ECL 6150				**Advanced Digital Communications**			Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Assignment	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	0	4	2 Hours	3 Hours	10	20	20	50	100

Course Outcomes

1. To learn the signal representation.
2. Study of various modulation schemes.
3. To Learn Signal Detection Schemes.
4. To Learn Digital Signal **Synchronization**
5. To Learn the Chactersitics of fading Signals

Course Contents

Unit I:Introduction (5 contact hours)

Digital communication system (description of different modules of the block diagram), Complex baseband representation of signals, Gram-Schmidt orthogonalization procedure. M-ary orthogonal signals, bi-orthogonal signals, simplex signal waveforms.

Unit II: Modulation (5 contact hours)

Pulse amplitude modulation (binary and M-ary, QAM), Pulse position modulation (binary and M-ary), Carrier modulation (M-array ASK, PSK, FSK, DPSK), Continuous phase modulation (QPSK and variants, MSK, GMSK).

Unit III: Receiver in additive white Gaussian noise channels (5 contact hours)

Coherent and non-coherent demodulation: Matched filter, Correlator demodulator, square-law, and envelope detection; Detector: Optimum rule for ML and MAP detection Performance: Bit-error-rate, symbol error rate for coherent and non-coherent schemes.

Unit IV: Band-limited channels (5 contact hours)

Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel with distortion: Design of transmitting and receiving filters for a known channel and for time varying channel (equalization); Performance: Symbol by symbol detection and BER, symbol and sequence detection, Viterbi algorithm.

Unit V: Synchronization (10 contact hours)

Different synchronization techniques (Early-Late Gate, MMSE, ML and spectral line methods)

Unit VI:Communication over fading channels (10 contact hours)

Characteristics of fading channels, Rayleigh and Rician channels, receiver performance-average SNR, outage probability, amount of fading and average bit/symbol error rate.

NOTE:	End Term Evaluation (Major Exam) shall be carried out in three stages. Minor I (20 marks), Minor II (20 marks), and Major (50 marks) exams.
	Assignment Marks shall be awarded on students' work in the form of Case Study / Design problem / Presentation / Quiz, which shall be evaluated by the concerned faculty.

Recommended Books:

1. Digital communication , Simon Hykins,ohn Willey & Sons
2. Digital communication , John G Proakis, McGraw Hill
3. Fundamental of Telecommunications, R G Freeman , John Wiley
4. Telecommunications Systems Engineering , R G Freeman, John Wiley
5. Telecommunication Transmissions Systems, R G Winch, McGraw-Hill
6. Electronic Communication Systems, W Tomasi, PHI

Advanced Digital Communication(ECL 6150)

Subject Name	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Advanced Digital Communication (ECL 6150)	**CO1**	3	2	1	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	2	3	2	2	2	2	1	2	2	1	3	2	3
	CO3	3	2	3	3	2	2	2	1	2	2	1	3	3	2
	CO4	3	2	3	3	1	3	3	2	3	2	1	3	3	2
	CO5	3	2	3	3	1	2	2	2	3	2	1	3	3	3

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ECL 6182				**Signal Processing Techniques & Applications**			Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Assignment	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	2	5	2 Hours	3 Hours	10	20	20	50	100

Course Outcomes

1. To learn the basics of signal and systems.
2. To learn the DTFT and DFT theories.
3. To Learn and analysis random process
4. To Learn the different image and methods.
5. To Learn the different Vedio and methods.

COURSE CONTENTS

Unit I: Continuous-Time and Discrete-Time Signals and Systems: (8 contact hours)

Continuous and discrete time signals: Some Elementary Continuous-time and Discrete-Time signals. Classification of Signals ,Periodic and a periodic even , odd ,energy and power signals ,Deterministic and random signals ,Causal and non-causal signals complex exponential and sinusoidal signals ,Simple Manipulations of Continuous and discrete time signals.

