SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF ENGINEERING & TECHNOLOGY

ELECTRONICS & TELECOMMUNICATION ENGINEERING

Syllabus Structure for

M.E. (Electronics & Telecommunication Engineering)

4 Semester PG Programme

To be effective from 2015-16

Semester-I

Sr. No.	Subject	Teaching Scheme		Examination Scheme				Credits Assigned	
				Theory		Pract/TW			
		Theory	Pract	ESE	ISE	ESE	ISE	Theory	Pract
1	Research Methodology	3	1(T)	70	30	-	-	3	1(T)
2	Antenna Theory and Design	3	2	70	30	-	25	3	1
3	Probability & Stochastic Processes	3	2	70	30	-	25	3	1
4	Advanced Network Systems	3	2	70	30	-	25	3	1
5	Elective - I	3	1(T)	70	30	-	25	3	1(T)
6	Seminar- I	-	2	-	-	-	50	-	2
	Total	15	10	350	150	-	150	15	7
		Total=25		**Total=650**				**Total=22**	

Elective- I : 1. Optical Networks

2. Speech & Video Processing

3. Advanced VLSI Design

Note –

Students have to select any one course from Elective -I

Semester-II

Sr. No.	Subject	Teaching Scheme		Examination Scheme				Credits Assigned	
				Theory		Pract/TW			
		Theory	Pract	ESE	ISE	ESE	ISE	Theory	Pract
1	RF and Microwave Circuit Design	3	2	70	30	-	25	3	1
2	Advanced Signal Processing	3	2	70	30	-	25	3	1
3	Wireless Communication	3	1(T)	70	30	-	-	3	1(T)
4	Cryptography & Network Security	3	2	70	30	-	25	3	1
5	Elective - II	3	1(T)	70	30	-	25	3	1(T)
6	Seminar- II	-	2	-	-	-	50	-	2
Total		15	10	350	150	-	150	15	7
		Total=25		**Total=650**				**Total=22**	

Elective- II : 1. Wireless Sensor Network & Optimization.

2. Wavelet Transform & Applications.

3. Advanced Embedded Systems.

Note –

- ***Students have to select any one course from Elective –II***

Semester-III

Sr. No.	Subject	Teaching Scheme		Examination Scheme				Credits Assigned	
				Theory		Pract/TW			
		Theory	Pract	ESE	ISE	ESE	ISE	Theory	Pract
1	**Self Learning**	$	-	70	30	-	-	3	-
2	**Lab Practice**	-	2	-	-	-	25	-	1
3	**Dissertation Phase-I:** Synopsis Submission Seminar*(Format to designed)(ISE)	-	4@			-	75	-	3
	Dissertation Phase-II: Term work *(ISE)	-	-			-	100	-	3
	Dissertation Phase-II: Progress Seminar* Presentation(ESE)	-	-			200	-	-	6
Total		-	6	70	30	200	200	3	13
		Total=6		**Total=500**				**Total=16**	

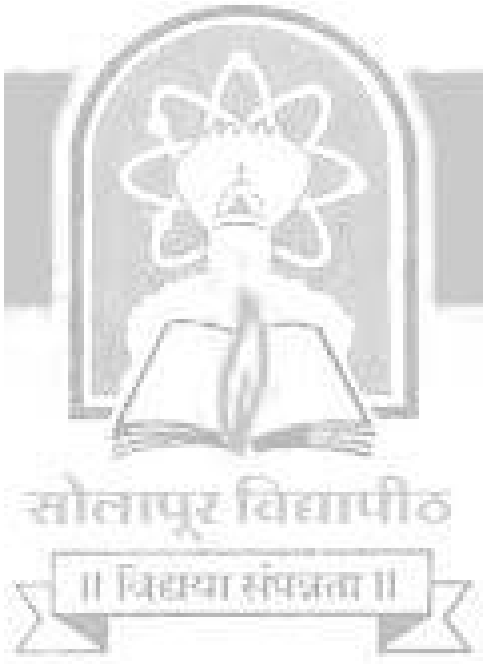
Self Learning Corses :

1. Internet of Things
2. Software Defined and Cognitive Radio
3. Modeling & Simulation of Communication System

- $-Being a self learning subject ,student shall prepare for examination as per specified syllabus.
- *****-For all activities related to desertation phase I (Synopsis submission seminar and progress seminar) student must interact regularly every week with the adviser.\
- Synopsis submission seminar shall cover detailed synopsis of the proposed work.Student shall submit synopsis of desertation work only after delivering this seminar.
- Progress seminar shall be delivered capturing details of the work done by student for desertation.

- Student shall deliver all seminar using modern presentation tools. A hard copy of report shall be submitted to the department before delivering the seminar .A PDF copy of report must be submitted to the adviser along with other details if any.
- Lab practice shall include any of the below activities related to desertation work and recommended by advisor.Student shall submit report after completion of the activity to the advisior –

  Software assignments ,learning new software ,hardware realization ,literature survey,filed work,Industrial traing etc.
- @ Indicates contact hours of student for interaction with advisior.
- Details of mode of assignment of seminar and desertation shall be as specified in 7(III) of PG Engineering ordinance of Solapur University ,Solapur



Semester-IV

Sr. No.	Subject	Teaching Scheme		Examination Scheme				Credits Assigned	
				Theory		Pract/TW			
		Theory	Practical	ESE	ISE	ESE	ISE	Theory	Pract
1	**Dissertation Phase-III:**Progress Seminar #(ISE) Dissertation Phase IV: Term work #(ISE)	-	4@	-	-	-	100	-	4
2	**Dissertation Phase-IV:**Term Work#(ISE)	-	2@	-	-	-	200	-	6
3	**Final submission of Dissertation** and Viva-voce(ESE)	-	-	-	-	200	-	-	6
Total		-		-	-	200	300	-	16
		Total = 6		**Total=500**				**Total=16**	

- **#**-For all activities related to dissertation phase-II student must interact regularly every week with the advisior .
- Progress seminar shall be delivered capturing details of the work done by student for desertation.
- Student shall deliver all seminar using modern presentation tools. A hard copy of report shall be submitted to the department before delivering the seminar .A PDF copy of report must be submitted to the adviser along with other details if any.
- Student must submit hard copy of project report to the department .
- @ Indicates contact hours of student for interaction with advisior.
- Details of mode of assignment of seminar and desertation shall be as specified in 7(III) of PG Engineering ordinance of Solapur University ,Solapur.

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-I

RESEARCH METHODOLOGY

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hrs. /Week	**Tutorial Credit -** 1.0

SECTION-I

UNIT I: Research Fundamentals **(6 Hrs.)**

Definition, objectives, motivation, types of research and approaches, research- descriptive, conceptual, theoretical, applied and experimental.

