FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABUS

FOR

M.TECH. (ELECTRONICS & COMMUNICATION ENGINEERING) SPECIALIZATION (COMMUNICATION SYSTEMS) (SEMESTER: I – IV)

(Under Credit Based Continuous Evaluation Grading System)

SESSION: 2014-15

GURU NANAK DEV UNIVERSITY AMRITSAR

M.TECH. (ELECTRONICS & COMMUNICATION ENGINEERING) SPECIALIZATION (COMMUNICATION SYSTEMS) (SEMESTER SYSTEM)
(Under Credit Based Continuous Evaluation Grading System)

SCHEME

Semester – I:		**L**	**T**	**P**
ECL 511	Fiber Optic Communications	4	0	0
ECL 512	Analysis of Digital Communication Systems	4	0	0
	Interdisciplinary Course – 1	4	0	0
ECL 514	Microwave Circuits	4	0	0
ECP 515	Fiber Optics & Optical Communication Lab	0	0	1
ECP 516	Term Paper – I	0	0	1
	Sub Total:	**16**	**0**	**2**
	Total:	**18**		

M.TECH. (ELECTRONICS & COMMUNICATION ENGINEERING) SPECIALIZATION (COMMUNICATION SYSTEMS) (SEMESTER – I)
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ECL–511: FIBER OPTIC COMMUNICATIONS

Credits		
L	**T**	**P**
4	0	0

1. Introduction: Evolution of optical communication systems, elements of optical fiber transmission link. Comparison of optical communication systems with other contemporary communication systems.
2. Optical Fibers & Signal Degradation: Basics of optical fibers. Attenuation and dispersion effects in single mode and multimode optical fibers. Control of dispersion in single mode & multimode fibers. Non linear effects in single mode fibers and their control.
3. Transmitter Receivers & Modulators: Light emitting diodes, laser diodes, their structures, efficiency of laser diodes, functional block diagram & typical circuits of transmitter. p.i.n & A P D photodiodes noise sources in photo detectors, SNR and noise equivalent power, sensitivity & quantum limit of receivers. Functional block diagram and typical circuits of a receiver, decision circuit design, Electro- optic, electroabsorption & acousto-optic external modulators.
4. Digital Transmission Systems: Point to Point link, system considerations, link power, budget & rise time budget analysis. Line coding techniques, NRZ, RZ, Manchester etc. eye pattern analysis.
5. WDM Base Optical Communication System: Introduction to wavelength division multiple access. Receiver & transmitter requirements in WDM networks. Repeaters & amplifiers, Erbium doped fiber amplifier (EDFA).
6. Passive Components for WDM Based Systems: Couplers & splitters, FBT couplers, WDM multiplexer & demultiplexers fixed & tunable filters, isolators, circulators & attenuators. Optical switches & wavelength converters.

Books:

1. G. Keiser, “Optical Fiber Communications”, McGraw Hill, 2009.
2. D.K. Myanbaev & Lowell L. Scheiner, “Fiber Optic Communication Technology”, Pearson Education Asia, 2008.
3. G.P. Agrawal, “Nonlinear Fiber Optics”, Academic Press, 2009.
4. J.M. Senior, “Optical Fiber Communications”, Prentice Hall, India, 2008.

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ECL–512: ANALYSIS OF DIGITAL COMMUNICATION SYSTEMS

Credits		
L	**T**	**P**
4	0	0

Review of Fourier Transforms, Random Processes Probability, Probability density function, Gaussian, density function, Rayleigh probability density, Correlation between random variables, Autocorrelation, Power spectral density of random sequences, Noise, spectral components of noise, Noise bandwidth, Quadrature components of noise, Representation of noise using orthonormal components, Sampling Theorem, Quantization, pulse code modulation, Digital modulation schemes, PSK, QPSK, FSK, QASK, MPSK, Performance Analysis of the digital modulation schemes. Bandwidth S/N tradeoff.

References:

1. Tanb Scuilling−Communication System, Tata McGraw Hill, 2006.
2. Digital Communication System−Simon & Haykin, John Wiley & Sons, 2004.
3. Communication Systems−RP Singh & Sapre, Tata McGraw Hill, 1995.
4. Salvatore Gravano−Error Correcting Codes, Oxford Press, 2008.
5. J. Das−Principals of Communication System, Wiley Eastern Limited, 1986.

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Credits		
L	**T**	**P**
4	0	0

Interdisciplinary Course – I

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ECL–514: MICROWAVE CIRCUITS

Credits		
L	**T**	**P**
4	0	0

Circuit Theory for Waveguide System:
Impendence description of waveguide elements and circuits, one port circuit, N port circuit. Normalized impendence and admittance matrix, Two port junction, scattering matrix formulation, properties of scattering matrix, Scattering matrix for two port junction, Magic T, E plain & H plain T, directional couples, circulator, rat race, Smith chart, Circulators, Isolators, Attenuators.

Periodic Structure and Filters:
Introduction, maximally flat filter, Characteristics, Chebyshev filter, low pass filter design, low pass to Band pass transformation, low pass to high pass transformation, Microstrip parallel coupled filter examples.