Continuous-Time Systems: Mathematical equation governing LTI Continuous-Time systems, Block diagram and signal flow graph representation, response of LTI Continuous-Time system in time domain, classification of Continuous-Time systems, convolution of Continuous-Time signals.

Discrete-Time Systems: Input-Output Description, Block Diagram Representation, Classification, Interconnection;

Analysis of Discrete-Time LTI Systems: Techniques, Response of LTI Systems, Properties of Convolution, Causal LTI Systems, Stability of LTI Systems; Discrete-Time Systems Described by Difference Equations; Implementation of Discrete-Time Systems;

Correlation of Discrete-Time Signals: Cross correlation and Autocorrelation Sequences, Properties. Understanding of SISO, SIMO, MISO and MIMO

Unit II: Deterministic Discrete signal analysis: (8 contact hours)

Discrete Fourier transforms (DFT), Periodic and aperiodic signal analysis, limitations of DFT, Fast Fourier Transforms, Transform equivalence: Z, DTFT, CTFT, FS, DFT. DFT for long sequences, STFT. Practical aspects of DFT. Application of DFT: Filter banks. Stability analysis, Response of a stable system, marginal and asymptotic stability.

Unit III: Random Discrete signal and systems: (8 contact hours)

Mathematical description of random signals, pseudorandom signals, stochastic processes. Brief review of probability. Spectral representation and analysis of nonstationary signals, random signals. Linear systems to random input. Parametric representation of Stochastic processes. Basic concept of processing random signals

Unit IV: Image Representation and compression: (8 contact hours)

Gray scale and colour Images, image sampling and quantization. Two dimensional orthogonal transforms: DFT, WHT, Haar transform, KLT, DCT. Fundamental Concepts of Image Compression: Compression models - Information theoretic perspective -Fundamental coding theorem - Lossless Compression: Huffman Coding- Arithmetic coding - Bit plane coding – Run length coding - Lossy compression: Transform coding - Image compression standards.

Unit V: Video Processing: (8 contact hours)

Representation of Digital Video, Spatio-temporal sampling; Motion Estimation; Video Filtering; Video Compression, Video coding standards.

NOTE:	End Term Evaluation (Major Exam) shall be carried out in three stages. Minor I (20 marks), Minor II (20 marks), and Major (50 marks) exams.
	Assignment Marks shall be awarded on students' work in the form of Case Study / Design problem / Presentation / Quiz, which shall be evaluated by the concerned faculty.

Recommended Books:

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Pearson.
2. Alan V. oppenheim and Alan S. Willsky ,Signals and Systems---, PHI
3. A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India,
4. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education.

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Signal Processing Techniques & Applications (ECL 6182)

Subject Name	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Signal Processing Techniques & Applications (ECL 6182)	**CO1**	3	2	1	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	2	3	2	2	2	2	1	2	2	1	3	2	3
	CO3	3	2	3	3	2	2	2	1	2	2	1	3	3	2
	CO4	3	2	3	3	1	3	3	2	3	2	1	3	3	2
	CO5	3	2	3	3	1	2	2	2	3	2	1	3	3	3

ECL 6221				**Integrated Circuit Design**			Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Assignment	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	0	2	4	2 Hours	3 Hours	10	20	20	50	100

Course Outcomes

1. To learn the basic concept of CMOS logic.
2. To study the different inverter circuits and VTC curve.
3. To learn the different sources of power dissipation in digital circuits.
4. To learn the SPICE for logic circuits.
5. To learn the different abstraction levels for designing digital circuits.

Course Contents

Unit I: (5 contact hours)

IC components - their characterization and design. Analysis and design of basic logic circuits. Linear ICs. Large Scale Integration.

Unit II: (12 contact hours)

Basics of MOSFET ,Introduction to digital IC design, MOS inverter-Resistive load ,Depletion load,CMOS inverter,Switching Characteristics of MOS inverter, design of combinational logic gates in CMOS- static and dynamic CMOS -design, CMOS Transmission gates, Power consumption in CMOS gates,Low power CMOS logic ckts ,MOS memory circuits, Bi-CMOS Logic ckts, Design of sequential logic circuits, Set up time,Hold time requirements.