UNIT II: The Initial Research Process **(6 Hrs.)**

Literature review, research design, assortment of the problem, identification of problem, defining a problem, objective, sub objective and scope, assumptions, validation criteria, research proposal(synopsis).

UNIT III: Mathematical Modeling And Simulation **(8 Hrs.)**

Mathematical modeling – need, techniques and classification, system models –types, static, dynamic, system simulation – why to simulate, technique of simulation, Monte Carlo simulation, types, continuous modeling, discrete model.

SECTION - II

UNIT IV: Probability And Statistics In Simulation **(6 Hrs.)**

Role of probability and statistics in simulation, statistical distributions, inference about the difference in means, statistical output analysis.

UNIT V: Design of Experiment **(6 Hrs.)**

Strategy of experimentation, types, basic principle, guidelines, need of precision, types of errors.

UNIT VI: Report Writing And Presentation of Results **(5 Hrs.)**

Need, report structure, formulation, sections, protocols, graphs, tables, IEEE format, evaluation of report, writing abstract, writing technical paper.

UNIT VII: Information Communication Technology **(3 Hrs.)**

Introduction, e-research, indices, patents, virtual lab, digital lab, ethical issues in research.

Term work:

*Term work shall consist of minimum **six assignments** based upon above syllabus*

Reference books:

1. Fundamental of Research Methodology and Statistics, Yogesh Kumar Sing, New Age International Publishers
2. Research Methodology: Methods and Techniques, C.R. Kothari, New Age International Publishers, 2nd revised Edition
3. Research Methodology, Concepts and Cases, Deepak Chawla, Neena Sondhi, Vikas Publishing House Pvt. Ltd
4. Simulation Modeling and Simnet, Hamdy A. Taha, Prentice Hall International Edition
5. System Simulation, Geoffrey Gorden, Prentice Hall of India Pvt. Ltd.
6. Mathematical Modeling, J N Kapur, Wiley Eastern Ltd
7. Design and analysis of Experiments, Douglas C. Montgomery, Wiley Student Edition, 7th Edition
8. Role of ICT in Doctoral Research, Capt. Dr.Nitin P. Sonaje.

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-I

ANTENNA THEORY & DESIGN

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Practical - 2 Hrs. /Week	**Practical Credit -** 1.0

SECTION-I

UNIT I: Antenna Arrays **(8 Hrs.)**

Linear arrays, planner arrays and circular arrays. Array of two isotropic point sources, non isotropic Sources, principle of pattern multiplication linear arrays of n elements, broadside, End-fire radiation pattern, directivity, Beam-width and null directions, array factor.

UNIT II: Microstrip Radiators **(8 Hrs.)**

Introduction, Advantages and limitations of microstrip antenna, Radiation mechanism of Microstrip antenna, Various microstrip antenna configurations, feeding mechanisms, Transmission line model, cavity model and Design consideration of rectangular microstrip antenna.

SECTION –II

UNIT III: Broadbanding of Microstrip Antenna **(8 Hrs.)**

Effect of substrate parameter on bandwidth, selection of shape of patch, selection of feeding technique: aperture coupled, transmission line model of aperture coupled antenna, broadbanding using stacked elements, broadbanding using coplanar parasitic elements and design examples.

UNIT IV: Substrate of Microstip Antenna **(4 Hrs.)**

Substrate characteristics for Microstrip Antenna Design, Ceramic Substrate, Semiconductor Substrate, Ferrimagnetic Substrate, Synthetic Substrate, Composite Material Substrate, Low-cost Low-loss Substrate and Desirable Substrate Characteristics for Antenna Fabrication.

UNIT V: Design and Analysis of Microstrip Antenna Arrays **(8 Hrs.)**

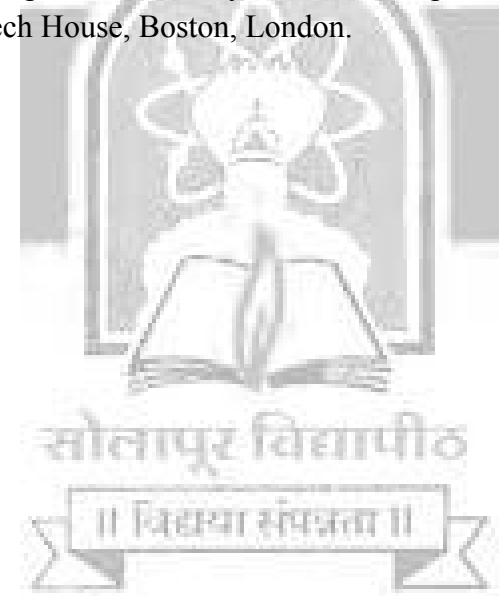
Parallel and series feed systems, Series feed of microstrip antenna, Mutual Coupling, Design of Liner Arrays, Linear Array Design with Microstrip Patches.

Term Work:

*Term work shall consist of any **eight experiments** based on above curriculum. Students are encouraged to use suitable **modeling software** for these experiments.*

Reference Books:

1. Antenna Theory analysis and design-Costantine A. Balanis, John Wiley publication.
2. Antennas-John D. Kraus, Tata McGraw Hill publication.
3. Antenna and wave propagation, Harish A. R., Oxford University Press.
4. Microstrip antenna design handbook by Ramesh Garg, Prakash, Bhartia, Inder Bahl and Apisak Ittipiboon, Artech House, Boston, London.



Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-I

PROBABILITY & STOCHASTIC PROCESSES

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Practical - 2 Hrs. /Week	**Practical Credit -** 1.0

SECTION-I

UNIT I: Concepts of Probability **(5 Hrs.)**

Set theory, Applying set theory to probability, probability axioms, Conditional probability and Baye's theorem, Independence of events, Bernoulli trails.

UNIT II: Discrete & Continuous Random variables **(6 Hrs.)**

Discrete Random variable : Probability mass function, Cumulative distribution function, Averages, Functions of Random variables, Expected value, Variance and standard deviation, Conditional probability mass function.

Continuous Random Variables: The Cumulative distribution function, Probability Density Function, Statistical properties, Jointly distributed Gaussian random variables, Conditional probability density, properties of sum of random variables, Central limit theorem, Estimate of population means, expected value and variance and covariance

UNIT III: Multiple Random Variables **(6 Hrs.)**

Joint cumulative distribution function, Joint probability mass function, Marginal PMF, Joint probability density function, Marginal PDF, statistical properties, properties of sum of two random variables, Bivariate Gaussian random variable, Estimate of population means, Expected value and variance and covariance

UNIT IV: Estimation of Random Variables **(5 Hrs.)**

Optimum estimation given another random variable, Linear estimation of X given Y, MAP and ML estimation, Linear estimation of Random Variables from Random Vectors.