Solid State Amplifiers:
Bipolar transistors at microwave frequency FET microwave transistors, microwave amplifiers design using Scattering Matrix parameters, Amplifiers gain derivation, Amplifier stability circle, conditionally stable devices, constant power gain circles, unstable devices, Stable Device, Unstable Devices, Constant noise figure circles, constant mismatch circles, out put impendence mismatch circle. Single stage amplifier design, two stage amplifier design, Low noise amplifiers design.

Oscillate and Mixes:
Gunn diode Oscillators, IMPAITT diode oscillator, Transistor oscillator, PIN diode oscillator circuit, oscillator design, linear mixer operation, non linear mixer, balanced mixer.

References:

1. SY Liao, Microwave Circuit Analysis and Amplifier Design, Prentice Hall, 2006.
2. GD Vendelin, A.M.Pavio, U.L. Rahde, Microwave Circuit Design, Using Linear and Non Linear Techniques, John Wiley, 1990.
3. Y.Konishi, Microwave Integrated Circuits, Marcel Dekker, 1991.
4. Robert. E Collin, Foundation of Microwave Engineering, Mc Graw Hill, 2006.

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ECP–515: FIBER OPTICS & OPTICAL COMMUNICATION (LAB.)

Credits		
L	**T**	**P**
0	0	1

Lab will cover the experiments on optical fiber characterization, Link power budget and Rise-time budget evaluation, BER analysis from eye diagrams. Study of WDM optical communication systems, Crosstalk in WDM components. Study of non-linear effects in optical communication systems.

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ECP–516: TERM PAPER – I

Credits		
L	**T**	**P**
0	0	1

The students are required to de literature survey on the topics related to the theory subjects taken during the semester. Every student will prepare a detailed report on the selected topics and will present the findings of the report in front of the examination board.

M.TECH. (ELECTRONICS & COMMUNICATION ENGINEERING) SPECIALIZATION (COMMUNICATION SYSTEMS) (SEMESTER – II)
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SCHEME

Semester – II:		**L**	**T**	**P**
ECL 521	Data Communication & Computer Networks	4	0	0
ECL 522	Information Theory and Coding	4	0	0
ECL 523	Wireless & Mobile Communication System	4	0	0
ECL 524	Photonic Network and Switching	4	0	0
ECP 526	Communication Systems Simulation Lab using Matlab	0	0	1
ECP 527	Term Paper – II	0	0	1
	Sub Total:	**16**	**0**	**2**
	Total:	**18**		

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ECL–521: DATA COMMUNICATION & COMPUTER NETWORKS

Credits		
L	**T**	**P**
4	0	0

Chapter 1: Overview of Data Communications & Networking:
Data Communication, Computer Network, Types, Network Standards, Networking Models, Data Transmission Modes, Multiplexing & Switching, Network Architecture, Layered Architecture, OSI Reference Model, TCP/IP Model.

Chapter 2: Network Hardware Components:
Connectors, Transceivers, Media Converters, repeaters, Network Interface Card (NIC), Bridges, Switches, Routers, Gateways, Virtual Private Network (VPNs).

Chapter 3: High Speed Network:
X.25, Frame Relay, Asynchronous Transfer Mode (ATM) High Speed LAN – Ethernet, Fast Ethernet, Gigabit Ethernet, Fiber Channel, Wireless LANs, Wimax, SONET, FDDI, ISDN.

Chapter 4: Internet Routing:
Routing Protocols, Interior Routing Protocols, Exterior Routing Protocols.

Chapter 5: Congestion & Traffic Management:
Congestion control in Data Networks & Internets, Flow & Error Control, TCP Traffic Control, Traffic and Congestion Control in ATM Networks.

Chapter 6: Network Security:
Issues, Threat Assessment, Network Attacks, Firewalls, Encryption Methods, Authentication & Access Control Measures, Digital Certificates, Public Key Infrastructure (PKI), KERBEROS.

References:

1. Michael A. Gallo & William M. Hancock; Computer Communications & Network Technologies: Thomson Publications, 2007.
2. William Stallings; High Speed Networks & Internets: PEARSON Publications, 2007.
3. William Stallings; Computer Networking with Internet Protocols & Technology: PEARSON Publications, 2007.
4. ATUL KAHATE; Cryptography & Network Security: Tata McGraw Hill, 2008.

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ECL–522: INFORMATION THEORY AND CODING

Credits		
L	**T**	**P**
4	0	0

1. Information Theory, Information Rate and Coding to increase average information per bit.
2. Mutual information, entropy for discrete ensembles, Shannon's noiseless coding theorem; Encoding of discrete sources.
3. Markov sources; Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.
4. Techniques of coding and decoding; Huffman codes and uniquely detectable codes; Cyclic codes, convolution arithmetic codes.

References:

1. R.B. Ash, Information Theory, Prentice Hall India, 2006.
2. Modern Analog & Digital Communication System by BP Lathi, 4th Edition, Oxford University Press, 2008.
3. Communication Systems by Singh and Sapre PHI, 2007.
4. Digital Communication Systems by Simen Hakins TMH, 2006.
5. Principles of Digital Communication by J Das, SK Mullick and PK Chatterjee, PHI, 2006.

