# SOLAPUR UNIVERSITY, SOLAPUR

## FACULTY OF ENGINEERING & TECHNOLOGY

## ELECTRONICS & TELECOMMUNICATION ENGINEERING

**Syllabus Structure for**

**M.E. (Digital Electronics & communication Systems)**

**4 Semester PG Programme**

**To be effective from** 2016-17

Choice Based Credit System Syllabus

# 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 | Communication Networks | 3 | 2 | 70 | 30 | - | 25 | 3 | 1 |
| 3 | CMOS VLSI Design | 3 | 2 | 70 | 30 | - | 25 | 3 | 1 |
| 4 | Modern Digital Signal Processing | 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. Color Image and Video Processing

2. Fuzzy Logic

3. Speech Processing

***Note –***

***Students have to select any one course from Elective –I***

- *** Indicates the Common Subject with ME- E&TC**

# Semester-II

| Sr. No. | Subject | Teaching Scheme | | Examination Scheme | | | | Credits Assigned | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | Pract/TW | | | |
| | | Theory | Pract | ESE | ISE | ESE | ISE | Theory | Pract |
| 1 | Microwave Devices and Circuits | 3 | 2 | 70 | 30 | - | 25 | 3 | 1 |
| 2 | High Speed Digital Design | 3 | 2 | 70 | 30 | - | 25 | 3 | 1 |
| 3 | Advanced Embedded Systems | 3 | 2 | 70 | 30 | - | 25 | 3 | 1 |
| 4 | Cryptography & Network Security* | 3 | 1(T) | 70 | 30 | - | - | 3 | 1(T) |
| 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. Artificial Neural Network

2. Wavelet Transform & Applications*.

3. Wireless Sensor Network & Optimization*.

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***Note –***

- ***Students have to select any one course from  Elective –II***
- *** Indicates the Common Subject with ME- E&TC**

# 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 Courses :

1. Internet of Things#
2. Intellectual Property
3. Modeling & Simulation of Communication System#

- $-Being a self learning subject, student shall prepare for examination as per specified syllabus.
- # indicates syllabus common subjects with ME-E&TC
- ***-**For all activities related to dissertation 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 dissertation work only after delivering this seminar.

- Progress seminar shall be delivered capturing details of the work done by student for dissertation.
- 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 dissertation work and recommended by adviser. Student shall submit report after completion of the activity to the adviser – Software assignments, learning new software, hardware realization, literature survey, filed work, Industrial training etc.
- @ Indicates contact hours of student for interaction with adviser.
- Details of mode of assignment of seminar and dissertation 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) | - | 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 adviser
- Progress seminar shall be delivered capturing details of the work done by student for dissertation.
- 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 adviser.
- Details of mode of assignment of seminar and dissertation shall be as specified in 7(III) of PG Engineering ordinance of Solapur University, Solapur.

**Solapur University, Solapur**

M.E. (**Digital Electronics & Communication Systems) Semester-I**

**RESEARCH METHODOLOGY***

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

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## 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. **(Digital Electronics & Communication Systems) Semester-I**

# COMMUNICATION NETWORKS

**Teaching Scheme**
**Lectures-** 3 Hrs. /Week
**Practical - 2** Hrs. /Week

**Examination Scheme**
**Theory Credits-** 3.0
**Practical Credit -** 1.0

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## SECTION-I

**UNIT I: Internet Technology** **(5 Hrs.)**

IP address, ARP, RARP, Routing IP, Kern's Algorithm.

**UNITII: Datagram** **(8 Hrs.)**

Pinging, Datagram, ICMP, UDP, TCP, DHCP and Mobile IP, IP in IP encapsulation, Internet Routing Protocols, multicast Routing, IP V6.

**UNIT III: ATM Networks** **(6 Hrs.)**

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

## SECTION-II

**UNIT IV:DNS Techniques** **(8Hrs.)**

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 IV:FTP** **(6 Hrs.)**

File access and transfer, online shared access, Sharing by file transfer, FTP features, FTP model, TFTP, NFS, NFS implementation, remote procedure call (RPC).