SECTION – II

UNIT V: Stochastic Processes **(5 Hrs.)**

Types of Stochastic process, Random variables from random processes, Independent, Identically distributed random sequences, The poisson process, properties of the poisson process, Expected value and correlation, Stationary processes, Wide sense stationary stochastic process, Auto correlation and cross correlation function, properties, Estimate of auto correlation function, Gaussian processes.

UNIT VI: Markov Chains **(5 Hrs.)**

Chapman Kolmogorov equation, Classification of states, Limiting probabilities, Stability of Markov system, Reducible chains, Markov chains with continuous state space.

UNIT VII: Queuing Theory **(5 Hrs.)**

Introduction, Cost equation, steady state probabilities, Models of single server exponential queuing system with no limit and with finite buffer capacity (M/M/I,M/M/N). Queuing system with bulk service, Network of queues with open system and closed system. The M/G/I system and application of work to M/G/I.

UNIT VIII: Spectral Density **(5 Hrs.)**

Definition, Properties, white noise, Estimation of auto-correlation function using frequency domain technique, Estimate of spectral density, cross spectral density and its estimation, coherence.

Term Work:

*Term work shall consist of any **eight experiments** based on above curriculum. Students are encouraged to use suitable **modeling software** for these experiments.*

Reference Books:

1. Probability and Stochastic Processes (Second Edition) – Roy D. Yates and David J. Goodman, Johan Wiley and Sons Inc.
2. Introduction to Probability Models, (Third edition) - Sheldon M. Ross, Elsevier.
3. Probability Random Variables & Stochastic Process- Athanasios Papoulis, Mc Graw Hill
4. Stochastic Processes–J. Medhi, New Age International.
5. Probability and Random Processes for Electrical Engg. - Alberto Lean-Garcia, Pearson Education.
6. Introduction to Probability and Random Processes.-Jorge I. Aunin, V. Chandrashekar.
7. Probability & Statistics- Murrary R. Spiegel, Mc Graw Hill.

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-I

ADVANCED NETWORK SYSTEMS

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Practical - 2 Hrs. /Week	**Practical Credit -** 1.0

SECTION- I

UNIT I: Internet Technology **(4 Hrs.)**

Internet address, ARP, RARP, Routing IP, Datagram, ICMP, UDP, TCP, DHCP,Mobile IP, Internet Routing Protocols, multicast Routing, IP V6.

UNIT II: DNS Techniques **(6 Hrs.)**

Names for machines, Flat Namespace, Hierarchical Names, Delegation of Authority for names, Subset Authority, TCP/IP Internet domain names, official and unofficial Internet, Domain names, items named and syntax of names, mapping domain, names to addresses, domain names resolution, efficient translation caching. The key to efficiency, Domain mapping message format, compressed name format, abbreviation of domain names, inverse mappings, pointer queries, object types and resource record contents, obtaining authority for a sub domain.

UNIT III: FTP **(4 Hrs.)**

File access and transfer, online shared access, sharing by file transfer, the major view of FTP, An example of anonymous FTP session, TFTP, NFS, NFS Implementation, Remote procedure call (RPC).

UNIT IV: Internet Security and firewall Design **(6 Hrs.)**

Protection resources, the need for and information policy,communication, cooperation, and mutual mistrust, mechanisms for internet security, firewalls and Internet access, multiple connections and weakest links, firewall implementation and High-speed hardware, packet-level filters, security and packet filter specifications, the consequence of restricted access for clients, Accessing services through A firewall, the details of firewall architecture, Types of fire walls, stub network, An alternative Firewall implementation, monitoring and logging.

SECTION- II

UNIT V: NGN standards and architectures **(6Hrs.)**

Main drivers to Next Generation Networks – NGN, All-IP concept and ITU NGN standards, NGN control architectures and protocols (TISPAN), Numbering, naming and addressing in NGN

UNIT VI: ATM Networks **(4 Hrs.)**

Need of ATM, BISDN model, ATM layer, ATM Adaptation Layer, ATM signaling, PNNI Routing.

UNIT VII: Advanced Network Architecture **(4 Hrs.)**

IP forwarding Architecture, Overlay model MPLS, Integrated Services in the internet, RSVP, Differentiated Services

UNIT VIII: Giga Bit Ethernet **(4 Hrs.)**

Architecture and overview of Giga Ethernet, MAC, Physical layer, IEEE 802.32 Standard.

Term Work:

*Term work shall consist of any **eight experiments** based on above curriculum. Students are encouraged to use suitable **simulation software** for these experiments*

Reference books:

1. Internet working with TCP/IP D.E. Comer, (for chapter 1& 2)
2. Communication Networks: Fundamental & concepts and Key Architectures Leon-Garcia, widjaja (for chapter 3 & 4) (Tata McGraw-Hill)
3. ATM - Rich Seifert (for chapter 5)
4. TU NGN standards and architectures (Module 1) ITU
5. Gigabit Ethernet: Technology and Applications for High Speed LANs, Addison Wesley.
6. Gigabit Ethernet Networking, David Cunningham, William G. Lane, Bill Lane., Pearson Higher Education.
7. Data Communication & Networking- Behrmz Foruzan, Tata Mc Graw Hill.

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-I

Elective-I

OPTICAL NETWORKS

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hr. /Week	**Tutorial Credit -** 1.0

SECTION- I

UNIT I: Introduction (5 Hrs.)

Three generations of digital transport networks, combining WDM and TDM, the local loop bottleneck, wireless optical systems, evolution of optical systems, digital multiplexing and digital signaling hierarchies, timing and synchronization in digital networks, types of timing in networks, the synchronous clock hierarchy, methods of clock exchange, distribution of timing using SONET and DS1,the building integrated timing supply, synchronization status messages and timing loops,

UNIT II: SONET and SDH (5 Hrs.)

the SONET multiplexing hierarchy,SONET and SDH multiplexing and frame structure,SONET and SDH functional components,SONET and SDH problem detection, locating and adjusting payload with pointers, virtual tributaries and virtual containers, the overhead bytes, SONET and SDH concatenation.

UNIT III: Architecture of Optical Transport Networks (5 Hrs.)

Digital wrapper, control planes, in-band and out-of-band control signaling,SONET multiplexing hierarchy,SDH multiplexing hierarchy, revised SDH transport hierarchy, the new optical transport and digital transport hierarchy.

UNIT IV: Wavelength Division Multiplexing (5 Hrs.)