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ECL–523: WIRELESS & MOBILE COMMUNICATION SYSTEM

Credits		
L	**T**	**P**
4	0	0

1. Mobile Communications: Types of Mobile Communication Systems, Cellular Mobile Architecture overview.
2. Cellular Communication, Signal Strength and Cell parameters, Capacity of cell, cochannel interference, cell splitting, cell sectoring and reuse cellular system operation and planning.
3. Multiple Access schemes in Mobile communications: TDMA, FDMA, CDMA, WCDMA, OFDMA.
4. Multiple Propagation: Fading, Interference, Diversity Schemes, Interference Suppression, Improving Signal Strength, Power Control.
5. Educational Field visit to a mobile switching Centre (MSC)/ Study of Cellular Tower-Offering public services.

References:

1. Mullett, 'Introduction to Wireless Telecommunication Systems & Networks', Cengage Learning, 2008.
2. Theodore S. Rappaport, 'Wireless Communications Principles & Practice', PHI, 2007.
3. J. Schiller, 'Mobile Communications', Pearson Education, 2007.
4. J.W. Mark & W. Jhuang, 'Wireless Communications & Networking', PHI, 2006.
5. WCY Lee, 'Mobile Cellular Telecommunications Systems', McGraw Hill International Editions, 1990.
6. WCY Lee, 'Mobile Communications Design Fundamentals', Prentice Hall, 1993.
7. Raymond Steele, 'Mobile Radio Communications', IEEE Press, New York, 1992.
8. AJ Viterbi, 'CDMA: Principal of Spread Spectrum Communications', Addison Wesley New York, 1995.
9. VK Garg and JE Wilkes, 'Wireless and personal Communication Systems', Prentice Hall, 1996.

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ECL–524: PHOTONIC NETWORK & SWITCHING

Credits		
L	**T**	**P**
4	0	0

Introduction: Introduction to basic optical communication & devices, WDM optical Network evolution.

Optical Multiplexing Techniques: Wavelength Division multiplexing, Optical time division multiplexing & optical code division multiplexing.

Optical Networks: Why optical networks? Conventional optical networks, SONET/SDH, FDDI, IEEE 802.3, DQDB, WDM optical networks architectures and issues in wavelength routed networks.

All Optical Networks: Amplification in all optical networks. Design issues of WDM based optical Networks. Passive Optical Networking and some common PON architectures.

Optical Switching & Routing: Optical switching, example of an optical switch using 2 x 2 coupler, evolution of switching technologies, switching architectures, Micro Electro Mechanical Systems (MEMS), free space optical switching, thermoptic & bubble switches,

optical routers. Protection of optical switched path. Wavelength converters, Implementation of wavelength converters using optoelectronics approach, Optical Gating, Interferometric techniques & Wave mixing.

Books:

1. Uyless Black, ‘Optical Networks’, Pearson Education, 2008.
2. D.K. Mynbaeu & L. Scheiner, ‘Fiber Optic Communication Technology’, Pearson Edu. Asia, 2008.
3. C. Siva Ram Murthy & M. Gurusamy, ‘WDM Optical Networks’ Pearson Education, 2009.
4. RG Gallager & D Bertsekas, ‘Data Networks’, PHI, 2006.
5. R. Ramaswami & Kumar N. Sivarajan, “Optical Networks – A Practical Perspective” second edition, Morgan, Kaufonan Publishers and Imprint of Elsevier.

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ECP–526: COMMUNICATION SYSTEMS SIMULATION LAB USING MATLAB

Credits		
L	**T**	**P**
0	0	1

- Simulation of Fibre Optic Communication Systems
- Microwave satellite link design
- Microwave line of sight with design
- Fibre Optic WDM System simulation
- LAN/WAN Topologies Simulation

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ECP–527: TERM PAPER – II

Credits		
L	**T**	**P**
0	0	1

The students are required to do literature survey on the topics related to the theory subjects taken during the semester. Every student will prepare a detailed report on the selected topics and will present the findings of the report in front of the examination board.

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SCHEME

Semester – III:		**L**	**T**	**P**
	Elective I	4	0	1*
	Elective II	4	0	1*
ECL-614	Digital Signal Processing	4	0	1*
ECL-615	Microwave Communication Systems	4	0	1*
	Interdisciplinary Course-II	3	0	0
	Sub Total:	**19**	**0**	**4**
	Total:	**23**		

***Credit for Term Paper**

Elective Courses:				
ECL-601	Image Processing	4	0	1*
ECL-602	Integrated Optics	4	0	1*
ECL-603	Radiating Systems	4	0	1*
ECL-604	Detection & Estimation Theory	4	0	1*
ECL-605	Telematics	4	0	1*
ECL-606	Microwave Materials	4	0	1*
ECL-607	Advance Computer Architecture	4	0	1*
ECL-608	Neural Networks	4	0	1*
ECL-609	Fuzzy Logic Processing	4	0	1*
ECL-610	Communication Networks	4	0	1*
ECL-611	Operational Research	4	0	1*
ECL-612	Nano Technology Applications in Engineering	4	0	1*
ECL-613	Bio Informatics	4	0	1*
ECL-617	Quantum Transport & Nano Electronics	4	0	1*

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ECL–614: DIGITAL SIGNAL PROCESSING

L T P
4 0 1*

1. Review of Discrete Time Signals and Systems: Review of Signals & Systems, Z and Inverse, Z Transformation and their properties, Discrete and Fast Fourier Transforms.

