SNDT Women's University

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Syllabus M.Tech.

in

Electronics and Communication

SNDT Women's University

1, Nathibai Thackersey Road,

Mumbai 400 020 Revised – 2013

	SNDT Women's University 1, Nathibai Thackersey Road, Mumbai 400020

SNDT Women's University

SCHEME OF INSTRUCTION AND EVALUATION

Programme: M.Tech (Electronics and Communication)

Scheme for Semester I

Sr. No	Subjects	No. of Periods per week (60 minutes each)			Credits	Duration of Theory papers (Hours)	Marks			
		Lecture	Practical	Tutorial			Theory (%)	Term-work(%)	Oral	Total (100%)
1	Statistical Signal Analysis	3		2	4	3	50	50		100
2	Research Methodology	3		-	4	3	50	50		100
3	Error correcting code	3		2	4	3	50	50		100
4	Advance Computer Network	3			4	3	50	50		100
5	Elective-I	3		-	4	3	50	50		100
6	Seminar		4		2			50	50	100
Total….		**15**	**14**	**04**	**24**	**-**	**250**	**300**	**50**	**600**

Scheme for Semester II

Sr. No	Subjects	No. of Periods per week (60 minutes each)			Credits	Duration of Theory papers (Hours)	Marks			
		Lecture	Practical	Tutorial			Theory	Term-work	Oral	Total
1	Optical Network	3		-	4	3	50	50		100
2	Electronic Warfare system	3		2	4	3	50	50		100
3	Advance Wireless communication	3		-	4	3	50	50		100
4	R&D Project	-	4	-	2	-	-	50	50	100
5	Network Planning , Design and Management	3		2	4	3	50	50		100
6	Elective -II	3		2	4	3	50	50		100
Total….		**15**	**4**	**6**	**24**	**-**	**250**	**300**	**50**	**600**

Scheme for Semester III

Sr. No	Subjects	No. of Periods per week (60 minutes each)			Credits	Duration of Theory papers (Hours)	Marks			
		Lecture	Practical	Tutorial			Theory	Term-work	Oral	Total
1	Adaptive signal processing	3		2	4	3	50	50		100
2	Digital Message Transmission	3		2	4	3	50	50		100
3	Elective-III	3		2	4	3	50	50		100
4	Stage-I Project		8		8			100	100	200
5	Seminar/Project				4			50	50	100
Total….		**9**	**8**	**6**	**24**	**-**	**150**	**300**	**150**	**600**

Scheme for Semester IV

Sr. No	Subjects	No. of Periods per week (60 minutes each)			Credits	Duration of Theory papers (Hours)	Marks			
		Lecture	Practi-cal	Tuto-rial			Theory	Term-work	Oral	Total
1	Project–II Dissertation Report		2	-	12			150	150	300
2	Project-II Dissertation Viva		2	-	12			150	150	300
Total….			**6**		**24**	**-**		**150**	**150**	**600**

Elective List for M.Tech Electronics and Communications

Students are required to select any one group. Once the group is selected it will be maintained for three semesters

Group Number	Group Name	Elective-I	Elective-II	Elective-III
Group-I	VLSI	VLSI Design	Mix Design using VLSI	VLSI Signal Processing
Group-II	HF Communication System	RF Circuit	RADAR and Navigations	Satellite Communication
Group-III	Signal Processing	Image Processing	Computer Vision	Speech Processing

Semester I

E501 Statistical Signal Analysis

	Objective :- To understand and study the statistical nature of signals and behavior of the systems.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Review of probability theory and random variables: Transformation (function) of random variables Conditional expectation	06	10
2	Sequences of random variables: convergence of sequences of random variables.	04	10
3	Stochastic processes: wide sense stationary processes, orthogonal increment processes, Wiener process, and the Poisson process, KL expansion.	08	20
4	Ergodicity, Mean square continuity, mean square derivative and mean square integral of stochastic processes.	08	20
5	Stochastic systems: response of linear dynamic systems (e.g. state space or ARMA systems) to stochastic inputs; Lyapunov equations; correlational function; power spectral density function; introduction to linear least square estimation, Wiener filtering and Kalman filtering.	14	40
		40	100

Text and Reference Books:

1. A. Papoulis, Probability, Random Variables and stochastic processes, 2nd Ed., McGraw Hill, 1983.

2 . A. Larson and B.O. Schubert, Stochastic Processes, Vol.I and II, Holden-Day, 1979.