Unit III: (12 contact hours)

Low power design:
Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Physics of power dissipation in CMOS devices.
Device & Technology Impact on Low Power Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

Unit IV: (11 contact hours)

Power estimation, Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems.

NOTE:	End Term Evaluation (Major Exam) shall be carried out in three stages. Minor I (20 marks), Minor II (20 marks), and Major (50 marks) exams.
	Assignment Marks shall be awarded on students' work in the form of Case Study / Design problem / Presentation / Quiz, which shall be evaluated by the concerned faculty.

Recommended Books:

1. R.S. Muller and T.I. Kamins, "*Device Electronics for Integrated Circuits*", Wiley,
2. DA. And Eshrachian K, "*Basic VLSI design systems & circuits*", PHI,
3. Geigar BR, Allen PE &Strader ME, " *VLSI design techniques for analog & digital circuit*",McGraw Hill,
4. Carver Mead and Lynn Conway, "*Introduction to VLSI Systems*", BS Publications, Indian Reprint
5. Neil H. E. Weste& Kamran Eshraghian, "*Principles of CMOS VLSI Design*", Pearson education asia,
6. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP,
7. Rabaey, Pedram, "Low power design methodologies" Kluwer Academic,
8. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley,

9. Rabaey J.M, Chandrakasan A, Nikolic B , "Digital Integrated Circuits- A Design Perspective", Prentice Hall.
10. S M Kang and Y Lebici,"CMOS Digital Integrated Circuits-analysis and design", McGraw Hill.

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Integrated Circuit Design(ECL 6221)

Subject Name	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Integrated Circuit Design(ECL 6221)	**CO1**	3	2	1	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	2	3	2	2	2	2	1	2	2	1	3	2	3
	CO3	3	2	3	3	2	2	2	1	2	2	1	3	3	2
	CO4	3	2	3	3	1	3	3	2	3	2	1	3	3	2
	CO5	3	2	3	3	1	2	2	2	3	2	1	3	3	3

ECL 6110				**Wireless Networks & Protocols**			Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Assignment	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	1	2	5	2 Hours	3 Hours	10	20	20	50	100

Course Outcomes:

1.Students can familiar with basic concept of data communication and computer networks that will further help to understand the different kind of wireless technology.

2. Provide ability to understand the concept of various multiple access techniques, channel diversity, and fading.

3. They can acquire knowledge about Wi-Fi, and WPANs technology.

4. It will help to develop an interest among student to do research in emerging research area as MANETs & WSN.

COURSE CONTENTS

Unit 1 (10 contact hours)

Introduction to Fundamentals of Wireless Communication, Channel Diversity & Fading, Multiple Access Techniques, Wireless LANs: IEEE 802.11 WLANs - protocol architecture, physical layer, MAC layer, analysis, deployment of 802.11 infrastructure

Unit 2 (10 contact hours)

WPANs: IEEE 802.15.4, Bluetooth, ZigBee, UWB. protocol architecture, physical layer, MAC layer, analysis, deployment of 802.15.4 infrastructure

Unit 3 (10 contact hours)

Mobile Ad-Hoc Networks (MANETS): Introduction; MAC Protocols - classification, comparative analysis; Routing - reactive and proactive routing, power-aware routing, performance comparison; Quality of Service

Unit 4 (10 contact hours)

Wireless Sensor Networks (WSNs): Overview/Architectures; Data Dissemination/Data Gathering; MAC Protocols; Routing Protocol, Security, Power control; Cross layer design; Localization

NOTE:	End Term Evaluation (Major Exam) shall be carried out in three stages. Minor I (20 marks), Minor II (20 marks), and Major (50 marks) exams.
	Assignment Marks shall be awarded on students' work in the form of Case Study / Design problem / Presentation / Quiz, which shall be evaluated by the concerned faculty.