2. Digital Filter Structures: Structure of Digital Filter realizations, Basic FIR, IIR Structures (Direct form I & II) Cascade and parallel forms.

3. Design of FIR Filter Digital Filters: Introduction, Advantages over IIR, Design Techniques for FIR Filters, Magnitude / Phase Response of Digital Filters, Design Techniques for FIR Filters.

4. Design of IIR Digital Filter: Design from Analog Filter, impulse invariant & Bilinear Transformation Techniques, Frequency Transformation.

5. Multirate Signal Processing: Introduction Sampling Rate Conversion, Decimation and interpolation. Filter structures.

6. Application of DSP: Radar, Communication, Image and Speech processing.

References:

1. Digital Signal Processing by Proakis & Manolaki, Pearson Education Society, 2007.
2. Speech and Audio Processing for Multimedia PC's by Iain Murray.
3. Digital Image Processing by Keenneth R Castleman, Pearson Education Society, 2007.
4. Digital Image Processing by Rafact Gonzalez and Richard E Woods, Pearson Education Society, 2007.
5. Related IEEE/IEE Publication.

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ECL-615: MICROWAVE COMMUNICATION SYSTEMS

L T P
4 0 1*

1. Characteristics of Radio Wave Propagation: Attenuation and absorption, interference and noise, ground wave propagation, line of sight space wave propagation and effective earth radius, ionosphere propagation and critical frequency, troposphere scatter propagation.

2. Line of Sight Microwave Relay Systems: Mobile radio propagation large-scale path loss, Fraunhofer region, Fresnel Zone geometry, modulation technique, multi-path fading, frequency diversity, space diversity, link calculation, system gain, fade margin, outage probability.

3. Satellite Microwave Systems: Satellite orbits and dynamics, Frequency allocation and satellite footprints, Earth stations and satellite transponders, Noise considerations. Link budget calculations. Multiple access methods, Mobile satellite systems, their uses and illustrative systems.

4. Mobile Communications: Cellular mobile phones: basic network structure, multiple access techniques, frequency reuse, capacity of cellular networks, signal to interference ratio, channel allocation techniques, location management, handoff management, quality of services (QoS).

Books:

1. Microwave Mobile Communications by William
2. Digital Communications: Microwave Applications by Kamilo Feher C Jakes
3. Theodore S. Rappaport, “Wireless Communication Principles & Practice”, PHI, 2nd Edition, 2008.
4. DC Aggarwal, “Satellite Communication”, 2nd Edition, PHI, 2nd Edition, Khanna Publishing, 2006.
5. T.Pratt and CW Bostian, “Satellite Communication”, John Wiley & Sons, 2nd Edition, 2006.
6. Wayne Tomasi, "Electronic Communication Systems”, Pearson Education, 4th Edition, 2007.

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L	T	P
3	0	0

Interdisciplinary Course-II

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ECL–601: IMAGE PROCESSING

L T P
4 0 1*

Image Representation and Modeling: Fourier transform, z- transform, optical and modulation transfer functions, Matrix theory results, block matrices, Random signals, Discrete random fields, spectral density functions, results from estimation theory.

Image Perception: Light, luminance, brightness and contrast, MTF of Visual system, Visibility function, Monochrome vision methods, Image fidelity criteria, color matching and reproduction, color coordinate systems, color difference measures, color vision model, Temporal properties of vision.

Image Sampling & Quantization: Introduction, two dimensional sampling theory, Extensions of sampling theory, Practical limitations in sampling and reconstruction, Image Quantization, Optimum mean square or lloyd Max quantizer, A compandor design.

Image Transform: Two dimensional orthogonal and unitary transforms, properties of unitary transforms, Two dimensional DFT, Cosine transform, KL-transform. Image Representation by Stochastic Models: Introduction, One dimensional causal models, One dimensional Spectral Factorization, AR Models, linear prediction in two dimension, Image decomposition, Fast KL transforms.

Image Enhancement: Point Operations, Spatial Operations, Transform Operations, Multispectral Image Enhancement, False Color and pseudocolor, color image enhancement. Image Filtering and Restoration: Introduction, Image observation models, Inverse and Wiener filtering, FIR Wiener filters, Fourier domain filters, filtering using image transforms, Smoothing splines and Interpolation, least square filters, Generalized inverse, SVD and Iterative methods, Recursive filtering for state variable system, causal models, Semi-causal models, Digital processing of speckle images, Maximum entropy restoration, Bayesian methods.