3.. Gardener, “Stochastic Processes”, McGraw Hill, 1986

E502 Research Methodology

Research Methodology for Technology

	Objective:- To understand the basic process and steps of research in engineering, and study various presentation models of research.	
Sr. No	**Topics and Details**	**Weightage in %**
1	Research Basic: What is research, Importance of Research, Role of research in society, aims and Objective of Research, Literature Survey, purpose and use of literature survey, various resources for literature survey, presentation of compiled literature reviews of various models and methods in literature survey. Identification of thrust areas, formulation of Problems, research objectives.	25%
2	Design of research:-Problem Definition, Data collection, steps in design process, Introduction to various statistical tools for data analysis, modeling, simulation packages and tools, characterization of Experimental process.	25%
3	Research Presentation:- Research paper writing, paper presentation, Introduction to presentation tools, thesis writing, introduction to tools for writing thesis and graphics for presentation of thesis. Introductions to patents, process of filing patents etc.	25%
4	Ethics and Morals in Research:-Issues related to Plagiarism, acknowledgements, intellectual property rights, copy rights etc Project proposal suggested by BOS	25%

Text and Reference Books:

1. Kothari C K, “Research Methodology Research and Techniques” second Ed, Vishwa Prakashan, New Delhi, 2009.
2. Montgomery, Douglus C, “Design and Analysis of Experiment” 5th Edition, Wiley India, 2007.
3. Murry R, “How to write Thesis” 2ed Tata Mc Graw Hill, 2010.

E602 Error Correcting Codes

	Objective :- To study and understand various error correcting codes, in discrete , wireless and optical communications, with its various properties and analysis.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Linear block codes : Systematic linear codes and optimum decoding for the binary symmetric channel;	08	15
2	Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes.	08	20
3	Introduction to finite fields and finite rings; factorization of (X^{n-1}) over a finite field; Cyclic Codes.	04	15
4	BCH codes; Idempotent and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes.	06	15
5	Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm.	06	15
6	Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.	08	20

Texts and Reference Books

1.F.J. MacWilliams and N.J.A. Slone, The theory of error correcting codes,

North Holland, 1977.

2.R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

Advance Communication Network

	Objective:- To study the latest trends in networking, characterization of networks, its models, traffic analysis.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Overview of Internet-Concepts, challenges and history. Overview of high speed networks-ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.	06	15
2	Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (intServ). Resource reservation in Internet. RSVP.	06	15
3	Characterization of Traffic by Linearly Bounded arrival Processes (LBAP). Concept of (o,, p) regulator. Leaky bucket algorithm and its properties.	04	10
4	Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design.	04	10
5	Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management.	04	10
6	IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producting and controlled prefix expansion algorithms.	04	10
7	Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework.	06	15

8	IP switching and MPLS-Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS. [P control of Optical Routers. Lamda Switching, DWDM Networks	06	15

Text and Reference Books:

1. Jean Wairand and Pravin Varaiya, High Performance Communications Networks, Second Edition, 2000
2. Jean Le Boudec and Patrick Thiran, Network Calculus A Theory of Deterministic Queueing Systems for the Internet, Springer Veriag, 2001.
3. Zhang Wang, Internet Qo,5, Morgan Kaufman 2001
4. George Kesidis, ATM Network Performance, Kluwer Academic, 2000 5. Research Papers.