**UNIT V:Giga Bit Ethernet** **(5 Hrs.)**

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

**Term Work:** Term work shall consist of max 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 by D.E. Comer
2. Communication Networks: Fundamental & concepts and Key Architectures by Leon-Garcia, Widjaja (Tata McGraw-Hill)
3. ATM by Rich Seifert
4. Gigabit Ethernet: Technology and Applications for High Speed LANs, (Addison Wesley).
5. Gigabit Ethernet Networking by David Cunningham, William G. Lane, Bill Lane.(Pearson Higher Education )

6.Data Communication & Networking- Behrmz Foruzan (TMH)


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## Solapur University, Solapur

M.E. **(Digital Electronics & Communication Systems) Semester-I**

## CMOS VLSI DESIGN

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

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### SECTION-I

**UNIT I: MOS transistor theory** **(06 Hrs.)**

Physical structure of MOS Transistors ( PMOS and NMOS),Threshold voltage ,Body Effect, accumulation, depletion & inversion modes, MOS device design equations-VI Characterics , Technology scaling.

**UNIT II: CMOS inverter** **(06 Hrs.)**

Static and dynamic behavior of CMOS inverter, power and energy delay, impact of technology scaling on inverter

**UNIT III: Combinational logic design in CMOS:** **(08 Hrs.)**

Static CMOS design- complementary CMOS, Radioed logic and pass transistor logic; dynamic CMOS design- dynamic logic basic principle, speed and power dissipation, issues in dynamic design, cascading dynamic gates, comparison of static and dynamic designs in CMOS

### SECTION-II

**UNIT IV: Sequential logic designs in CMOS:** **(06 Hrs.)**

Static latches and registers- the bistability principle, multiplexer based latches, Master-slave edge triggered register, low voltage static latches, static SR flip flops, dynamic latches and registers- dynamic transmission-gate edge triggered registers, C2MOS- A -phase clocked clock-skew insensitive approach, true single register (TSPCR)

**UNIT IV: Timing issues in digital circuits:** **(07 Hrs.)**

Timing classification: synchronous interconnect, mesochronous interconnect, plesiochronous interconnect, asynchronous interconnect, synchronous design- clock skew, jitter, clock distribution, latch based clocking, synchronizers and arbiters, using PLL for clock Synchronization

**UNIT V: Designing arithmetic and memory building blocks: (07 Hrs.)**

Designing of adders, designing of multipliers, designing of shifters, designing ROMs, DRAMs & SRAMs

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

**Reference books:**


1. Digital Integrated Circuits, Rabey, Chandrakasan, Nikolic, Pearson Education
2. Principles of CMOS VLSI Design, Neil Weste, Kamran Eshraghian, Addison Wesley/Pearson Education
3. CMOS digital integrated circuits, Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, TATA McGRAW Hill
4. CMOS VLSI design, Neil H. E. Weste, David Harris, Ayan Banerjee, Pearson Education

# Solapur University, Solapur
M.E. **(Digital Electronics & Communication Systems) Semester-I**
# MODERN DIGITAL SIGNAL PROCESSING

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

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## SECTION-I

**Unit I: Design of FIR filters** **(06 Hrs.)**

Symmetric and anti-symmetric FIR filters, design of linear phase FIR filters by using Windows and frequency sampling method ,Design of optimum equi-ripple linear phase FIR filters; Design of FIR differentiator, Design of Hilbert transformers,

**Unit II: Linear prediction and optimal linear filters** **(07 Hrs.)**

Forward and backward linear prediction; the optimum reflection for the forward and backward predictors; relationship of an AR process to linear prediction; the Levinson Durbin algorithm; the Schur algorithm; properties of the linear prediction –error filters, FIR Wiener filter.

**Unit III: Multirate DSP** **(08 Hrs.)**

Decimation by a factor of D; Interpolation by a factor of I; Sampling rate conversion by a rational factor I/D; filter design & implementation for sampling rate conversion, direct from FIR filter structure; application of Multirate DSP ,Digital Filter bank

## SECTION-II

**Unit IV: IIR filters** **(07 Hrs.)**

Design of IIR filter using BLT method and IIR method, Characteristics of Commonly Used Analog Filter, frequency transformation in digital domain

**Unit V: Power spectrum estimation** **(07 Hrs.)**

Estimation of spectra from finite duration observation of signals; computation of energy density Spectrum, estimation of auto-correlation and power spectrum of random signals, the periodogram, the use of DFT in power spectrum estimation; nonparametric methods for power spectrum estimation