The WDM operation, DWDM, TDM & WDM topologies, relationship of WDM to SONET/SDH, erbium-doped fiber (EDF),WDM amplifiers, gain flatness, add-drop multiplexers, WDM input and output ports and cross-connects, wavelength continuity property, average versus maximum span loss and chromatic dispersion, higher dispersion for DWDM, tunable DWDM lasers

SECTION- II

UNIT V: MPLS and optical networks (6 Hrs.)

label switching, scalability and granularity: labels and wavelengths, types of MPLS nodes, label distribution and binding, methods for label distribution, label swapping and traffic forwarding,MPLS support of virtual private networks, MPLS traffic engineering, traffic oriented or resource oriented performance, traffic trunks, traffic flows and label switched paths. LDP, CR-LDPRSVP-TE and OSPF for TE support, multiprotocol lambda switching,MPLS and optical wavelength correlation, failure of the optical connection, possibilities for the mpls network control and data planes interworking

UNIT VI: Architecture of IP and MPLS based optical transport networks (6 Hrs.)

IPMPLS and optical control planes, the Internet control and data planes, the MPLS control and data planes, the optical control and data planes, interworking the three control planes, management of the planes, diverse views on control planes interworkings, framework for IP over optical networks, domain services model&unified service model, interconnections for IP over optical, generalized MPLS use in optical networks, considerations for interworking layer 1 lambdas and layer 2 labels, the next horizon: gmpls extensions for g.709.

UNIT VII: Optical Routers: Switching in Optical Internets (6 Hrs.)

The state of the art in optical switching, order of preferences in switching implementations, evolution of switching technologies, the speeds of electronics and photonics, an optical router, optical switching technologies,microelectromechanical systems, correlating the wavelength optical switched path with the MPLS Label Switched path, recovery and use of protection path, nesting the LSPS and OSPS, topology choices for a node failure, granularity of labels vs. wavelength support.

UNIT VIII: Optical Internets: Evolving to a 3G Architecture (4 Hrs.)

Migration to IP optical networking,IP and the optical backbone,IP subnets, support of non-optical nodes,MPLS cross-connect table

Term Work:

*Term work shall consist of any **eight tutorials** based on above curriculum. Students are encouraged to use suitable **simulation software** for these tutorials.*

Text book:

1.Optical Networks (Third Generation) Transport Systems ,Uyless Black, Prentice hall,2002

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-I
Elective - I
SPEECH & VIDEO PROCESSING

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hrs. /Week	**Tutorial Credit -** 1.0

SECTION-I

UNIT I: Speech Construction and Taxonomy **(8 Hrs.)**
Introduction, speech production, Acoustic phonetics like vowels, diphthongs, semivowels, nasals, stops and affricates, digital simulations of speech signals.

UNIT II: Speech analysis and Synthesis **(7 Hrs.)**
Time and frequency analysis of speech, pitch estimation, Linear predictive coding (LPC) analysis and synthesis of speech.

UNIT III: Speech enhancement and Recognition **(5 Hrs.)**
Introduction, speech enhancement techniques, speech filtering- LMS, NLMS filters, Adaptive noise cancellation, Baye's rule, HMM algorithm for Speech recognition.

SECTION-II

UNIT IV: Basics of Video Processing **(8 Hrs.)**
Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations.

UNIT V: Motion Estimation` **(7 Hrs.)**
Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation.

UNIT VI: Video Coding **(5 Hrs.)**
Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

Term Work:

*Term work shall consist of any **six experiments** based on above curriculum.*

Reference books:

1. Digital Processing of Speech Signals, L. R. Rabiner and R. W. Schafer, Pearson Education Asia, 2004.
2. Video processing and communication- Yao wang, JoemOstarmann and Ya–quin Zhang,1st edition , PHI
3. Digital video Processing- M. Tekalp Prentice Hall International
4. Discrete Time Speech Signal Processing, T. F. Quatieri, Pearson Education Asia, 2004.
5. Speech and Audio Signal Processing: Processing and Perception of Speech and Music,B. Gold and N. Morgan, John Wiley, 2004.
6. Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab- Chris Solomon, Toby Breckon John Wiley & Sons

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M.E. (Electronics and Telecommunication Engineering) Semester-I

Elective-I

ADVANCED VLSI DESIGN

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hr. /Week	**Tutorial Credit -** 1.0

SECTION-I

UNIT I: Introduction to Digital Signal Processing Systems (5 Hrs.)

Introduction, Typical DSP Algorithms, DSP Application Demands and Scaled CMOS Technologies, Representations of DSP Algorithms

UNIT II: Pipelining and Parallel Processing (5 Hrs.)

Introduction, Pipelining of FIR Digital Filters, Parallel Processing ,Pipelining and Parallel Processing for Low Power Filters.

UNIT III: Fast Convolution (5 Hrs.)

Introduction, Cook-Toom Algorithm ,Winograd Algorithm, Iterated Convolution, Cyclic Convolution, Design of Fast Convolution Algorithm by Inspection.

UNIT IV: Scaling and Roundoff Noise (5 Hrs.)

Introduction , Scaling and Roundoff Noise ,State Variable Description of Digital Filters , Scaling and Roundoff Noise Computation, Roundoff Noise Computation Using State Variable Description , Slow –Down, Retiming and Pipelining.

SECTION-II

UNIT V: Bit Level Arithmetic Architectures (8Hrs.)

Introduction, Parallel Multipliers, Interleaved Floor Plan and Bit Plane Based Digital Filters, Bit Serial Multipliers, Bit Serial Filter Design and Implementation, Canonic Signed Digit Arithmetic, Distributed Arithmetic.

UNIT VI: Synchronous , Wave , and Asynchronous Pipelines (6Hrs.)

Introduction , Synchronous Pipelining and Clocking Styles , Clock Skew and Clock Distribution in Bit –Level Pipelined VLSI Designs ,Wave Pipelining , Constraint Space Diagram and Degree of Wave Pipelining , Implementation of Wave Pipelined Systems , Asynchronous Pipelining , Signal Transition Graphs, Use of STG to Design Interconnection Circuits, Implementation of Computational Units.

UNIT VII: Low Power Design: **(6Hrs.)**

Introduction , Theoretical Background , Scaling Versus Power Consumption , Power Analysis, Power Reduction Techniques , Power Estimation Approaches

Term Work:

*Term work shall consist of any **eight tutorials** based on above curriculum. Students are encouraged to use suitable **simulation software** for these tutorials.*

Reference Book:

1. VLSI Digital Signal Processing Systems - Design and implementation – Keshab K. Parhi ,Wiley.

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M.E. (Electronics and Telecommunication Engineering) Semester-II

RF and Microwave Circuit Design

Teaching Scheme	Examination Scheme
Theory: 3 Hrs/Week	**Theory credit: 3**
Practical: 2 Hrs/Week	**Practical credit: 1**

SECTION I

UNIT I: Two port Network **(6 Hrs)**

Two-Port Parameters, S-Parameters, S-Parameters from Spice Analysis, Stability, Power Gains, Voltage Gains and Current Gains, Derivation of Transducer Power Gain and Differential S-Parameters