Semster –II

E510 Optical Network

	Objective:- To study and understand the advancements in optical components and architectures from the view of the networks for access and backbone networks.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Introduction to Optical Networks: Multiplexing technique, Optical Packet switching, Network evolution	04	20
2	Propagation of signal in Optical fiber : Chromatic Dispersion, Nonlinear Effects	06	15
3	Components: Couplers, Multiplexers, Isolators, Switches, Wavelength converters, Modulation, Subcarrier Modulation, Spectrum Efficiency, Optical Duobinary Modulation, Demodulation	04	15
4	Client layers of Optical layer, Storage area network, Gigabit and 10Gigabit Network, WDM Network elements, Optical ADD/DROP Mux, Optical Cross connects	06	15
5	WDM Network Design, LTD and RWA problem, Dimensioning wavelength Routing	10	15
6	Access Network , PON evolution, Photonic packet switching, Optical TDM, Synchronization, Buffering and burst switching	10	20
		40	100

Text and Reference Books:

1. Rajiv Ramaswami, Kumar N Sivarajan, Optical Networks: A Practical Prespecctive,

Morgan Kauffman

2. Siva Ram Murthy and Mohan Guruswamy, WDM optical Networks, Prentice Hall India, 2002

3 J.E. Midwinter, Optical fibers for transmission, John Wiley, 1979.

4. J.Gowar, Optical communication systems, Prentice Hall India, 1987.

5. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.

6. G.Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.

7. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1992

8. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

E503 Electronics Warefare System

	Objective:- To understand the architecture, design and analysis of various electronics systems in warfare with latest trends.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
	Objective :- Know electronics Warfare Principles, Design principles of EW receivers and transmitters subsystem and Modules.		
1	Introduction:- Electronics Warfare, ELINT, SIGINT, ESM and ECM definitions, RADARS and EW mutual interaction.	04	10
2	Passive Systems:- Purpose, defense Chaff, Decoys, Advantages, Disadvantages, ECCM aspects, Surveillance (ESM) Characteristic such as Noise Figure, Noise skirt, Noise floor, sensitivity, Dynamic Range ECCM aspects. Active Systems:- Defense Characteristics, Noise floor, Modulation, power output, Dynamic range, Advantages, Disadvantages, ECCM aspects.	04	10
3	Surveillance (ESM):- Direct receivers Advantages/disadvantages, ECM aspects database EPL, Parameter list, ECM aspects, Super heterodyne (indirect) receivers:- scanning receivers advantages, disadvantages, wide open receivers advantages disadvantages, frequency scanning and space scanning.	04	10
4	Wide Open Receiver:- Segmentation frequency, IFM,DFD, Space, IDF, Array receivers frequency and Space:- Space coverage, Frequency Coverage, Advantages, Disadvantages.	04	10

5	Active Systems:- Defense, Data integration and receivers, on board systems, off board systems, dispensable, reusable, ECCM aspects.	04	10
6	Low Power Units:- Avoidance- Jammers, CW, FM, Noise Modulation, Spot, SSN, pulse Wobulation, staggers, Deception FML Pulse, CW, DRFM AM< FM, PM, Pulse CW, Rage Deception RGPO, RGPI, Hooks, Angular Deception, Radar Scan types, Related Deception Techniques.	08	20
7	High Power Units:- Real beam transmitter, MBAT, Phased arrays	08	20

Suggestion by the BOS

Text and Reference Books:

1. Rechard Poissel, "Introduction to Communication Electronics Warefare Systems" 2nd Edition, Artech House Intelligence and Information Operations, 2012.
2. Rechard Poissel, " Target Acquisition in Electronics Warefare Systems", 2nd Artech House Intelligence and Information Operations, 2012
3. D Curties Schleher, " Electronics Warfare, in information age" Artech House Radar Library, 2012.

