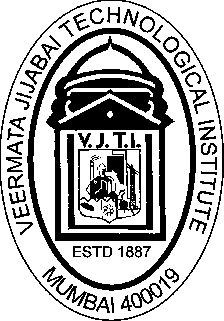
VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE



**(VJTI)**

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

For

Four Year Undergraduate Programme Leading to Bachelor of Technology (B.Tech.) Degree

in

Electronics& Telecommunication Engineering

# Implemented from Academic Year 2016-17

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

For

Four Year Undergraduate Programme Leading to Bachelor of Technology (B. Tech.)

In

|  |  |
| --- | --- |
| 109 | Electronics& Telecommunication Engineering |

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

* **Deliver fundamental as well advanced knowledge with research initiatives in the field of Electronics and Communication Engineering with emphasis on state of the art technology.**
* **Design solutions for electronic systems for real world applications which are technically feasible and economically viable leading to societal benefits.**
* **Demonstrate the leadership qualities and professional attitudes to deal with challenges.**

**PROGRAM OUTCOMES (POs)**

* **Graduates will demonstrate knowledge of mathematics, science and Telecommunication engineering.**
* **Graduates will demonstrate an ability to identify, formulate and solve Electronics and telecommunication engineering problems.**
* **Graduate will demonstrate an ability to solve telecommunication Engineering design problems, analyze and interpret data.**
* **Graduates will demonstrate an ability to design Telecommunication system or component as per needs and specifications**
* **Graduates will demonstrate an ability to visualize and work on laboratory and multi-disciplinary tasks.**
* **Graduate will demonstrate skills to use modern telecommunication engineering tools, software and equipment to analyze problems.**
* **Graduates will demonstrate knowledge of professional and ethical responsibilities**
* **Graduate will be able to communicate effectively in both verbal and written form.**
* **Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues**
* **Graduate will develop confidence for self-education and ability for life-long learning.**

**B. Tech. (Electronics and Telecommunication Engineering)**

**Scheme**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S Y B. Tech (Electronics and Telecommunication Engineering), SEMESTER III** | | | | | | | | |
| **Scheme of Instruction** | | | | **Scheme of Evaluation** | | | | |
| **S. No.** | **Course Code** | **Course Title** | **L-T-P (Hours/week)** | **Credits** | **TA** | **MST** | **ESE** | **ESE hours** |
| 1. | R4MA2003S | Mathematics for Electrical Engineers - I | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
| 2. | R4ET2001S | Signals and Systems | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
| 3. | R4ET2002S | Network Analysis and Synthesis | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
| 4. | R4ET2003T | Electronics Circuit Analysis and Design | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
|  | R4ET2003P | Electronics Circuit Analysis and Design Lab | 0-0-2=2 | 1 | 60 | - | 40 | 2 |
| 5. | R4ET2004T | Analog Communication | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
|  | R4ET2004P | Analog Communication  Circuits Lab | 0-0-2=2 | 1 | 60 | - | 40 | 2 |
| 6. | R4ET2005T | Digital Logic Design | 2-0-0=2 | 2 | 20 | 20 | 60 | 3 |
|  | R4ET2005P | Digital Logic Design Lab | 0-0-2=2 | 1 | 60 | - | 40 | 2 |
| 7. | R4ET2006A | Information Technology Acts | 1-0-2=3 | MNC | 60 | - | 40 | 2 |
|  |  | **Total** | 26 | 20 |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S Y B. Tech (Electronics and Telecommunication Engineering), SEMESTER IV** | | | | | | | | |
| **Scheme of Instruction** | | | | **Scheme of Evaluation** | | | | |
| **S. No.** | **Course Code** | **Course Title** | **L-T-P (Hours/week)** | **Credits** | **TA** | **MST** | **ESE** | **ESE hours** |
| 1. | R4MA2013S | Mathematics for Electrical Engineers – II | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
| 2. | R4ET2011S | Numerical Techniques | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
| 3. | R4ET2012T | Principles of Digital Communication | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
|  | R4ET2012P | Principles of Digital Communication Lab | 0-0-2=2 | 1 | 60 | - | 40 | 2 |
| 4. | R4ET2013T | Integrated Circuits and Applications | 2-0-0=2 | 2 | 20 | 20 | 60 | 3 |
|  | R4ET2013P | Integrated Circuits and Applications Lab | 0-0-2=2 | 1 | 60 | - | 40 | 2 |
| 5. | R4ET2014T | Microprocessor and Microcontroller | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
|  | R4ET2014P | Microprocessor and Microcontroller Lab | 0-0-2=2 | 1 | 60 | - | 40 | 2 |
| 6. | R4ET2015T | Python Programming | 3-0-0=3 | 3 | 20 | 20 | 60 | 3 |
|  | R4ET2015P | Python Programming Lab | 0-0-2=2 | 1 | 60 | - | 40 | 2 |
| 7. |  | Environmental Studies | 1-0-1=2 | MNC | 60 | - | 40 | 2 |
|  |  | **Total** | 27 | **21** |  |  |  |  |