**Unit VI: Digital Signal Processors** **(05 Hrs.)**

Architecture-von Neumann, Harvard, super Harward, VLIW, Multiply Accumulate Unit, Pipelining, Circular Buffering, Fixed point and floating point representation, addressing modes, instruction set, architecture of TMS320C50, Architecture of TMS320C54X

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

**Reference Books :**


1. Digital Signal Processing : Principles, Algorithms and Application , By John Proakis/ Dimitris G. Manolakis, Published by Pearson Education.
2. Digital Signal Processing – Dr. Shaila D. Apte by Willy India Pvt. Ltd.
3. Digital Signal Processing – P Ramesh Babu – Scitech publications Pvt. Ltd.

## Solapur University, Solapur

M.E. **(Digital Electronics & Communication Systems) Semester-I**

## ELECTIVE-I: COLOR IMAGE & VIDEO PROCESSING

**Teaching Scheme**
**Lectures-** 3 Hrs. /Week
**Tutorial- 1** Hr. /Week

**Examination Scheme**
**Theory Credits-** 3.0
**Tutorial Credit -** 1.0

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## SECTION-I

**UNIT I: Fundamentals of Image processing** **(4 Hrs.)**

Image Sensing and acquisition, Image Sampling & quantization, Relationship between pixels, Image enhancement- Histogram, Smoothing & Sharpening Filters

**UNIT II: Color Models** **(6 Hrs.)**

Terminologies in Color Images, Color Spaces & Distances- Physic & technique based color spaces, Uniform & perception based color spaces, Color Difference Formulae.

**UNIT III: Color Image Formation and Enhancement** **(4Hrs.)**

CCD Cameras, Color filters & Illuminants, Noise removal in Color images, Contrast Enhancement in color Images

**UNIT IV: Edge Detection** **(4Hrs.)**

Vector Valued Techniques, Color Edge operators, classification of edges, Color Harris operator.

## SECTION -II

**UNIT V: Segmentation & Color Constancy** **(4Hrs.)**

Pixel based, Area based segmentation, edge based segmentation, physics based segmentation, Color Constancy.

**UNIT VI: Basics of Video** **(4Hrs)**

Types of video- Analog, Digital, Time varying image formation- Three Dimensional, Geometric and photometric.

**UNIT VII: Motion Detection & Estimation:** **(4Hrs)**

MAP Detection, 2D motion estimation, Block based methods.

**8. Motion Segmentation:** **(4Hrs)**

Direct Methods, Optical flow segmentation, Simultaneous estimation and segmentation

**Term Work:** Term work shall consist of max eight tutorials based on above curriculum. Students are encouraged to learn suitable software for these tutorials.

**Reference Books:**


1. Digital Image Processing – R.C. Gonzalez, R.E. Woods, Prentice Hall, 2nd or higher edition.
2. Digital Color Image Processing by A. Koschan, M. Abidi, John Willy & sons Publication.
3. Color Image Processing- Methods & Applications by R. Lukac, K. Plataniotis, CRC press
4. Color constancy by Mark Ebner, John Willy & sons Publication.
5. Digital Video Processing by A Murat Tekalp, Prentice Hall publication
6. Handbook of Image & Video Processing by Al Bovik, Academic Press

**Solapur University, Solapur**

M.E. **(Digital Electronics & Communication Systems) Semester-I**

# ELECTIVE-I: FUZZY LOGIC

**Teaching Scheme**
**Lectures-** 3 Hrs. /Week
**Tutorial- 1** Hr. /Week

**Examination Scheme**
**Theory Credits-** 3.0
**Tutorial Credit -** 1.0

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## SECTION-I

**UNIT I: Introduction (4 Hrs.)**

Fuzzy sets & membership, classical sets & fuzzy sets, Classical relation and fuzzy relation

**UNIT II :Fuzzy System (6 Hrs.)**

Membership function& its properties, Fuzzification, & defuzzification, fuzzy logic & fuzzy system, fuzzy automata, development of membership function.

**UNIT III :Fuzzy Arithmetic (4 Hrs.)**

Extension principle, fuzzy arithmetic, Interval analysis in arithmetic, approximate methods of extension.

**UNIT IV: Fuzzy Decision Making (4 Hrs.)**

Fuzzy ordering, preference & consensus, multi objective decision, no transitive ranking, multi criterion Decision making, fuzzy ranking method, fuzzy linear programming.