E512 Advance Wireless Communication

	Objective:- To understand and study the latest trends and standards in wireless Communication for voice/ data/multimedia and other applications		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	**Basics of Communication Engineering:** Analog and Digital signal formats, RF fundamentals, Information capacity.	04	10
2	**RF Engineering and Signal Processing:** Introduction to mobile communication systems; GSM, CDMA 2000, UMTS and UTRAN technologies. Transmission, reception, propagation, channel modeling, and signal processing; system performance and reliability; path loss; effects of different fading and empirical path loss models; antennas & antenna arrays; coverage and interference prediction maps; optimize the coverage of a radio; RF system measurements.	10	25
3	**Wireless Access Technologies:** Wireless access networks, physical, MAC, and link layers. Building blocks, multiple access, mobility management, and spectrum implications in wireless access system design; design considerations to optimize capacity/coverage; bandwidth for a wireless system and tradeoffs; wireless access technology standards, their features, and evolution. **Multiple access technologies:** MIMO channels, uplink & downlink with multiple receive antennas, space division multiple access (SDMA) , capacity region, SDMA with multiple transmit antennas, OFDM systems.	10	25

4	**Network and Service Architecture:** Network infrastructure, including core networks; service frameworks such as IMS; and application architectures such as voice, video streaming, and messaging. All-IP services architecture as in 3GPP Rel 6 and beyond, including Enhanced Packet Services (EPS) as in 3GPP Rel 8 LTE (Long Term Evolution) and EPC (Enhanced Packet Core). Service platforms, IP addressing schemes for various technologies; Quality of service (QoS); Load-balancing scheme; IP routing and ad hoc routing and mesh protocols; Capacity planning, error tracking, and trace analysis; evolution of mobile networks to enable IP multimedia.	10	25
5	**Network Management and Security:** Fault, configuration, account, performance, maintenance, security management, management availability, and operation support systems. Fault monitoring system and performance monitoring system; types and methods of alarm reporting; availability and reliability metrics; potential impacts of known security attacks. **Analytical methods:** Probability theory in signal processing, Linear Algebra.	06	15
		40	100

Texts and Reference Books:

1 Wireless & Mobile Systems by Dharma Prakash Agarwal & Qing Ann Zeng

2. Mobile Cellular Telecommunications Systems by WCY Lee.

3. Mobile Radio Communications by Raymond Steele.

4. CDMA: Principles of Spread Spectrum Communications by A.J Veterbi.

5. VK Garg and JE Wilkes, Wireless and personal Communication Systems,

Prentice Hall, 1996.

Network and Service Management

	Objective:- To understand the various architectures, tools and standards in network and service management.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Introduction to network management	02	05
2	Network management architectures and application, Functions. SNMP version 2 and 3	06	15
3	Remote network monitoring statics collections, alarms, filters, traffic monitoring etc. Network management tools, systems and applications	08	20
4	Traffic sizing, Traffic Characteristics, Traffic Engineering and capacity planning	08	20
5	Technology Comparisions, Choosing the service provider	08	20
6	Access Network Design, Backbone Network Design	08	20
		40	100

Text and Reference Book:

1. Becker, Hal B., Functional Analysis of Information Networks: A Structured

2. Approach to the Data Communications Environment, John Wiley and Sons, New York,l973.
3. Flood, J. E. (ed.), Telecommunications Networks, International Scholarly Book
4. Services,ForestGrove,Oregon,l976. Kuehn, Richard A., Cost-Effective Telecommunications,AmericanManagementAssociation,NewYork,l975.
5. Martin, James Future Developments in Telecommunications, Prentice-Hall,
6. Martin, James, Telecommunications and the Computer, Prentice-Hall, Englewood Cliffs, NewJersey,1976.
7. Martin, James, Teleprocessing Network Organization, Prentice-Hall, Englewood
8. Darren L SPOHN, "Data Network Design, 3rd Edition , Tata Mcgraw Hill Edition,2002

Semster-III

E601 Adaptive Signal processing

	Objection:- To understand and study various tool and algorithm for signal to have least error and BERs.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Review of linear and non-linear estimation theory. Signal modelling. Optimal filtering	08	20
2	Adaptive filtering as an extension of the optimal least mean square error case	08	20
3	Adaptive algorithms: adaptive equalization and echo cancellation; adaptive lattice filters.	08	20
4	Application to radar, sonar, geophysics and hydrology, economic processes	08	20
5	Least Mean square, RMS Algorithm	08	20
		40	100

Text and Reference Book:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.