Books:

1. Digital Image Processing by Keenneth R Castleman, Pearson Education Society.
2. Digital Image Processing by Rafact Gonzalez and Richard E. Woods, Pearson Edu.Society.
3. Related IEEE/IEE Publications.

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ECL–602: INTEGRATED OPTICS

L T P
4 0 1*

Optical Wave Guide Analysis: Single mode waveguide analysis, loss mechanisms, Material attenuation, waveguide attenuation, Dispersion in single mode waveguide, standard waveguide profiles & bandwidth considerations.

Planar Waveguide Integrated Optics: Overview of planar waveguide components, phase matching at a single interface, the FTIR beam splitter, prism coupler, phase matching for guided modes, respective optical components gratings, gratings in guided wave optics.

Channel Waveguide Integrated Optics: Channel waveguide types, input & output couplings, sources of propagation loss, polarizer, mirrors, tapes & Y-Junctions, phase modulators, Frequency shifting & high speed operation, Interferometers.

Optical Device Fabrication: Overview, planar processing, substrate growth & preparation, Deposition & growth of materials, material modification, Etching lithography & Optical Fiber fabrication.

Integrated Optics & Network Components: Fiber optic switches & active couplers, fixed couplers, wavelength multiplexing & demultiplexing fiber optic modulators, VLSI Techniques applied to integrated optics.

Books:

1. Richard Syms & John Cozens ‘Optical Guided Waves & Devices, McGraw Hill International Ed.
2. Donald G. Baker, ‘Monomode Fiber Optic Design with Local Area & Long Haul Network Applications” Van Nostrand Rainhold Company, New York.

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ECL–603: RADIATING SYSTEMS

L T P
4 0 1*

PART-I

1. Basic Concepts of Radiation: Radiation mechanism, Current distribution on antennas, Fundamental Antenna parameters, Types of Antennas.

2. Analysis and Synthesis of Antennas: Vector potential for electric and magnetic source, Antenna theorems, types of linear arrays, linear wire antennas-Infinitesimal, Small and Finite Length Dipole, Antenna synthesis- Schelkunoff Polynomial Method, Fourier Transform Method, Woodward-Lawson Method and Taylor Line-Source.

PART-II

3. Antennas/ Antenna Measurement: Different antennas-Dipole, loop, reflector, slot antennas, Microstrip Antennas- Feeding structure, Methods of Analysis. Antenna Measurement- Gain, Directivity, Impedance, Polarization and radiation pattern.

4. MIMO Communication Systems: Introduction, Basic Principle, Types: SIMO, MIMO, Space time block codes, SISO & MIMO Characteristics, Space time transmit diversity, MIMO Capacity gain, MIMO radio Channel model.

PART-III

5. Smart Antennas: Spatial Radio Channel, Spatial processing for wireless systems: introduction, Vector channel impulse response & the Spatial signature, Spatial processing receivers, fixed beam forming networks, switched beam system, Adaptive antenna systems, Wide band smart antennas, Digital radio receiver & software radio smart antennas.

Books:

1. Joseph C. Liberti, Theodore S. Rappaport-“Smart Antennas for Wireless Communications IS95 and Third Generation CDMA Applications”, Prentice Hall, Communications Engineering and Emerging Technologies Series, 2007.
2. Kraus J.D., “Antennas for all Applications”, III Edition, TMH, 2005.
3. Collin R.E. and Zucker F.- “Antenna Theory” Part I, Tata McGraw Hill, 2005.
4. Balanis A., “Antenna Theory Analysis and Design”, John Wiley and Sons, New York, 2002.

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ECL–604: DETECTION & ESTIMATION THEORY

L T P
4 0 1*

Signals and Systems: System theory, Stochastic process, Gauss Markov models, Representation of Stochastic Process, Likelihood and Sufficiency.
Review of Random Processes: Review of Probability Theory, Random variable, Two random variables, Moments and conditional statistics, Sequence of random variables, Random Process definition and classification, Stationary and non stationary process, correlation functions, Stochastic Integrals, Fourier transform of random process. Ergodicity and power spectral density, transformation of random process by linear systems. Representation of random processes via sampling, K-L sampling and narrow band representations, Special random processes (White Gaussian Noise, Wiener Levy Processes, Special random processes, Shot noise processes, Markov processes).
Hypothesis Testing: Simple binary hypothesis tests, Decision Criteria, Neyman pearson tests, Bayes Criteria, Receiver operating characteristics, Multiple Hypothesis testing, Composite hypothesis testing, Asymptotic Error rate of LRT for simple hypothesis testing.
Detection Theory: CFAR Detection, Sequential detection, Walds test, Detection of known signals in white noise: the correlation receiver, Detection of known signals in coloured noise, Maximum SNR Criteria. Detection of signals with unknown parameters.
Estimation Theory: Bayes estimation, Real parameter estimation, Maximum likelihood estimation, Cramer Rao inequality, lower bound on the minimum mean square error in estimating a random parameter, Multiple parameter estimation bound on estimation errors of non random variables, General gaussian problem.
Estimation of Waveforms: Linear MMSE of waveforms, Estimation of stationary process: The Wiener Filter, Estimation of non-stationary process: The Kalman Filter, Relation between Kalman and Wiener filters, Non linear estimation.
Applications to Communication & Radar Systems: Digital communication, Spread Spectrum Communication, Radar Systems, Radar Target Models, Target detection, Parameter estimation in radar systems, Dynamic Target tracking.