Recommended Books:

1. Rappaport, "Wireless Communications – Principles& Practices", PHI, Latest Edition
2. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson Education, Inc.,
3. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons,
4. Charles E Perkins, "Ad Hoc Networking", Addison Wesley,
5. Jochen Schiller, "Mobile Communications", Addison Wesley,
6. Ramjee Prasad and Luis Munoz, "WLANs and WPANs towards 4G wireless", Artech House,
7. Selected papers from IEEE & ACM to be provided by Faculty

Wireless Networks & Protocols (ECL 6110)

Subject Name	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Wireless Networks & Protocols (ECL 6110)	**CO1**	3	2	1	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	2	3	2	2	2	2	1	2	2	1	3	2	3
	CO3	3	2	3	3	2	2	2	1	2	2	1	3	3	2
	CO4	3	2	3	3	1	3	3	2	3	2	1	3	3	2
	CO5	3	2	3	3	1	2	2	2	3	2	1	3	3	3

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ECL7084				**Embedded System Design**			Pre Requisites			
Version R-01							Co-requisites			
L	T	P	C	Minor Duration	Major Duration	Assignment	Minor-I Marks	Minor-II Marks	Major Marks	Total Marks
3	0	2	4	2 Hours	3 Hours	10	20	20	50	100

Course Outcomes

1. To study the Issues and Challenges in Embedded System Design.
2. To study the architectures of RISC and CISC processors.
3. Able to understand the concept of Inter-Integrated Circuit (I2C) Interface, Interrupts, Analog-to-Digital Converter and Controller Area Network (CAN).
4. Able to do programming using Kiel µVision IDE & Simulator.
5. To apply the knowledge for embedded system applications using Keyboards, display, Relays

Course Contents

Unit I: (7 contact hours)

Introduction of Embedded Systems: Hardware/software systems and codesign, Hardware Software synthesis, Hardware Software Interface

Unit II: (8 contact hours)

Modeling: Models of computation for embedded systems, Behavioral design, Requirement Specifications, System Architecture

Unit III: (8 contact hours)

Architectural Aspects: Architecture selection, Hardware software partitioning, scheduling, and communication, resource allocation and binding. Optimization techniques.

Unit IV: (8 contact hours)

Design: Implementation, Simulation, synthesis, and verification, Hardware/software implementation. System level low power and high performance techniques.

Unit V: (5 contact hours)

Methodologies: Design methodologies and tools, Performance analysis and optimization.

Unit VI: (4 contact hours)

Examples: Design examples and case studies

Recommended Books:

1. Embedded System Design by Peter Marwedel, Springer,
2. *Computers as Components* by Wayne Wolf, Morgan Kaufman
3. Readings in Hardware/Software Co-Design by G. De Micheli, Rolf Ernst, and Wayne Wolf, eds. Morgan Kaufmann, **Systems-on-Silicon Series**
4. Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid and Tony D. Givargis, Addison Wesley
5. Programming Embedded Systems in C and C++ by Michael Barr, O'Reilly,
6. An Embedded Software Primer by David E. Simon, Addison Wesley
7. The Art of Designing Embedded Systems by Jack Ganssle, Newnes

NOTE:	End Term Evaluation (Major Exam) shall be carried out in three stages. Minor I (20 marks), Minor II (20 marks), and Major (50 marks) exams.
	Assignment Marks shall be awarded on students' work in the form of Case Study / Design problem / Presentation / Quiz, which shall be evaluated by the concerned faculty.

Embedded System Design(ECL 7084)

Subject Name	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Embedded System Design (ECL 7084)	**CO1**	3	2	1	2	2	2	2	1	2	2	1	3	3	3
	CO2	3	2	3	2	2	2	2	1	2	2	1	3	2	3
	CO3	3	2	3	3	2	2	2	1	2	2	1	3	3	2
	CO4	3	2	3	3	1	3	3	2	3	2	1	3	3	2
	CO5	3	2	3	3	1	2	2	2	3	2	1	3	3	3