2. B. Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

E503 Digital Message Transmission

	Objective:- To study the statistical analysis of various digital communication messages from signal and system design aspect.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Examples of analog pulse and digital transmission systems	04	10
2	Performance analysis of analog and pulse modulation systems.	04	10
3	Role and review of probability theory and stochastic processes in digital message transmission.	04	10
4	Principles of detection theory: Binary and m-ary hypothesis testing. Bayes' likelihood ratio test.	04	10
5	Principles of detection theory: Performance analysis of digital communication systems.	04	10
6	Spectrum of digital signals: Spectral efficiency of digital communication systems; Nyquist pulse shaping. Correlative coding schemes.	08	20
7	Equalization techniques	08	20
8	Synchronization techniques. Carrier, bit and frame synchronization schemes	04	10
		40	100

Text and Reference Books:

1.Wozencraft J.M. and Jacobs I.M., Principles of Communication Engineering, John Wiley, 1965.

2.Carlson A., Communication Systems, 3rd ed., McGraw Hill, 1986.

3.Van Trees H.L., Detection Estimation and Modulation Theory, Vol. 1., Wiley, 1968.

4.Proakis J.J., Digital Communications, 2nd Ed., McGraw Hill, 1989.

5.Blahut R.F., Digital transmission of Information, Addison Wesley 1990.

6.Benedetto S., Biglieri E. and Castellari V., Digital Transmission Theory, Prentice Hall, 1987.

Electives

Group I :

VLSI Design

	Objective :- To study the process and steps in VLSI design.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Review of Microelectronics and Introduction to MOS Technologies: MOS, CMOS, BiCMOS Technology, Trends And Projections. Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits: Ids-Vds Relationships,Thereshols voltage Vt, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.	08	20
2	LAYOUT DESIGN AND TOOLS: Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools. LOGIC GATES & LAYOUTS: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.	08	20
3	COMBINATIONAL LOGIC NETWORKS: Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.	08	20

4	SEQUENTIAL SYSTEMS: Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.	08	20
5	FLOOR PLANNING & ARCHITECTURE DESIGN: Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.	08	20
		40	100

Texts and Reference Books

1. Essentials of VLSI Circuits and Systems, K. Eshraghian Eshraghian.

   D, A.Pucknell, 2005, PHI.

2. Modern VLSI Design - Wayne Wolf, 3rd ed., 1997, Pearson Education.

3 Principals of CMOS VLSI Design – N.H.E Weste, K.Eshraghian, 2 ed., Adisson Wesley.

MIXDESIGN VLSI

	Objective :- To study and understand the mixed signal approach, its necessary and implementation with VLSI design.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Introduction to Mixed-signal design; Advanced data converters: Working principle and architecture of a folding-and-interpolation ADC, Design of sample and hold amplifier, Design of folding amplifier and interpolation network, Design of decimation filter, Working principle and architecture of a Sigma-delta ADC, Design of basic and multistage sigma-delta converters, Working principle and architecture of a pipeline ADC.	10	25
2	Design of one-and-half-bit converter, Working principle and various architectures of high speed DAC, Working principle and architecture of a high resolution DAC; Clock and timing: Block diagram of a PLL, PLL based frequency synthesizer, Application and block diagram of a DLL, Design of a multiphase generator; Implementation of system on a chip and the associated issue: Precautionary measure for integrating analog and digital modules within an IC, Signal integrity, floor planning and physical design of mixed signal IC design.	10	25
3	Overview of RF system: Introduction to RF Transceiver architectures, Multiple access techniques, Different wireless standards, Various modulation techniques used in RF system.	10	25
4	Aspects and considerations of RF design: Low voltage and low power design, RF-models of devices; Building blocks of RF: Design of oscillator and mixer, Frequency synthesizer, Design of low noise amplifiers, Design of narrowband and wideband amplifiers, Design of high efficiency power amplifier, Matching network design; RF system design and testing: Design of RF system, Noise and distortion measures and mitigation methods.	10	25
		40	100