**Veermata Jijabai Technological Institute**

**Scheme of Instruction and Evaluation (R – 2018)**

**B.Tech : EXTC Semester V**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SrNo** | **Course Code** | **Course Name** | **Hr/ Week** |  |  | **Credits** | **Scheme of Evaluation** | | |
|  |  |  | L | T | P |  | TA | MST | ESE |
| 1 |  | Electromagnetic Wave Engineering | 3 | 1 | 0 | 4 | 20 | 20 | 60 |
| 2 |  | Control Systems | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 3 |  | Digital Signal Processing | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 4 |  | Digital Communication Systems | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 5 |  | Computer Communication Networks | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 6 |  | Telecom Regulations | 2 | P/NP |  |  |  |  |  |
| 7 |  | Digital Signal Processing Lab | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 8 |  | Digital Communication Systems Lab | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 9 |  | Computer Communication Networks Lab | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 10 |  | Communications Circuit Design lab | 1 | 0 | 2 | 2 | 60 |  | 40 |
|  |  |  | 18 | 1 | 8 | 21 |  |  |  |

**B. Tech : EXTC – Semester VI**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SrNo** | **Course**  **Code** | | **Course Name** | **Hr/Week** | | | **Credits** | **Scheme of**  **Evaluation** | | |
|  | | | | L | T | P |  | TA | MST | ESE |
| 1 |  | Cellular communication | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 2 |  | Microwave Engineering | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 3 |  | Principles of VLSI | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 4 |  | Professional Elective I | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 5 |  | Open Elective I(Industry 4.0 and Industrial Internet of Things) | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 6 |  | Professional Communication  Skill | | 1 | 0 | 2 | 2 | 60 | 40 |  |
| 7 |  | Microwave Engineering Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 8 |  | Principles of VLSI Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 9 |  | Professional Elective 1Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 10 |  | Cellular communication Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
|  | | | | 16 | 0 | 10 | 21 |  |  |  |

**T Y B. Tech (Electronics and Telecommunication Engineering) SEMESTER VI: Elective – I**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Course Code** | **Course Title** |
| 1. |  | Telecom Network Management |
|  |  | Telecom Network Management Lab |
| 2. |  | Data Compression & Encryption |
|  |  | Data Compression & Encryption Lab |
| 3. |  | Digital Image Processing |
|  |  | Digital Image Processing Lab |
| 4. |  | Neural Network and Fuzzy Logic |
|  |  | Neural Network and Fuzzy Logic Lab |
| 5 |  | Advance Digital Communication |
|  |  | Advance Digital Communication Lab |