UNIT II : Small and Large Signal Amplifier Design **(8 Hrs)**

Introduction, Single-Stage Amplifier Design— High Gain, Maximum Available Gain and Unilateral Gain, Low-Noise, High-Power, Broadband, Feedback, Cascode, Multistage, Millimeter-Wave Amplifiers, Stability Analysis and Limitations

UNIT III: Microwave Mixer Design **(6Hrs)**

Introduction. Diode Mixer Theory. Single Diode mixer, Balanced mixer, and Double-Balanced Mixers. FET Mixer Theory. Balanced FET Mixers

SECTION II

UNIT IV: Microwave Oscillator design **(8Hrs)**

Two-Port Oscillator Design, Negative Resistance from Transistor Model, Oscillator Q and Output power, Analytic Approach to Optimum Oscillator Design using S Parameters and Nonlinear Active Models for Oscillators

UNIT V: Filter Design **(6Hrs)**

Introduction. Periodic Structures. Filter Design- Image-Parameter Method, Insertion-Loss Method. Filter Transformations. Filter Implementation. Low Pass-Filer Design

UNIT VI Monolithic Microwave Integrated Circuits & Technology **(6Hrs)**

Introduction, History of Monolithic Microwave Integrated Circuits, Materials, Fabrication techniques of MMIC.

Term Work:

*Term work shall consist of any **eight experiments** based on above curriculum.*

Reference Books:

1. Microwave engineering –Annapurna Das and Sisir K Das (TMH)
2. RF circuit design, theory & applications- Reinhold Ludwig, PavelBretchko, (PearsonEducation – LPE)
3. Microwave Devices and Circuits- Samuel Y. Liao, (PHI)
4. Microwave Engineering-David M. Pozar (John Wiley & Sons)
5. Microwave Devices & Circuit Design-Gupta &Shrivastava(PHI)
6. Microwave Circuit Design - George D. Vendelin, Anthony M. Pavio & Ulrich L. Rehde John Wiley & Sons publication
7. Radio Frequency and Microwave Electronics - Matthew M. Radmanesh, Pearson Education
   Asia publication

List of Experiments:

Design and simulation of any one microwave device as directional coupler, magic-Tee, microwave filters etc; and analysis of S-parameter, Power Gain, Input Impedance of the respective device using any microwave simulation software as HFSS, FEKO, IE3D and detailed report should be submitted at the end of semester.

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M.E. (Electronics and Telecommunication Engineering) Semester-II

ADVANCED SIGNAL PROCESSING

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Practical - 2 Hrs. /Week	**Practical Credit -** 1.0

SECTION -I

UNIT I: Introduction To Adaptive Systems And Basics Of Estimation Theory **(06 Hrs.)**

Definitions, Characteristics, Applications, Examples of adaptivesystems, Gradient error, least absolute deviation, least mean squareminimization, Mean square error, Cramer Rao bound, Maximumlikelihood estimate(MLE)

UNIT II: Non Adaptive Filters **(08 Hrs.)**

Wiener filtering, LLSE, Principle of orthogonality, Wiener-Hopfequation, Solution of Wiener Hopf equation, Error performance surfaceand MMSE. Levinson filtering, Levinson-Predictor, Levinson-DurbinRecursion, Gram-Schmidt orthogonalisation, Kalman filtering and itsderivation

UNIT III: Adaptive Filters **(08 Hrs.)**

Principle of adaptive filters, Method of steepest decent, Newton's typeof algorithm, LMS algorithm and its applications, Convergence of LMSalgorithm, Normalized MS(NLMS),RLS algorithm, convergenceanalysis of RLS algorithm, Application of RLS algorithm

Section -II

UNIT IV: Adaptive Equalisation **(07 Hrs.)**

Decision feedback equalizer, Adaptive blind equalizer, Sato algorithm,Constant modulus algorithm, CM equalizer and carrier tracking

UNIT V: Application Of Adaptive Filters **(05 Hrs.)**

Echo cancellation, Equalisation of data communication channels,Linear predictive coding and Noise cancellation

UNIT VI: Multirate Digital Signal Processing **(08 Hrs.)**

Mathematical description of change of sampling rate, Interpolation and Decimation,Continuous time model, Direct digital domain approach, Decimation by integer factor,Interpolation by an integer factor, Single and multistage realization, Poly phaserealization, Applications to sub band coding, Wavelet transform and filter bankimplementation of wavelet expansion of signals

Term Work:

*Term work shall consist of any **six to eight experiments** based on above curriculum.*

Reference Books:

1. Adaptive Filter Theory, S. Haykin, Prentice-Hall, 4th edition
2. Statistical and Adaptive Signal Processing, Manolakis, D. G., Ingle, V. K., and Kogon, S. M. (2005), Artech House INC., 2005.
3. Adaptive Signal Processing, B. Widrow, S. Stearns, Prentice-Hall, 1985
4. Adaptive signal processing – Theory and Applications , S Thomas Alexander,Springer-Verlag
5. Adaptive filters- A H Sayed, John Wiley
6. Digital Signal Processing- . John G. Proakis, Dimitris G. Manolakis, Prentice Hall Of India, New Delhi, 2005
7. Multirate systems and filter banks- P.Vaidyanathan ,PHI

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-II

WIRELESS COMMUNICATION

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hr. /Week	**Tutorial Credit -** 1.0

SECTION – I

UNIT I: Wireless Communications and Diversity (7 Hrs.)

Small-Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of small-Scale Fading,Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space.

UNIT II: Broadband Wireless Channel Modeling (5 Hrs.)

WSSUS Channel Modeling, RMS Delay Spread, Doppler Fading, Jakes Model, Autocorrelation, Jakes Spectrum, Impact of Doppler Fading

UNIT III: Cellular Communications (5 Hrs.)

Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes - Call Setup, Handover etc., Teletraffic Theory.

UNIT IV: CDMA (5 Hrs.)

Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization.

SECTION - II

UNIT V: OFDM (5 Hrs.)

Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

UNIT VI: MIMO (5 Hrs.)

Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO - OFDM.

UNIT VII: UWB (Ultrawide Band) **(5 Hrs.)**

UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error Rate Performance of UWB

UNIT VIII: 3G and 4G Wireless Standards **(5 Hrs.)**

GSM, GPRS, WCDMA, LTE, WiMAX

Term Work:

*Term work shall consist of any **eight tutorials** based on above curriculum. Students are encouraged to use suitable **simulation software** for these tutorials.*

Reference Books:

1. Fundamentals of Wireless Communications – David Tse and Pramod Viswanath, Publisher - Cambridge University Press.
2. Wireless Communications: Andrea Goldsmith, Cambridge University Press.
3. Wireless Communications: Principles and Practice –Theodore Rappaport - Prentice Hall.
4. MIMO Wireless Communications – Ezio Biglieri – Cambridge University Press.