Texts and Reference Books:

1. CMOS mixed-signal circuit design by R. Jacob Baker, Wiley India, IEEE press, reprint 2008.
2. CMOS circuit design, layout and simulation by R. Jacob Baker Revised second edition, IEEE press, 2008.
3. Design of analog CMOS integrated circuits by Behad RazaviMcGraw-Hill, 2003.
4 . Y.P. Tsividis Mixed Analog and Digital VLSI Devices and Technology, McGraw Hill,1996

VLSI for Signal Processing

	Objective :- To study and understand the need for VLSI design for signal processing, its requirements and various process.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	**UNIT I INTRODUCTION TO DSP SYSTEMS** Introduction To DSP Systems -Typical DSP algorithms; Iteration Bound – data flow graph representations, loop bound and iteration bound, Longest path Matrix algorithm; Pipelining and parallel processing – Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power.	10	25
2	**UNIT II RETIMING** Retiming - definitions and properties; Unfolding – algorithm for Unfolding, properties of unfolding, sample period reduction and parallel processing application; Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, parallel architectures for rank-order filters, Odd- Even Merge- Sort architecture, parallel rank-order filters	10	25
3	**UNIT III FAST CONVOLUTION** Fast convolution – Cook-Toom algorithm, modified Cook-Took algorithm; Pipelined and parallel recursive and adaptive filters – inefficient/efficient single channel interleaving, Look- Ahead pipelining in first- order IIR filters, Look-Ahead pipelining with power-of-two decomposition, Clustered Look-Ahead pipelining, parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters, pipelined adaptive digital filters, relaxed look-ahead, pipelined LMS adaptive filter.	10	25
4	**UNIT IV BIT-LEVEL ARITHMETIC ARCHITECTURES** Scaling and roundoff noise- scaling operation, roundoff noise, state variable description of digital filters, scaling and roundoff noise computation, roundoff noise in pipelined first-order filters; Bit-Level Arithmetic Architectures- parallel multipliers with sign extension, parallel carry-ripple array multipliers, parallel carry-save multiplier, 4x 4 bit Baugh-Wooley carry-save multiplication tabular form and implementation, design of Lyon‟s bit-serial multipliers using Horner‟s rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner‟s rule for precision improvement.	10	25

5	**UNIT V PROGRAMMING DIGITAL SIGNAL PROCESSORS 9** Numerical Strength Reduction – subexpression elimination, multiple constant multiplications, iterative matching. Linear transformations; Synchronous, Wave and asynchronous pipelining-synchronous pipelining and clocking styles, clock skew in edge-triggered single-phase clocking, two-phase clocking, wave pipelining, asynchronous pipelining bundled data versus dual rail protocol; Programming Digital Signal Processors – general architecture with important features; Low power Design – needs for low power VLSI chips, charging and discharging capacitance, short-circuit current of an inverter, CMOS leakage current, basic principles of low power design.		
		40	100

Texts and Reference Books

1. Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation", Wiley Inter Science, 1999.
2. Gary Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic Publishers, 1998.
3. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", Mc Graw-Hill, 1994.