## SECTION -II

**UNIT V: Fuzzy classification (4 Hrs.)**

Classification by equivalence, clustering, HCM, FCM, pattern recognition, image processing, syntactic

**UNIT VI:Fuzzy Control System (4 Hrs.)**

Simple fuzzy controls, fuzzy in process control, fuzzy statistical process control, FLC with example.

**UNIT VII:Fuzzy Application (4 Hrs.)**

Fuzzy regression, fuzzy cogitative map, medicine, genetic algorithm, Engineering Applications

**UNIT VIII:Advanced Fuzzy Concepts (6 Hrs.)**

Fuzzy neuro system, neuro fuzzy system, Introduction to type 2 fuzzy logic and fuzzy sets, fuzzy expert system, Fuzzy Artmap.

**Term Work:** Term work shall consist of max eight tutorials based on above curriculum. Students are encouraged to learn suitable software for these tutorials.

**Reference Books:**

**1.** Fuzzy logic with engineering application- Timothy J. Ross, Wiley Publication, ( Second Edition)

2. Fuzzy sets & fuzzy logic _ Theory & application – Jorge Klir / Bo Yaun- PHI

3. Type 2 fuzzy logic- Theory & applications- Oscar Castillo and patricia Melin, Springer

4. Fuzzy logic for Embedded Systems Applications- Ahmad Ibrahim, Elsevier- Newnes publication

**Solapur University, Solapur**
M.E. **(Digital Electronics & Communication Systems) Semester-I**

# ELECTIVE-I: SPEECH PROCESSING

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

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## SECTION-I

**UNIT I : Fundamentals of speech signal** **(6 Hrs)**

Review of signal processing, Speech presentation, Types of Speech Signals, models of speech production, Refined models, Basic Speech processing concepts.

**UNIT II : Speech Enhancement** **(6 Hrs)**

Speech enhancement basics, Noise characteristics and estimation, speech enhancement methods, Distortion measures, Enhancement algorithms.

**UNIT III: Feature extraction in speech** **(6Hrs)**

Endpoint Detection, Dynamic Time Warping, Linear Predictive Co-efficients, Poles of the Vocal Tract, Reflection Co-efficients, Log Area Ratio, Cepstrum, , Line Spectral Frequencies, Mel-Frequency Cepstral Co-efficients. Spectrogram, Discrete Wavelet Transformation, Pitch Frequency Estimation, Formant Frequency Estimation

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## SECTION-II

**UNIT IV**: **Speech Coding** **(6 Hrs.)**

Sampling and Quantization of Speech, Digital Speech Coding, Closed-Loop Coders, Open-Loop Coders, Frequency-Domain Coders, Evaluation of Coders

**UNIT V:Speech Synthesis** **(6 Hrs.)**

Concatenative- Word & subword, waveform segments, Text to speech- morphological analysis, TTS application.

**UNIT VI:Speech Recognition** **(6 Hrs.)**

Speech recognition algorithms- HMM, GMM, Viterbi Algorithm, Front-end analysis,

Recognition using ANN, SVM & Dimensionality Reduction Techniques

**Term Work:** Term work shall consist of max eight tutorials based on above curriculum. Students are encouraged to learn suitable software for these tutorials

**Reference Books:**


1. Introduction to Digital Signal Processing by Lawrence R. Rabiner, Ronald W. Schafer, now Publishers Inc.
2. Speech Processing in Embedded Systems by Priyabrata Sinha, Springer.
3. Speech Processing and Soft Computing by Sid-Ahmed Selouani, Springer.
4. Digital Speech Processing Using Matlab by E. S. Gopi, Springer
5. Modern Methods of speech processing by Ravi P. Ramachandran, Richard J. Mammone, Springer Science+Business Media, Llc

**Solapur University, Solapur**

M.E. **(Digital Electronics & Communication Systems) Semester-II**

# MICROWAVE DEVICES AND CIRCUITS

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

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## SECTION-I

**UNIT I: EM Theory** **(5Hrs.)**

Maxwell's equations for –conductor, air, dielectric media, Maxwell's equations for time harmonic field, EM waves equations in dielectric & conducting media, Poynting theorem. Basic of Circular wave guide – waveguide equation, power equation, different mode, related problems.

**UNIT II: Microwave Tubes** **(6 Hrs.)**

Disadvantages of vacuum tubes.