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M.E. (Electronics and Telecommunication Engineering) Semester-II

CRYPTOGRAPHY AND NETWORK SECURITY

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Practical - 2 Hrs. /Week	**Practical Credit -** 1.0

SECTION – I

UNIT I: Overview **(5 Hrs.)**

Introduction to security attacks, services and mechanism, A model for network security, Classical encryption techniques, substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers.

UNIT II: Modern Block Ciphers **(8 Hrs.)**

Block ciphers principles, modes of operations, Shannon's theory of confusion and diffusion, Fiestal structure, Data encryption standard(DES), Strength of DES, Triple DES, Advanced Encryption Standard (AES),

UNIT III: Public Key Cryptography **(8 Hrs.)**

Encryption and decryption Principles of public key crypto systems, RSA algorithm, security of RSA, Key Management and distribution: Symmetric key distribution,
Diffie-Hellman Key Exchange.

Section - II

UNIT IV: Message Authentication Codes **(8 Hrs.)**

Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm,

UNIT V: Authentification Applications **(6 Hrs.)**

Public key distribution, X.509 Certificates, Public key, Infrastructure, Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME.

UNIT VI: IP Security **(8 Hrs.)**

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, Introduction to Secure Socket Layer, Secure electronic, transaction (SET)
System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls.

Term Work:

*Term work shall consist of any **six experiments** based on above curriculum.*

Reference Books:

1. Cryptography and Network Security, William Stallings, Principals and Practice, Pearson Education.
2. Cryptography and Network Security, Behrouz A. Frouzan ,TMH.
3. Applied Cryptograph, Bruce Schiener, John Wiley & Sons.
4. Network Security and Cryptography, Bernard Menezes, Cengage Learning.
5. Cryptography and Network Security, Atul Kahate, TMH

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-II
Elective-II

WIRELESS SENSOR NETWORK AND OPTIMIZATION

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hr. /Week	**Tutorial Credit -** 1.0

SECTION- I

UNIT II: Overview of wireless sensor networks (8 Hrs.)

Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in ad-hoc wireless networks, key design issues of sensor network, sensor network architecture, data dissemination and gathering.

UNIT II: Architecture (7 Hrs.)

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III: Network Topology (5Hrs.)

Network topologies for WSN, Physical Layer and Transceiver Design Considerations, Personal area networks (PANs),Topologies of PANs, MANETs, WANETs, hidden node and exposed node problem.

SECTION II

UNIT IV: MAC Protocols for WSN (6 Hrs.)

Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols with reservation Mechanisms and Scheduling Mechanisms.

UNIT V: Routing protocols (6 Hrs.)

Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

UNIT VI: Energy Management and Application of WSN (8 Hrs.)

Need for energy management, classification, battery, transmission power and system power management schemes- local power, processor, communication subsystems, IEEE 802.15.4,WSN Applications – Military surveillance, Industrial & commercial

Term Work:

*Term work shall consist of any **eight tutorials** based on above curriculum. Students are encouraged to use suitable **simulation software** for these tutorials.*

Reference Books:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli and Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Networks, Holger Karl and Andreas Willig, John Wiley & Sons, Ltd, 2005.
3. Wireless sensor networks , Feng Zhao and Leonides Guibas, Elsevier publication – 2004.
4. Ad Hoc Wireless Networks, C.Siva Ram Murthy and B.S.Manoj Pearson Edition 2008.
5. Wireless Communications and Networks , William Stallings, Pearson Education –2004
6. Wireless Sensor Networks Design, Anna Hac , John Wiley& Sons Limited Publications 2003.
7. Networking Wireless Sensors, Bhaskar Krishnamachari**,** Cambridge University Press 2005.

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-II
Elective-II

WAVELET TRANSFORM AND APPLICATIONS

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hr. /Week	**Tutorial Credit -** 1.0

SECTION-I

UNIT I: Wavelet Transforms (6 Hrs)

Introduction, FT, STFT, Time-Frequency localization, Analogies and differences with Windowed Fourier transform, The basic functions, Specifications, Admissibility conditions, Continuous wavelet transform (CWT), Discrete wavelet transform (DWT).

UNIT II: Discrete Wavelet Transform (8 Hrs)

Discretizing the wavelet transform, *The multiresolution analysis (MRA) of* $L^2(R)$*:-* The MRA axioms, Construction of an MRA from scaling functions - The dilation equation and the wavelet equation, Compactly supported orthonormal wavelet bases - Necessary and sufficient conditions for orthonormality. *Regularity and selection of wavelets:-* Smoothness and approximation order - Analysis in Soboleve space, Criteria for wavelet selection with examples.

UNIT III: Types of Discrete Wavelet transform and construction of wavelets (6 Hrs)

Wavelet decomposition and reconstruction of functions in $L^2(R)$. Pyramid structured and tree structured, Fast wavelet transform algorithms - Relation to filter banks, Wavelet packets – Representation of functions, Selection of basis. Construction of wavelets- Biorthogonality and biorthogonal basis, Biorthogonal system of wavelets - construction, The Lifting scheme.

SECTION-II

UNIT IV: Wavelet Transform And Data Compression (6 Hrs)

Introduction, Transform Coding, DTWT for Image Compression, Audio Compression, And Video Coding Using Multi-resolution Techniques: a Brief Introduction.

UNIT V: Applications in Bio-medical (8 Hrs)

Face Recognition System Using Discrete Wavelet sub-bands, ECG Signal Compression using Discrete Wavelet Transform, Statistical analysis of image differences by wavelet decomposition, Feature extraction in digital mammography, Adapted wavelet techniques for encoding MRI diagnosis of coronary artery disease using wavelet based neural networks.

UNIT VI: Other Application of Wavelet Transforms (6 Hrs)

Introduction, Wavelet denoising, speckles Removal, Edge Detection and Object Isolation,Image Fusion, Discrete Wavelet Transform Based Wireless Digital Communication System

Term Work:

*Term work shall consist of any **eight tutorials** based on above curriculum*

Reference Books:

1. Tutorial on Wavelets, part I-IV, Robi Polikar, (http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html)
2. A Primer on Wavelets and their Scientific Applications, James S. Walker, CRC Press, (1999).
3. Wavelet Transforms - Rao and Bopardikar, Pearson Education, Asia.
4. Introduction to Wavelets and Wavelets Transforms, C. Sidney Burrus, Ramesh A. Gopinath, Prentice Hall, (1997).
5. Wavelets in Medicine and Biology, Akram Aldroubi and Michael Unser., CRC press
6. Discrete Wavelet Transforms - Theory and Applications, Juuso Olkkonen (Editor), Published by InTech, Rijeka, Croatia.
   A free online edition of this book is available at www.intechopen.com ISBN 978-953-307-185-5 www.intechopen.com
7. Ten Lectures on Wavelets, I.Daubechies, SIAM publications
8. A Wavelet Tour of Signal Processing, Second Edition-S. Mallat Academic Press