Group-II High Frequency Communication

E511 RF Circuit Design

	Objectve :- To study, understand and design various RF circuits.		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Introduction: Importance of RF design, RF behavior of Passive Components	04	10
2	RF Filter Design, Basic Resonator and Filter configuration, Filter types and parameters, Special Filter Realizations Butterworth type Filters, Chebyshev type filters, Coupled Filters	06	20
3	RF component modeling, Diode models, Transistor Models, Measurement of Active Devices RF Transistor Amplifier Design Characterstics of Amplifiers, amplifier Power relations, Stability Considerations, Broad band , high power and multistage amplifiers	12	25
4	Oscillator and mixers, Basic Oscillator Model, High frequency Oscillator Configuration, Fixed Frequency oscillator, Dielectric Resonator Model, Voltage controlled Oscillator, Gunn Element Oscillator, Basic characterstics of Mixers, Frequency Domain Considerations, Single ended Mixer design, Single balanced mixer	12	25
5	Introduction to Microstrip Lines	06	25
		40	100

Text and Reference Books

1. Reinhold Ludwig, Pavel Bretchko, " RF circuit Design."Pearsons 2001

2. R. Collin "Foundation of Microwave Engineering". 2nd Edition, Mc Graw Hill

3 Samuel Liao, "Microwave circuits and devices", 2nd ed. PHI, 1987

RADAR and Navigations

Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Radar and systems :- Overview, EW overview, ELINT, SIGINT, ESM and ECM definitions	7	15
2	Radar:- Principles, cross sections, equations, parameters such as frequency, PRI/PRF PW	7	15
3	Types of Radars:- Bistable, Pulse, FM/CM, CW Doppler, pulse Doppler, Pulse compression	10	20
4	Search Radars:- Range and direction detection, space coverage search radars	7	15
5	Tracking and locking Radars:- search phase, Track phase, Lock Phase, scanning type search radars, CS COSRO, LS, LORO, TWS, Mono Pulse	10	20
6	Application of RADARs in defense, navigation and other applications	7	15

Text and Reference Books:

1.M.I.Skolnik, Introduction to Radar Systems, McGraw Hill, 1980.

2.D.K.Barton, Modern radar systems analysis, Artech House, 1988.

3.B,Edde, Radar: Principles, Technology, Applications, Prentice Hall, 1993.

Satellite Communication

Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	**Introduction :** • Origin of Satellite Communication. • Development, Space Segment, Ground Segment • Types of Orbit • Evolution of Satellite Communications, Development of Service		
2	**Link Analysis :** • Characteristic parameters of an antenna, Received Signal Power at receiver input. • Carrier to noise ratio fat the receiving input, Influence of the propagation medium. • Compensation for the effects of the propagation medium constraints, Signal to noise ratio for a station-to-station link.		
3	**Regenerative Satellite Networks :** • Transparent and regenerative repeaters. • Comparison of link budgets on board processing, Impact to the earth segment. Orbits • Keplerian Orbits, Useful orbits for Satellite Communication. • Perturbations of the Orbits.		
4	**Earth Stations :** • Station Organisation, Radio Frequency Characteristics, Antenna subsystems. • Radio Frequncy subsystem Communication subsystem		

5	**Communication Payload :** • Mission and Characteristics of the payload. • Transparent repeaters, Multibeam Satellite repeaters, Regenerative repeater • Antenna Coverage, Antenna Characteristics. Platform • Subsystems, Attitude Control, Propulsion Subsystem, Electric Power supply, Telemetry, Tracking and Command, Thermal Control and Structure		
6	**Satellite Installation and Space Environment** • Installation in orbit. Vaccum Mechanical Environment, Radiation flux of high energy particles, Environment during Installation, Satellite System availability. Component reliability.		

Text and Reference Books:

1. Satellite Communication Systems Techniques and Technology (3rd edition, Maral and M. Bousquet. John Wiley and sons.
2. VASAT Networks G. Maral, John Wiley and Sons.
3. Satellite Communication, Firs quarter century of Service David W.E. Rees John Wiley & Sons
4. Satellite Communications Systems Design Principles – Richard M. McGraw Hill.
5. CDMA, Principles of Spread Spectrum Communication – Andrew J. Virebi, Addition – Wiley 1995.