Helical Travelling wave tube-Construction, operation, improved efficiency and power, Dual mode operation, Backward wave devices- Backward wave amplifier- operation, frequency of operation, problems, Backward wave oscillator.

**UNIT III** : **Microwave devices** **(9 Hrs.)**

S parameter, importance of S parameter. Hybrid ring, waveguide impedance matching- T-section, probe, irises and window, waveguide terminations- Horns, Dummy load, Waveguide bends, waveguide joints, Directional couplers- Two hole directional coupler, single hole directional coupler, Multi hole type, Bidirectional coupler, Hybrid Coupler-3db hybrid coupler, 180 degree hybrid ring coupler, Gyrator, waveguide transitions-rectangular to circular, circular to rectangular.

## SECTION-II

**UNIT IV: Microwave solid state devices** (**6 Hrs.)**

Hytero-junction Bipolar Transistor (HBTs), Gunn diode, PIN diode, IMPATT diode, TRAPATT Diode, LSA diodes, InP diodes, MESFETs

**UNIT V:Microwave circuits** **(9 Hrs)**

Tunnel diode- construction, characteristics, tunnel diode amplifier, oscillator, frequency converter and mixer, Parametric amplifiers- basic theory, parametric frequency converters, Monley-Rowe power relation, Parametric up converters, Parametric down converters, negative resistance parametric amplifier, degenerative parametric amplifier, Pin diode as limiter, as attenuator, modulator,

**UNIT VI :MMICS (5 Hrs)**

Introduction to MMIC, materials used for MMIC, MMIC manufacturing technique.

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

**Reference Books-**


1. Microwave Engineering-David M. Pozar (John Wiley & Sons)
2. Microwave Devices and circuits - Samuel Y. Liao, (Pearson)
3. Microwave Engineering- Sisodiya and Raghuvanshi, (PHI)
4. Microwave Devices & Circuit Design"-Gupta & Shrivastava(PHI)
5. Fundamentals of Microwave and Radar Engineering – Er. K.K.Sharma (S.Chand)
6. Microwave and Radar Engineering- M.L. Sisodia, Vijay Laxmi Gupta, J.K. Agrawal (New Age Publications)

## Solapur University, Solapur

M.E. **(Digital Electronics & Communication Systems) Semester-II**

# HIGH SPEED DIGITAL DESIGN

**Teaching Scheme**
**Lectures-** 3 Hrs. /Week
**Practical - 2** Hrs. /Week

**Examination Scheme**
**Theory Credits-** 3.0
**Practical Credit -** 1.0

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### SECTION- I

**UNIT I:.Introduction to high speed digital design. (7 Hrs)**

Frequency, time and distance , Capacitance and inductance effects ,High speed properties of logic gates , Speed and power , Modeling of wires ,Geometry and electrical properties of wires Electrical models of wires ,transmission lines , lossless LC transmission lines , lossy LRC transmission lines ,special transmission lines.

**UNIT II: Power distribution and noise (6 Hrs)**

Power supply network , local power regulation , IR drops ,area bonding , on chip by pass capacitors , symbiotic bypass capacitors , power supply isolation , Noise sources in digital system , power supply noise , cross talk , intersymbol interference.

**UNIT III. Signaling convention and circuits (7 Hrs)**

Signaling modes for transmission lines ,signaling over lumped transmission media, signaling over RC interconnect ,driving lossy LC lines , simultaneous bi-directional signaling, terminations , transmitter and receiver circuits.

### SECTION- II

**UNIT IV: Design issues of high speed Electronics (5 Hrs)**

Simulation tools, Prototyping Circuits, Grounding in high speed systems.

**UNIT V:Power supply issues (6 Hrs)**

Power supply noise reduction and filtering, Power supply conditioning, EMI/RFI considerations, Shielding concepts

**UNIT VI: High Speed ADCs** (9 Hrs)

Fundamental of high speed sampling, Base band ant aliasing filters, Study of Harmonic sampling and band pass sampling, Direct IF to digital conversion, Distortion and noise in an ideal N bit ADC, AD9220 12 bit ADC, Spurious free Dynamic Range, Measurement of Noise Power Ratio, Case study of AD9066, Study of latency of ADCs.