Books:

1. Detection Estimation and Modulation Theory - by HL Van Trees Wiley New York.
2. Introduction to Statistical Signal Processing with Application - by MD Srinath, PK. Rajasekran, R.Viswamathan (PHI).
3. Signal detection theory - by Hancock and Wintz.
4. Detection of signals and noise - by AD Whalen.
5. Related IEEE/IEE Publications.

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ECL–605: TELEMATICS

L T P
4 0 1*

Introduction: Evolution of telecommunication, simple telephone communication, Basic Switching system, Manual-switching system.

Cross-Bar Switching: Principal of common control, touch-tone dial telephone, principles of cross bar switching, cross bar switching configuration, cross point technology, cross bar exchange organization.

Electronics Space Division Switching: SPC, centralized SPC, distributed SPC, software architecture, application software, enhanced services, two, three and n-stage networks.
Speech digitization and Transmission: Sampling, vocodors, TDM.

Time Division Switching: Basic time division space and time switching, time multiplexed space and time switching, combination switching, three stages and N-stages combination switching.

Traffic Engineering: Network traffic load parameters, grade of service, and blocking probability, modeling a switching systems, incoming traffic and service characterization, blocking models and loss estimates, delay systems.

Telephone Networks: Subscriber loop system, switching hierarchy, and routing, transmission plan, transmission system, numbering plan, charging plan, signaling techniques, in-channel and common channel signaling techniques.

ISDN: Motivation, new services, network and protocol architecture, transmission channel, user networks interface, signaling, numbering and addressing, service characterization, internetworking ISDN standards.

Books:

1. Thiagarajan Viswanathan, “Telecommunication Switching System and Networks”, 1st
2. Edition, PHI, 2001. (Rs. 195/-.)
3. John Bellamy, “Digital Bellamy”, 3rd Edition, John Willey, 2000. (Rs. 4548/-)
4. J.E Flood, “Telecommunications Switching, Traffic and Networks”, Pearson Education, 2002. (Rs. 180/-)

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ECL–606: MICROWAVE MATERIALS

L T P
4 0 1*

1. Electronics of Materials: - Crystal structure: Lattice type, Defects, reciprocal lattice, Miller indices. Band theory, band structure of Si and III-V semiconductors. Carrier Transport- Boltzmann transport theory, relaxation time approximation, high field transport and hot carrier effects, Hall Effect
2. Introduction to materials: types-semiconductor, conductor, dielectric and magnetic materials.
3. Ceramic materials- introduction, types of ceramics, properties and its applications.
4. Magnetic materials- different types, properties and applications.
5. Glasses and glass ceramics- Introduction, composition and structure, properties and applications.

Book:
Microwave electronics by L.F. Chen, C.K. Ong and CP Neo, John Wiley & Sons Ltd.

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ECL–607: ADVANCE COMPUTER ARCHITECTURE

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1. Introduction: Elements of modern computers, Evolution of computer architecture, system attributes to performance, Multiprocessors & Multi computers- Shared memory, Distributed memory, Multivector and SIMD computers- Vector & SIMD super computer.
2. Bus Cache & Shared Memory: Backplane bus systems- specification, addressing & timing protocols, arbitration, transaction & interrupt. Cache Memory Organization: Cache addressing Models, Direct Mapping & Associative Cache, Cache performance issues. Shared Memory Organization: Interleaved Memory Organization, Bandwidth & Fault tolerance, Memory Allocation schemes.
3. Pipelining & Superscalar Techniques: Linear pipeline processors, nonlinear pipeline processors, Instruction pipeline design, Arithmetic pipeline design, superscalar & super pipeline design.
4. Parallel & Scalable Architecture: Multiprocessor system interconnects cache coherence & Synchronization mechanisms, message passing mechanism, Vector processing principles, compound vector processing, SIMD Computer organization, Latency-Hiding techniques- Shared virtual memory, Perfecting techniques, Distributed coherent caches, Principles of Multithreading: Issues & Solution, Dataflow computer architectures, control flow vs data flow, advantage & potential problems, Static & dynamic data flow computers, data flow design alternatives.
5. Multiprocessing Control & Algorithms: Interprocessor communication Mechanisms, system deadlock & protection, Multiprocessor scheduling strategies, parallel algorithm for multiprocessors:

Books:

1. Computer Architecture by Nicholas Carter, McGraw Hill-Schaum Series.
2. Computer Architecture & parallel processing by Kai Hwang & Faye A Briggs McGraw Hill.
3. Advance Computer Architecture by Kai Hawang, TMH.