Group-III: Signal Processing Group

Image Processing

	Objectives: **1. Identify, formulate and solve digital signal and image processing problems in a multidisciplinary environment, individually or as a member of a team.** **2. Analyze, design and make use of systems, procedures and algorithms in order to achieve the proposed goals in a specific digital signal processing problem, making use of simulation, analysis and application development tools in this area (MATLAB), and to analyze and understand the given results.**		
Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Image representation-Gray scale and colour Images, image sampling and quantization.	04	10
2	Two dimensional orthogonal transforms-DFT, FFT, WHT, Haar transform, KLT, DCT.	08	20
3	Image enhancement - filters in spatial and frequency domains, histogram-based processing, homomorphic filtering.	04	10
4	Edge detection - non parametric and model based approaches, LOG filters, localisation problem.	03	05
5	Image Restoration - PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods.	04	10
6	Mathematical morphology - binary morphology, dilation, erosion, opening and closing, duality relations, gray scale morphology, applications such as hit-and-miss transform, thinning and shape decomposition.	04	10
7	Computer tomography - parallel beam projection, Radon transform, and its inverse, Back-projection operator, Fourier-slice theorem, CBP and FBP methods, ART, Fan beam projection	04	10

8	Image communication - JPEG, MPEGs and H.26x standards, packet video, error concealment. Image texture analysis - co-occurence matrix, measures of textures, statistical models for textures.	06	20
9	Hough Transform, boundary detection, chain coding	03	05
		40	100

Texts and Reference Books

1.A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.

2.R.M. Haralick, and L.G. Shapiro, Computer and Robot Vision, Vol-1, Addison Wesley, Reading, MA, 1992.

3.R.Jain, R.Kasturi and B.G. Schunck,Machine Vision,McGraw-Hill International Edition, 1995.

4. W. K. Pratt, Digital image processing, Prentice Hall, 1989.

5. A. Rosenfold and A. C. Kak, Digital image processing, Vols. 1 and 2, Prentice Hall, 1986.

6. H. C. Andrew and B. R. Hunt, Digital image restoration, Prentice Hall, 1977

Computer Vision

Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Imaging model and geometry: scene radiance and image irradiance, reflectance model of a surface, Lambertian and specular reflectance, photometric stereo.	08	20
2	Ill-posedness of vision problems: regularization theory.	06	15
3	Shape from shading, structured light and texture. Optical flow, structure from motion and recursive motion analysis. Stereo vision and correspondence problem.	08	20
4	Depth analysis using real-aperture camera: depth from defocused images.	04	10
5	MRF approach to early vision problems: (shape from shading, matching, stereo and motion), Image texture analysis	06	15
6	Introduction to image understanding.	04	10
7	Integrated vision, sensor fusion.	04	10

Suggestion by the BOS IEEE Biometric certification

Texts and Reference Books:

1 B. K. P. Horn, Robot Vision, MIT Press, 1986.

2.D. Marr, Vision, Freeman and Co., San Francisco, 1982

Speech Processing

Sr. No	**Topics and Details**	**No. of Hours**	**Weightage in %**
1	Speech production and acoustic phonetics, speech perception.	04	10
2	Speech analysis: time and frequency domain techniques for pitch and formant estimation, cepstral and LPC analysis.	08	20
3	Speech synthesis: articulatory, formant, and LPC synthesis, voice response and text-to-speech systems.	08	20
4	Applications: data compression, vocoders, speech enhancement, speech recognition, speaker recognition, aids for the speech and hearing impairments.	20	40

Texts and Reference Books:

1.D O'Shaughnessy, Speech Communication: Human and Machine, Addison Wesley, 1987.

2.L R Rabiner and RW Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978.

3.JL Flanagan, Speech Analysis, Synthesis, and Perception, Springer Verlag, 1972.