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

**Reference Books:**


1. High-Speed Digital Design: A Handbook of Black Magic by Howard Johnson
2. High Speed Signal Propagation: Advanced Black Magic by Howard W. Johnson
3. Signal Integrity Issues and Printed Circuit Board Design by Douglas Brooks. Prentice Hall Professional.
4. High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices by Stephen H. Hall
5. Signal Integrity - Simplified by Eric Bogatin. Prentice Hall Professional.
6. Handbook of Digital Techniques for High-Speed Design : Design Examples, Signaling and Memory Technologies, Fiber Optics, Modeling, and Simulation to Ensure (Prentice Hall Modern Semiconductor Design) by Tom Granberg
7. Noise Reduction Techniques in Electronic Systems, by Henry Ott. Wiley
8. High Speed Design Techniques, Manual by analog Devices, October 1996
9. High Speed Digital Circuits, Masakazu Shoji; Addison Wesley Publishing Company,1996

## Solapur University, Solapur

M.E. **(Digital Electronics & Communication Systems) Semester-II**

# ADVANCED EMBEDDED SYSTEMS

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

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### SECTION- I

**Unit I: Embedded System procesors** **(7 Hrs)**

Embedded systems overview and components, 8 bit processor, microcontrollers, INTEL 80286, 80386, 80486, Pentium, RISC, Sun SPARK RISC, standard RISC

**Unit II: Memory Systems** **(5 Hrs)**

Memory technologies, SRAM, EPROM and OTP, memory organization, parity, error detecting and correcting memory, DRAM interfaces, DRAM refresh techniques,

**Unit III: Writing software for embedded systems** **(8 Hrs)**

The compilation process, Run time libraries, writing library, using alternative library, using standard library , porting kernels, C extension for embedded systems, Downloading

### SECTION- II

**Unit IV: Real Time operating systems** **(7 Hrs)**

Task and task states, tasks and Data, Semaphore and shared Data, Multitasking operating system, scheduler algorithms, priority inversion, tasks, threads, and processes, memory model, memory management address translation

**Unit V:Emulation and debugging techniques, buffers** **(5 Hrs)**

Debugging techniques, emulation techniques, buffer, linear buffer, directional buffer, double buffering, buffer exchange, linked lists, FIFO, circular buffers

**Unit 6: ARM 9** **(8 Hrs)**

ARM 9 architecture, instructions and data handling; interfacing with memory; interrupts, timers, ARM bus, I/O devices, I/O controllers, simple & autonomous I/O controllers, parallel, multiplexed, tristate, and open-drain buses, bus protocols, serial transmission techniques & standards, wireless protocol, CAN & advanced buses

**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. Embedded Systems by Rajkamal, 2nd Ed, Tata McGraw Hill
2. Embedded system design A Unified Hardware/software approach by Frank Valid & Tony Givangis, Willy India Edition
3. Embedded Systems Design: Steve Heath ELSEVIER publication
4. ARM920T Technical Reference Manual (Rev 1) - ARM DDI 0151C, Data books of ARM7/ARM9 J., ARM Company Ltd.

## Solapur University, Solapur

M.E. **(Digital Electronics & Communication Systems) Semester-II**

## CRYPTOGRAPHY AND NETWORK SECURITY*

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures-** 3 Hrs. /Week | **Theory Credits-** 3.0 |
| **Tutorial - 1** Hr. /Week | **Tutorial 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 maximum* ***six tutorials*** *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. **(Digital Electronics & Communication Systems) Semester-II**

# ELECTIVE II: ARTIFICIAL NEURAL NETWORK

**Teaching Scheme**
**Lectures-** 3 Hrs. /Week
**Tutorial - 1** Hr. /Week

**Examination Scheme**
**Theory Credits-** 3.0
**Tutorial Credit -** 1.0

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## SECTION-I

**UNIT I: Fundamentals of ANN (4 Hrs)**

Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Learning and Adaptation

**UNIT II: NN learning rules (6Hrs)**

Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule ,Widrow-Hoff Learning Rule, Correlation Learning Rule,Winner-Take-All Learning Rule,Outstar Learning Rule, Stability & convergence

**UNIT III: Perceptron (4Hrs)**

Basic structure of perceptron, Single layer and multilayer perceptrons, Perceptron classifier, delta learning rule.