**SEM-VII**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SrNo** | **Course**  **Code** | | **Course Name** | **Hr/Week** | | | **Credits** | **Scheme of**  **Evaluation** | | |
|  | | | | L | T | P |  | TA | MST | ESE |
| 1 |  | Optical Communication and Networks | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 2 |  | Statistical Theory of Communication | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 3 |  | Antenna Theory and Design | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 4 |  | Professional Elective-II | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 5 |  | Open Elective II | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 6 |  | Intellectual Property Rights | |  |  |  |  |  |  |  |
| 7 |  | Optical Communication and Networks Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 8 |  | Antenna Theory and Design Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 9 |  | Professional Elective II Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 10 |  | Project –I | | 0 | 0 | 4 | 2 | 60 |  | 40 |
| 11 |  | Internship Presentation | | 0 | 0 | 2 |  |  |  |  |
|  | | | | 15 | 0 | 12 | 20 |  |  |  |

**B. Tech (Electronics and Telecommunication Engineering) SEMESTER VII: Elective – II**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Course Code** | **Course Title** |
| 1. |  | RF Circuit Design |
|  |  | RF circuit Design Lab |
| 2. |  | Advanced Digital Signal Processing |
|  |  | Advanced Digital Signal Processing Lab |
| 3. |  | OFDM-MIMO Communication |
|  |  | OFDM-MIMO Communication Lab |

**SEM-VIII**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SrNo** | **Course**  **Code** | | **Course Name** | **Hr/Week** | | | **Credits** | **Scheme of**  **Evaluation** | | |
|  | | | | L | T | P |  | TA | MST | ESE |
| 1 |  | Embedded Systems | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 2 |  | Satellite Communication | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 3 |  | Advance Mobile Communication | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 4 |  | Professional Elective-III | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 5 |  | Professional Elective IV | | 3 | 0 | 0 | 3 | 20 | 20 | 60 |
| 6 |  | Professional Elective III Lab | | 0 | 0 | 2 | 1 | 60 |  | 40 |
| 7 |  | Project –II | | 0 | 0 | 6 | 3 | 60 |  | 40 |
|  | | | | 15 | 0 | 8 | 19 |  |  |  |

**B. Tech (Electronics and Telecommunication Engineering) SEMESTER VIII: Elective – III**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Course Code** | **Course Title** |
| 1. |  | Wireless Sensor Networks |
| 2. |  | Wireless Sensor Networks Lab |
| 3. |  | Multimedia Communication |
| 4. |  | Multimedia Communication Lab |
| 5. |  | Medical Electronics |
| 6. |  | Medical Electronics Lab |
| 7. |  | Speech Processing |
| 8. |  | Speech Processing Lab |
| 9 |  | Wireless Networks |
| 10 |  | Wireless Networks Lab |

**B. Tech (Electronics Engineering) SEMESTER VIII: Elective – IV**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Course Code** | **Course Title** |
| 1. |  | Pattern Recognition |
| 2. |  | Next Generation Networks |
| 3. |  | Radar Engineering |
| 4. |  | E-Security |
| 5. |  | Coding Theory |

*Abbreviations:* ***L****: Lecture,* ***T****: Tutorial,* ***P****: Practical,* ***TA****: Teacher Assessment / Term work  
Assessment,* ***MST****: In Semester Tests (comprise of average of two In semester tests),* ***ESE****: End  
Semester Written Examination,* ***CIE****: Continuous In-semester Evaluation,* ***MNC: Mandatory noncredit courses***

**Minimum six weeks mandatory internship in industry/research Institute after 6th Semester**

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| **Programme Name** | **B. Tech. (Electronics & Telecommunication Engineering), SEMESTER – V** |
| **Course Code** |  |
| **Course Title** | **ELECTROMAGNETIC WAVE ENGINEERING** |

**COURSE OBJECTIVES**

1. To understand Maxwell’s Equations for time-harmonic fields and the boundary conditions across media boundaries and to study Gauss Law, Coulombs law and Poisson’s Equations to find fields and potentials for a variety of situations including charge distributions and capacitors.
2. To analyze electromagnetic wave propagation and attenuation in various medium and propagation through boundaries between media.
3. To understand the basic properties of transmission lines; analyze electromagnetic wave propagation in generic transmission line geometries, how to use Smith chart to design transmission lines, find reflection coefficient for a given impedance and conversely.
4. To design Impedance Matching Networks for microwave systems design and study Computational Electromagnetic on communication products.