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ECL–608: NEURAL NETWORKS

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1. Neural networks characteristics, History of development in neural networks principles, Artificial neural net terminology, Model of a neuron, Topology, Learning, types of learning, supervised, Unsupervised, Re-enforcement learning, Knowledge representation and acquisition.
2. Basic Hop field model, Basic learning laws, unsupervised learning, Competitive learning, K-means clustering algorithm, Kohonen's feature maps.
3. Architecture of Back propagation network, single perceptron and multilayer perceptron, Back propagation learning, BP algorithm.
4. Applications of neural nets such as pattern recognition, Associative memories, speech and decision making.

Books:

1. Artificial Neural Networks by B. Yegnatoarayana.
2. Neural Networks & Fuzzy Logic by Bart Kosko.
3. Neural Computing Theory & Practice by P.D. Wasserman (ANZA PUB)
4. Introduction to Artificial Neural Systems- by J.M. Zurada (Jaico Pub)
5. Architecture of Back Propagation Network, Single Perception and Multilayer Perceptron Back Propagation Learning, BP Algorithm.

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ECL–609: FUZZY LOGIC PROCESSING

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Introduction to Fuzzy sets and Fuzzy logic: The uncertain and inexact nature of the real world, ideas and examples, fuzzy membership function, fuzzy numbers and fuzzy arithmetic, basic concept and properties of fuzzy logic versus classical two valued logic.

Fuzzy Information Processing: Basic concept and techniques for fuzzy information processing.

Fuzzy Interface: Fuzzy inference principles, fuzzy decision making, approximate reasoning.

Fuzzy rule base: If-Then rules, general format of fuzzy rules base, establishment of fuzzy rule base.

Fuzzy modeling: Static fuzzy modeling, dynamic fuzzy modeling.

Application: Industrial Application.

References:

1. Introduction to fuzzy systems, by Guanrong Chen and Trung Tat Pham, Chapman & Hall, 2007.
2. Fuzzy Logic and Neuro Fuzzy Applications explained by C Van Altrock, Printice Hall, 2007.

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ECL–610: COMMUNCIATION NETWORKS

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Introduction: Historic overview of wireless communications & Challenges in wireless communication networking, wireless communication standards.

Wireless LAN: Infrared Vs radio transmission, infrastructure & adhoc networks, IEEE 802.11, HIPERLAN, Bluetooth, their system & protocol architecture, Physical & MAC layer security & link management.

Wireless ATM: Motivation for WATM, reference model, radio access layer, handover, location management & access point control protocol. Mobility Management in wireless networks call admission control, Handoff management, local management for cellular, PCS network.

Wireless/Wire line Networking: Mobile IP, IPV6 Vs IPV4, Mobile IPV6, TCP, Network Performance, WAP & Mobile ADHOC Networks.

Books:

1. J.W. Marks & W. Jhuang, ‘Wireless Communications & Networking’, PHI.
2. J. Schiller, ‘Mobile Communication’, Pearson Education.
3. T.S. Rappaport, ‘Wireless Communication’, Prentice Hall.

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ECL–611: OPERATIONAL RESEARCH

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Linear Programming: The theory of simplex solution, alternative optimal solution, unbounded solutions, infeasible solution, formulation of LP models for production scheduling, network planning, inventory maintenance and capital budgeting and similar industrial problems. Two phase methods, revised simpler method and dual simplex method sensitivity analysis.

Dynamic Optimisation Models: Formulation of dynamic optimization models for common industrial problems. Optimisation of non linear objective function by dynamic programming.

Non-Linear Optimisation Models: Non linear objective queuing function of unconstrained variables, quadratic programming.

Queues Models: Queing with single and parallel channels with limited and unlimited service. Bulk services, priority queue discipline.

Simulation Models: Generation of Random number, Use of Coeff random numbers for system simulation. Use of computers for system simulation.

Books:

1. Fundamental of Operation Research by Ackoff & Sasieni: Wiley Eastern.
2. Principles of OR with Applications to Managerial Decision by Wagner, Prentice Hall.
3. Introduction to OR by Hillier & Lieberman Holder Day.
4. Operation Research by PK Gupta & DS Hira.

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ECL–612: NANO TECHNOLOGY APPLICATIONS IN ENGINEERING

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Introduction: Introduction to nanoscale systems, lengh energy and time scales, top down approach to nanolithography, spatial resolution of optical, deep ultraviolet, x-ray, electron beam and icon beam lithography, single electron transistor, coulomb blockade effects in ultra small metallic tunnel junctions.

Quantum Mechanics: Quantum confinement of electron in semiconductor nano structures, two dimensional confinement (Quantum wells) Band gap engineering, epitaxy Landaeur-Puttiker formation for conduction in confined geometrical, one dimensional confinement, quantum point contacts, quantum dots and Bottom up approach; Introduction to quantum methods for information processing.

Molecular Techniques: Molecular Electronics, Chemical self assembly, carbon nano tubes, self assembled nano layers, Electromechanical techniques, applications in biological and chemical detection, Atomic scale characterization techniques, scanning tunneling microscopy, atomic force microscopy.

