systems. Real time parameter estimation. Model reference adaptive systems. Self-tuning regulators. -Gain scheduling techniques. Case studies.

07 15 826 Neural Network Control Systems
Introduction. Learning processes. Single and multilayer preceptors. Radial-basis function networks. Support vector machines. Neurodynamic programming. Neurodynamics.

7 15 827 Artificial Intelligence and Applications
Introduction. Artificial Intelligence techniques in Control systems Analysis and Control. Robotics. Neural and Fuzzy Machine Intelligence. Adaptive Fuzzy Control systems. Genetic Algorithms in Control system Analysis and Design.

07 15 828 Fuzzy Control Systems and Applications
Introduction. Basics of Fuzzy sets and Relations. Fuzzy Measures. Fuzzy Logic and reasoning. Fuzzy Logic Control Systems. Application of Fuzzy theory.

07 15 834 New Trends in Electrical Machines
PM machines. PM machines with fractional slot winding. Multiphase systems. Multiphase PM Machines. Multiphase Induction machines. Magnetic gearboxes. Active magnetic bearing. Bearingless drives.

07 15 835 Dynamic Modeling of Electrical Machines
Synchronous machine modeling. The one-axis model. The two-axes model. Higher-order models. Automatic voltage regulator dynamics. Turbine-governor dynamics. Power system stabilizers. Single-machine-infinite-bus (SMIB) systems. Multi-machine power systems. Steady state operating points. Linearization. Induction machine modeling. Doubly-fed induction generator (DFIG) dynamics. Wind turbine dynamics. Time-domain simulations, Performance of impedance relays during machine swing.

07 15 841 Power Electronic Interface of Renewable Energy Sources
Photovoltaic modules (PV) characteristics. DC-DC-AC conversion. Maximum power point tracking (MPPT). Wind turbine characteristics. AC-DC-AC conversion. Doubly-fed induction generator (DFIG) interface. Control of grid-side and generator-side converters. Control of injected active and reactive power. Synchronous frame current controller. DC voltage control.

07 15 842 Design for Power Electronic Converters
Transfer function of DC-DC converters. Design of closed loop controllers for DC-DC converters, Transfer function of DC/ AC converters. Design of closed-loop controllers for DC/AC converters. Design of proportional integral (PI) controllers. Passivity based controllers. Repetitive controllers for harmonic disturbance rejection. Adaptive controllers. Nonlinear controllers. Back-stepping controllers. Adaptive fuzzy controllers. Neural network controllers.

07 15 843 Power Electronic-Based Control of Electric Power Systems
Flexible AC transmission systems (Facts) - Static Var Compensator (SVC). Static Synchronous Compensator (STATCOM). Static Synchronous Series Compensator (SSSC). Unified Power Flow Controller (UPFC). Design of controllers. Using of Facts devices for power system voltage control, power flow control and damping of power system oscillations. High voltage DC systems (HVDC). Valve characteristics. Steady

state operating points. Control modes. Design of controllers. Power flow control. Transient stability enhancement using HVDC. Design of AC and DC harmonic filters.

07 15 844 Advanced Industrial Automation
Programmable Logic Controllers (PLC). PLC networks. Supervisory Control and Data Acquisition (SCADA) systems. Motor control centers (MCC). Distributed Control Systems (DCS).

07 15 845 Advanced Industrial Electronics
Resonant converters. Soft-switching converters. Zero-Voltage-Switching (ZVS) converters. Zero-Current-Switching (ZCS) converters. Z-source inverters. Multilevel-inverters. Cascaded inverters. Diode-clamping converters. Flying-capacitor converters. Load-sharing among parallel-connected inverters. Design of gate-drive circuits. Protection of power semiconductor devices.

07 15 846 Active Harmonic filtering
Active power filters. Circuit topologies. Harmonic extraction techniques. Reference current generation. Control techniques. Modulation techniques. Reactive power compensation. Four–wire systems. Load balancing and neutral current elimination.

07 15 891 High Voltage DC Transmission
History of HVDC transmission. HVDC advantages over HVAC systems technical merits. Economical considerations. Environmental aspects. Drawbacks facing HVDC. Categories of HVDC transmission: point to point, back to back, multi–terminal HVDC. HVDC transmission systems technology: LCC-HV system, VSC, HVDC system, MMC HVDC systems. Interaction between AC and DC systems.

07 15 601 Diploma Project in Power Engineering and Electrical Machines

07 15 701 Master of Engineering Scientific Report in Electrical Engineering (Power Engineering and Electrical Machines)

07 14 701 Master of Engineering Scientific Report in Electrical Engineering (Electronics and Communications)

07 15 705 Master of Science Thesis in Electrical Engineering (Power Engineering and Electrical Machines)

07 14 705 Master of Science Thesis in Electrical Engineering (Electronics and Communications)

07 15 801 **Doctor of Philosophy Dissertation in Electrical Engineering (Power Engineering and Electrical Machines)**

07 14 801 **Doctor of Philosophy Dissertation in Electrical Engineering (Electronics and Communications)**