**COURSE OUTCOMES**

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Apply Maxwell’s Equations for time-harmonic fields and the boundary conditions across media boundaries and use Gauss Law, Coulombs law and Poisson’s Equations to find fields and potentials for a variety of situations including charge distributions and capacitors.
2. Analyze electromagnetic wave propagation and attenuation in various medium and propagation through boundaries between media.
3. Apply the basic properties of transmission lines; analyze electromagnetic wave propagation in generic transmission line geometries.
4. Design transmission lines; Impedance matching network for microwave systems and analysis of Computational Electromagnetic on communication products.

**COURSE CONTENTS**

|  |  |
| --- | --- |
| Module I | Basic of Electromagnetic |
|  | * 1. Electromagnetic filed Concept, Field Intensities, Current and Flux Densities.   2. Differential and Integral form of Maxwell’s Equations.   3. Wave Equation and Polarization Theory.   4. Time Varying fields and its Applications.   5. Boundary Conditions. |
| Module II | Plane Wave Propagation |
|  | * 1. Introduction   2. Wave Equations.   3. Plane Waves in Lossless Media.   4. Plane Waves in Dielectric and Good Conductors.   5. Group Velocity. |

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| --- | --- | --- | --- |
|  | * 1. Flow of Electromagnetic Power and the Poynting Vector.   2. Normal and Oblique Incidence at a Plane Conducting Boundary and at Dielectric Boundary | | |
| Module III | Transmission Lines | | |
|  | * 1. Introduction   2. Concept of Distributed Elements   3. Equations of Voltage and Current   4. Standing Waves and Impedance Transformation.   5. Lossless and Low Loss transmission Lines   6. Power Transfer on a Transmission Lines   7. Graphical Representation of a Transmission Lines with Impedance Smith Chart   8. Application of Transmission Lines   9. Impedance Matching with Single and Double Stub matching networks | | |
| Module IV | Waveguides | | |
|  | * 1. Introduction.   2. Wave Equations.   3. Transverse Magnetic (TM) Mode.   4. Transverse Electric (TE) Mode.   5. Transverse Electro-Magnetic (TEM)Mode.   6. Rectangular Waveguides.   7. Circular Waveguides.   8. Hollow Waveguides. | | |
| Module V | Computational Electromagnetic | | |
|  | * 1. Introduction of Finite-difference method.   2. Finite-Element method.   3. Method of Moments.   4. Finite-Element one-dimensional analysis. | | |
| Text Books: |  | | |
| 1 | *Electromagnetic Waves* 2010 by R. K. Shevgaonkar. McGraw Hill. | | |
| 2 | *Electromagnetics, Microwave Circuit and Antenna Design*  *Communications Engineering*. 2006 by Peter Russer. Artech House. |  | *for* |
| 3 | *Computational Electromagnetic Transients* 2014 by R Ramanujam  International Publishing House Pvt. Ltd. New Delhi | I | K. |
| Reference Books: | | | |
| 1 | *Electromagnetic Field Theory Fundamentals*.2004 by Bhag Guru and Huseyin  Hiziroglu. Cambridge University Press | | |
| 2 | *Field and Wave Electromagnetics*. 1989 by David K. Cheng. Pearson  Education | | |
| 3 | *Computational Electromagnetics for RF and Microwave Engineering*.2011 by  David B. Davidson. Cambridge University Press | | |

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| **Programme Name** | **B. Tech. (Electronics & Telecommunication Engineering), SEMESTER – V** |
| **Course Code** |  |
| **Course Title** | **CONTROL SYSTEMS** |

**COURSE OBJECTIVES**

1. To model various control system problems
2. To improve performance and stability of control system
3. To stabilize the system through frequency compensation
4. To analyze and design state variable systems and various industrial controller

**COURSE OUTCOMES**

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Model various control system problems
2. Improve performance and stability of control system
3. Improve stability of the system through frequency compensation
4. Analyze and design state variable systems and various industrial controller