Books:

1. Beenaker and Van Houten, “Quantum Transport in Semiconductor Nanostructures in Solid State Physics” Ehemreich and Turnbell, A Cademic Press, 1991.
2. David Ferry “Transport in Nao Structures” Cambridge University Press 2000.
3. Y. Imry “Introduction to Meroscopic Physics”, Oxford University Press 1997.
4. S. Dutta “Electron Transport in Mesoscopic System” Cambridge University Press 1995.
5. H. Grabert and M Devoret “Single Charge Tunneling” Plenum Press 1992.

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ECL–613: BIO INFORMATICS

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4 0 1*

Molecular Biology and Biological Chemistry: The genetic material, Gene structure and information content, protein structure and function, the nature of chemical bonds, molecular biology tools, genomic information content.
Data Searches and Pairwise Alignments: Dot plots, Simple alignments, scoring, Gaps, Scoring matrices, The Needleman and Wunsch algorithm, local and global alignments, Database searches, multiple sequences alignments.
Substitution Patterns: Patterns of substitutions within genes, Estimating substitution numbers, variations in substitution rates between genes, Molecular clocks, Evolution in organelles.

Character-Based Approaches to Phylogenetics: Parsimony, Inferred ancestral sequences, strategies for faster searches, consensus trees, Tree confidence, comparison of phylogenetics methods, Molecular phylogenies.

Genomics and Goene Recognition: Prokaryotic genomes, Prokaryotic gene structure, prokaryotic gene density, Eukaryotic genomes, Eukaryotic gene structure, Open reading frames, Gene expression, Transposition, Repetitive elements, Eukaryotic gene density.

Protein Folding: Polypeptide composition, Secondary structure, Tertiary and quaternary structure, Protein folding structure prediction.

Proteomics: Protein classification, Experimental techniques, Inhibitors and drug design, Ligand screening, X-ray crystal structure, Empirical methods and prediction techniques, Posttranslational modification prediction.

Books:

1. Fundamental Concepts of Bioinformatics by Dan Krane, Michel Raymor & Bryan Bergeson Publisher Addison Wesley.
2. Introduction to Bioinformatics: A Theoretical & Practical Approach by Dawd D.Womble & Stephen A Krawetz Publisher: Humnana Press.

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ECL- 617 QUANTUM TRANSPORT & NANO ELECTRONICS

UNIT-I

1. INTRODUCTION TO NANOELECTRONICS

The "Top Down" Approach, The "Bottom-up" Approach, Why Nanoelectronics, Nanotechnology Potential

2. CLASSICAL PARTICLES, CLASSICAL WAVES AND QUANTUM PARTICLES

Comparison of classical and Quantum Systems, Origins of Quantum Mechanics, Light as a Wave, Light as a Particle, Electrons as particles, Electrons as Waves, Wavepackets and Uncertainty

3. QUANTUM MECHANICS OF ELECTRONS

General Postulates of Quantum Mechanics, Time Independent Schrodinger's Equation, Free Electrons, The Free Electron Gas Theory of Metals, Fermi level and Chemical Potential, Semiconductors, crystal lattices, electron energy bands, organic semiconductors, Quantum Dots, Wires and Wells

UNIT-II

4. TUNNEL JUNCTIONS AND APPLICATIONS OF TUNNELING

Tunneling through a Potential Barrier, Potential Energy Profiles for Material Interfaces, applications of Tunneling, Coulomb Blockade, The Single Electron-Transistor, Field effect transistors

5. QUANTUM STRUCTURES AND FABRICATION TECHNIQUES

Semiconductor Heterostructures and Quantum Wells, Quantum Wires and Nanowires, Quantum Dots & Nanoparticles, Fabrication Techniques for Nanostructures, Bulk crystal and heterostructure growth, Nanolithography, etching and other means for fabrication of nanostructures and nanodevices, techniques for characterization of nanostructures, clusters and nanostructures, methods of nanotube growth, chemical and biological methods for nanoscale fabrication.

UNIT-III

6. NANOWIRES, BALLISTIC TRANSPORT, AND SPIN TRASPORT

Classical and Semiclassical Transport, Ballistic Transport, Electron transport in semiconductors and nanostructures, Carbon Nanotubes and Nanowires, Resonant Tunneling Diodes,Transport of Spin, and Spintronics

RECOMMENDED BOOKS

1. Introduction to Nanoelectronics: Science, Nanotechnology, Engineering and Applications, Vladimir V. Mitin, Viatcheslav A. Kochelap,Michael A. Stroscio, Cambridge University Press, New Delhi (2011)
2. Fundamentals of Nanoelectronics, George W. Hanson, Pearson Education Inc.
3. Introduction to Nanoscience, Stuart Lindsay, Oxford University Press
4. Electron Transport in Mesoscopic Systems, Supriyo Datta, Cambridge University Press,

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SCHEME

Semester-IV		**L**	**T**	**P**
ECD-621	Dissertation	0	0	16
ECP-622	Research Seminar	0	0	4

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ECD- 621: DISSERTATION

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ECP- 622: RESEARCH SEMINAR

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