Solapur University, Solapur

M.E. (Electronics and Telecommunication) Semester-II

Elective - II

ADVANCED EMBEDDED SYSTEM

Teaching Scheme	**Examination Scheme**
Lectures- 3 Hrs. /Week	**Theory Credits-** 3.0
Tutorial - 1 Hrs. /Week	**Tutorial Credit -** 1.0

SECTION- I

UNIT I: Embedded architecture **(04 Hrs)**

Embedded computers, characteristics of embedded computing applications, challenges in embedded computing system design, embedded memories, embedded system design process, designing hardware and software components

UNIT II: Embedded processor **(06 Hrs.)**

ARM11, About the processor Extensions to ARMv6, MP11 CPU overview, Debug and programming support, Power ,Configurable options ,Pipeline stages ,Typical pipeline operations ,MP Core architecture with Jazelle technology, Parity checking support, Product revisions.

UNIT III: Programmers Model **(06 Hrs.)**

About the programmers model, Processor operating states, Instruction length, Data types, Memory formats, Addresses in an MP Core system, Operating modes, Registers, The program status registers, Exceptions

UNIT IV: Control Coprocessor CP15 **(04 Hrs.)**

About control coprocessor CP15, CP15 registers arranged by function, Summary of control coprocessor CP15 registers and operations, register descriptions, Summary of CP15 instructions.

SECTION- II

UNIT V: Embedded system software **(06 Hrs.)**

Software architectures, software developments tools, programming concepts, embedded programming in C and C++, queues, stacks, optimization of memory needs, program modeling concepts, software development process life cycle and its model, software analysis, design and maintenance.

UNIT VI: Real time operating systems **(08 Hrs.)**

Real time operating systems (µC/OS)- real-time software concepts, kernel structure, task management, time management, inter task communication & synchronization, memory management, and porting µCos-II; Linux/RT Linux- features of Linux, Linux commands, file manipulations, directory, pipes and filters, file protections, shell programming, system programming, RT Linux modules, POSIX Threads, mutex management, semaphore management

UNIT VII: Raspberry Pi **(06 Hrs.)**

Introduction to Raspberry Pi, ARM 11 Microcontroller Hardware Description & Interfacing Components, Hardware Interfacing of PI (HDMI Port, Keyboard mouse connection, 3.5mm audio jack, micro usb power cable) Programming the GPIO of Raspberry Pi, LCD interfacing

Term work:

*Term work shall consist of minimum **eight tutorials** based upon above curriculum.*

Reference books:

1. Embedded systems: a contemporary design tool, James K. Peckol- Wiley India
2. Embedded Real Time Systems-Concepts, Design & Programming, Dr. K.V.K.K. Prasad, Dreamtech Publication
3. ARM11 MPCore ™ Processor Revision: r2p0 , Technical Reference Manual
4. Introduction to Embedded Systems, Jonathan W. Valvano , Cengage 2009.
5. Getting Started with Raspberry Pi By Matt Richardson, Shawn Wallace.
6. ARM System Developer's Guide, Sloss, Symes, Wright, Morgan, Kaufmann, 2004, 1st Edition
7. An Embedded Software Primer, David E. Simon, Pearson Education Publication.
8. ARM920T Technical Reference Manual (Rev 1) - ARM DDI 0151C, Data books of ARM7/ARM9 J., ARM Company Ltd.
9. Embedded Systems Architecture: A Comprehensive Guide for Engineers and programmers, By Tammy Noergaard

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-III
Self Learning Course
INTERNET OF THINGS (IOT)

Examination Scheme
Theory Credits- 3.0

SECTION-I

UNIT I: Introduction to IoT **(6 Hrs)**

What is IoT?, IoT Applications, Physical interaction with IoT, Enabling Technologies, Challenges and Concerns, IoT Vision, Conceptual framework of IoT, Role of RFID in IoT, Applications of IoT, Ubiquitous computing, virtualization of network resources and physical devices in IoT.

UNIT II: Wireless Sensor Networkand RFID Technologies for IoT **(8 Hrs)**

Introduction of sensor networks, Key definitions of sensor networks , Advantages of sensor networks, Unique constraints and challenges, Driving Applications, Classification of routing protocols, Routing protocols, Networking Sensors, Unique features , Deployment of ad- hoc/sensor network, Sensor tasking and control, Introduction to RFID Technology and RFID Systems, Physics of RFID, Anatomy of an RFID, System, RFID Tags,Introduction to EPC, Overview of the EPC Network Architecture, RFID Middleware.

UNIT III: IoT Architecture Reference Model (IoT - ARM) **(6 Hrs)**

IoT Conceptual Framework, IoT Vision, The Need for a Common Ground for the IoT, The IoT Architectural Reference Model as Enabler, IoT Reference Model, IoT Reference Architecture, Interactions with physical world, Toward a Concrete Architecture, Technological Trends, Technology Enablers, Future Technological Developments.

SECTION-II

UNIT IV: IoT in Practice: Examples and Use Cases **(8 Hrs)**

IoT and M2M Communications, IoT Application Areas and Industrial Deployment, Applications and Scenarios, Retail and logistics, Smart Grid, Product management, Surveillance, Vehicular Adhoc Networks, Smart buildings and green buildings, Telematics, Telehealth, Future converged wireless networks and IoT.

UNIT V: Interoperability, Standardisation, Governance in the Era of Internet of Things
(6Hrs)

Architecture models, Network technology, Discovery and search engines, Security and privacy, Application areas and industrial deployment, Governance and socio-economic ecosystems,Computer vision for IoT, Physical mobile interaction, Data processing.

UNIT VI: Security and Privacy for IoT **(6Hrs)**

Security by design in IoT, Methods for IoT security analysis, Privacy and anonymization techniques in IoT, Secure cloud of things, Trust management, Lightweight security solutions, Authentication and access control in IoT, Identification and biometrics in IoT, Liability and policy enforcement in IoT, Virtualization and auto-immunity of smart objects, Security of Big data in IoT, Cyber physical systems security, Cyber attacks detection and prevention, Ethics and legal considerations in IoT.

Term Work:

*Term work shall consist of any **six assignments** based on above curriculum*

Reference Books:

1. The Internet of Things- Lu Yan, Yan Zhang, Laurence T. Yang, HuanshengNing, From RFID to the Next Generation Pervasive Networked Systems",Auerbach Publications, 2008.

2. Internet of Things Based on Smart Objects-Technology,Middleware and Applications-Giancarlo Fortino, Paolo Trunfio, Springer International Publishing, 2014.