**UNIT IV: Feedforward Networks (4Hrs)**

Back propagation Algorithm, Derivation of BP algorithm, Modified BP algorithm, Case study- Ex-OR classification, character recognition.

## SECTION -II

**UNIT V: Feedback networks (6Hrs)**

Hopfield Network, Mathematical Foundations of Discrete-Time and gradient type Hopfield Networks, BAM, Boltzman machine

**UNIT VI: Self organizing models (4 Hrs)**

Hamming Net and MAXNET, Kohonen SOM, ART1

**UNIT VII: Other Networks (4 Hrs)**

Radial basis function network and approximation, RBF classifiers, Probabilistic NN.

**UNIT VIII : Applications of ANN** **(4 Hrs)**

Linear Programming model, Character recognition, Robot kinematics, Control Applications and medical diagnosis.

## Term Work:

*Term work shall consist of maximum* ***six tutorials*** *based on above curriculum.*

**Reference Books:**


1. Introduction to Artificial Neural Network by J.M. Zurada, West Publishing Company.
2. Principles of Artificial Neural Networks by Daniel Graupe, World Scientific.
3. Artificial Neural Networks by B. Yagnanarayana, Prentice Hall(I)., $11^{th}$ Edition

**Solapur University, Solapur**

M.E. **(Digital Electronics & Communication Systems) Semester-II**

# ELECTIVE II: WAVELET TRANSFORM AND APPLICATIONS*

**Teaching Scheme**
**Lectures-** 3 Hrs. /Week
**Tutorial - 1** Hr. /Week

**Examination Scheme**
**Theory Credits-** 3.0
**Tutorial Credit -** 1.0

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## 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* ***six 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. **(Digital Electronics & Communication Systems) Semester-II**

# ELECTIVE II: WIRELESS SENSOR NETWORK AND OPTIMIZATION*

**Teaching Scheme**
**Lectures-** 3 Hrs. /Week
**Tutorial - 1** Hr. /Week

**Examination Scheme**
**Theory Credits-** 3.0
**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 max* ***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. **(Digital Electronics & Communication Systems) Semester-III**
**Self Learning Course**

**INTERNET OF THINGS (IOT)#**

**Examination Scheme**
**Theory Credits-** 3.0

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## 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 max **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. **(Digital Electronics & Communication Systems) Semester-III**

**Self Learning Course**

**INTELLECTUAL PROPERTY**

**Examination Scheme**
**Theory Credits-** 3.0

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## SECTION-I

**Unit 1: The Concept of Intellectual Property** **(06 Hrs.)**

History, Mission and Activities, Structure, Administration, Membership, Constitutional Reform, Wider Consultation and Outreach

**Unit 2: Patents** **(07 Hrs.)**

Introduction, Conditions of Patentability, Drafting and Filing a Patent Application, Examination of a Patent Application, Infringement ,Exploitation of the Patented Invention, Compulsory Licenses, Utility Models

**Unit 3 : Copyright and Related Rights** **(07 Hrs.)**

Introduction, Copyright Protection, Subject Matter of Copyright Protection, Rights Comprised in Copyright, Related Rights, Ownership of Copyright, Limitations on Copyright Protection, Piracy and Infringement, Remedies, Intellectual Property and Traditional Cultural Expressions Trends and Experiences in the Protection of TCEs

## SECTION-II

**Unit 4: Trademarks-I** **(07 Hrs.)**

Introduction, Definitions, Signs Which May Serve as Trademarks, Criteria of Protectability, Protection of Trademark Rights , Use Requirements

**Unit 5: Trademarks-II** **(07 Hrs.)**

Trademark Registration, Removal of the Trademark from the Register, Trademark Piracy, Counterfeiting and Imitation of Labels and Packaging, Change of Ownership, Trademark Licensing, Trade Names, Franchising

**Unit 6: Protection against Unfair Competition** **(05 Hrs.)**

The Need for Protection, The Legal Basis for Protection, The Acts of Unfair Competition

## Term Work:

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

## Reference Books:

WIPO Intellectual Property Handbook: Policy, Law and Use : WIPO PUBLICATION

**Solapur University, Solapur**

M.E. **(Digital Electronics & Communication Systems) Semester-III**

**Self Learning Course**

# MODELING & SIMULATION OF COMMUNICATION SYSTEM#

**Examination Scheme**

**Theory Credits-** 3.0

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## 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 max* ***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.