3. Enabling Things to Talk- Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner ,

4. Designing IoT solutions with the IoT Architectural Reference Model-Springer International Publishing, 2013.

5. Internet Of Things Converging Technologies For Smart Environments And Integrated Ecosystems- Dr. OvidiuVermesan, Dr. Peter Friess River Publishers Series In Communications, 2013.

6. Internet of Things: Emergence, Perspectives, Privacy and Security Issues- Emanuel DelgadoThe Nova Science Publishers, 2015.

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-III
Self Learning Course
SOFTWARE DEFINED AND COGNITIVE RADIO

Examination Scheme
Theory Credits- 3.0

SECTION-I

UNIT I: **(5 Hrs)**
SDR concepts & history, Benefits of SDR, SDR Forum, Ideal SDR architecture, SDR Based End to-End Communication, Worldwide frequency band plans, Aim and requirements of the SCA.

UNIT II: **(6 Hrs)**
Architecture Overview, Functional View, Networking Overview, Core Framework, Real Time Operating Systems, Common Object Request Broker Architecture (CORBA), SCA and JTRS compliance.

UNIT III: **(7 Hrs)**
Radio Frequency design, Baseband Signal Processing, Radios with intelligence, Smart antennas, Adaptive techniques, Phased array antennas, Applying SDR principles to antenna systems, Smart antenna architectures. Introduction to Software Radio platforms:such as GNU radio, Microsoft research software radio, and Universal Software radio peripherals (USRP)

SECTION-II

UNIT IV: **(7 Hrs)**
Cognitive Radio Communications : Cognitive Radios and Dynamic Spectrum Access ,The Capability of Cognitive Radios , Cognitive Radio cycle, Spectrum Sharing Models of DSA, Opportunistic Spectrum Access: Basic Components , Networking The Cognitive Radios,Analytical Approach and Algorithms for Dynamic Spectrum Access , Dynamic Spectrum Access in Open Spectrum ,Opportunistic Spectrum Access , Opportunistic Power Control ,Fundamental Limits of Cognitive Radios , Mathematical Models Toward Networking Cognitive Radios , CR Link Model, Overlay CR Systems , Rate-Distance Nature .

UNIT V: **(8 Hrs)**
Spectrum Sensing: Primary Signal Detection such as Energy Detector,Cyclostationary Feature Detector ,Matched Filter , Cooperative Sensing etc. , Spectrum Sensing to Detect Specific Primary System , conventional Spectrum Sensing, Power Control , Power-Scaling Power Control ,Cooperative Spectrum Sensing , Spectrum Sensing for Cognitive OFDMA Systems , Discrimination of States of the Primary System, Spectrum Sensing Procedure, Spectrum Sensing for Cognitive Multi-Radio Networks , Multiple System Sensing , Radio Resource Sensing.

UNIT VI: **(7 Hrs)**

Cognitive Radio Networks : Network Coding for Cognitive Radio Relay Networks , System Model , Network Capacity Analysis on Fundamental CRRN Topologies , Link Allocation , Numerical Results, Cognitive Radio Networks Architecture , Network Architecture ,Links in CRN , IP Mobility Management in CRN ,Terminal Architecture of CRN ,Cognitive Radio Device Architecture , Re-configurable MAC ,Radio Access Network Selection ,QoS Provisional Diversity Radio Access Networks , Cooperative/Collaborative Diversity and Efficient Protocols , Statistical QoS Guarantees over Wireless Asymmetry Collaborative Relay Networks.

Term Work:

*Term work shall consist of any **six assignments** based on above curriculum*

Reference Books:

1. Software Defined Radio, Architectures, Systems and Functions- Dillinger, Madani, Alonistioti (Eds.): Wiley 2003
2. Software Radio: A Modern Approach to Radio Engineering- Jeffrey H. Reed, Pearson.
3. Software Defined Radio, The Software Communications, Architecture- Bard, Kovarik, Wiley 2007
4. Implementing Software Defined Radio- Eugene Grayver, Springer
5. Software Defined Radio:With GNU Radio and USRP- Cory Clark, McGraw-Hill Companies,Incorporated, 29-Nov-2008

Solapur University, Solapur

M.E. (Electronics and Telecommunication Engineering) Semester-III

Self Learning Course

MODELING & SIMULATION OF COMMUNICATION SYSTEM

Examination Scheme

Theory Credits- 3.0

SECTION- I

UNIT I: Role of simulation **(6Hrs)**

Multidisciplinary Aspects of Simulation , Models ,Deterministic and Stochastic Simulations, The Role of Simulation, Aspects of Methodology, Performance Estimation.

UNIT II: Sampling And Quantizing **(7Hrs)**

Sampling , Quantizing , Reconstruction and Interpolation , The Simulation Sampling Frequency

UNIT III: Low pass simulation Models For Bandpass Signals and Systems **(7Hrs)**

The Lowpass Complex Envelope for Bandpass Signals, Linear, Bandpass Systems, Multicarrier Signals ,Nonlinear and Time-Varying Systems

SECTION-II

UNIT IV: Generating and Processing Random Signals **(6Hrs)**

Stationary and Ergodic Processes , Uniform Random Number Generators, Mapping Uniform RVs to an Arbitrary pdf, Generating Uncorrelated Gaussian Random Numbers, Generating Correlated Gaussian Random Numbers, Establishing a pdf and a PSD , PN Sequence Generators , Signal Processing

UNIT V: Methodology For Simulating a Wireless System **(7Hrs)**

System-Level Simplifications and Sampling Rate Considerations, Overall Methodology, Methodology for Simulation of the Analog Portion of the System , Simulatingthe Analog Portion of the System, Estimation of the Coded BER

UNIT VI: Modeling and Simulation of Waveform Channels **(7 Hrs)**

Introduction,Models of Communication Channels, Simulation of Communication Channels, Discrete Channel Models , Methodology for Simulating Communication ,System Performance , Wired and Guided Wave Channels , Multipath Fading Channels ,Modeling Multipath Fading Channels, Random Process Models

Term Work:

*Term work shall consist of any **six assignments** based on above curriculum.*

Reference Books:

1. "Principles of Communication systems Simulation with Wireless Applications", W.H. Tranter, K.S. Shanmugan, T.S. Rappaport, K.L. Kosbar, Prentice Hall, 2004.
2. "Simulation Techniques, Models of Communications, Signals and Process", F.M. Gardner, J.D. Baker, John Wiley & Sons Inc. 1997,
3. "Contemporary Communication Systems Using Matlab and Simulink", J.G. Proakis, M.Salehi, G.Bauch, CL-Engineering 2003.
4. "Simulation of Communication Systems, Modeling, Methodology and Techniques", M.C. Jeruchim, P.Balaban, K.S. Shanmugan, Cluwer Academic Publishers, 2nd Edition 2002.