**COURSE CONTENTS**

|  |  |
| --- | --- |
| Module I | Control System Modelling |
|  | * 1. Basic Elements of Control System   2. Open loop and Closed loop systems – Differential equation – Transfer function   3. Modeling of Electric systems   4. Translational and rotational mechanical systems – Block diagram reduction Techniques – Signal flow graph |
| Module II | Time response analysis |
|  | * 1. Time response analysis – First Order Systems,   2. Impulse and Step Response analysis of second order systems.   3. Steady state errors – P, PI, PD and PID Compensation,   4. Stability analysis – Routh-Hurwitz criterion. Root Locus technique, Design of compensators using Root Locus   5. Analysis using Simulator |
| Module III | Frequency response analysis |
|  | * 1. Frequency Response – Bode Plot, Polar Plot,   2. Nyquist Plot – Frequency Domain specifications from the plots – Constant M and N Circles   3. Nichols Chart – Use of Nichols Chart in Control System Analysis.   4. Series, Parallel, series-parallel Compensators – Lead, Lag, and Lead Lag Compensators,   5. Analysis using Simulator |
| Module IV | State Variable Analysis and Design |

|  |  |
| --- | --- |
|  | * 1. Concept of state, state variables and state model   2. State space representation of Continuous Time systems – State equations –   3. Transfer function from State Variable Representation – Solutions of the state equations   4. Concepts of Controllability and Observability   5. State space representation for Discrete time systems   6. Sampled Data control systems – Sampling Theorem – Sampler &   Hold – Open loop & Closed loop sampled data systems. |
| Module V | Controllers |
|  | * 1. PID Controllers: basic algorithm, structures, practical modifications – ISA PID control law, discrete implementation   2. Programmable Logic Controller (PLC) – Concept, Architecture, Programming and Interfacing..   3. Application case studies. |
| Text Books: |  |
| 1. | *Control system Engineering* 4th edition, 2011by Noman S Nise. Wiley. |
| 2 | *Control System Engineering* 5th edition, 2007 by I G Nagarath  M. Gopal. New age International publication. |
| 3 | *Advanced control system design*, 1996 by Bernard Friedland. Pearson. |
| 4 | *PID controller: Theory, Design and tuning* 2nd edition, 1995 by Karl J Astrom  Torrey Hagglund. ISA. |
| 5 | *Modern Control engineering* 5th edition 2009 by Katsuhiko Ogata. Pearson. |
| Reference Books: | |
| 1 | *Control System Design*, 2000 by Graham C Goodwin. Pearson. |
| 2 | *Digital control Systems: Design, Identification and implementation*, 2006 by  Loan Dore Landau. Springer. |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER V** |
| **Course Code** |  |
| **Course Title** | **DIGITAL SIGNAL PROCESSING** |

**COURSE OBJECTIVES**

1. To characterize digital signal processing system in various domains
2. To Model digital signal processing systems and design various digital filters
3. To analyze and design multirate digital processing system
4. To design and implement digital signal processing hardware

**COURSE OUTCOMES**

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

* 1. Characterize digital signal processing system in various domains
  2. Modeling digital signal processing systems and design various digital filters
  3. Analyze and design multirate digital processing system
  4. Design and implement digital signal processing hardware

**COURSE CONTENTS**

|  |  |
| --- | --- |
| Module I | Characterization of LTIDT System |
|  | * 1. Basic elements of DSP system   2. Advantages of DSP over analog processing   3. Time Domain Analysis of DT System: Difference equations, Recursive solution of difference equation, zero input response, unit impulse response, system response to external input, convolution sum, total response of DT system, causal LTIDT system stability.   4. Systems with Finite Duration and Infinite Duration Impulse response |
| Module II | Analysis of DT system |
|  | * 1. DTFS & DTFT, Power & Energy density of periodic and aperiodic signals,   2. Computation of DTFT, DFT.   3. Properties of DFT, FFT, DIT, DIF   4. Need of Z – transform Definition, Inverse, properties   5. Connection between DTFT and Z-Transform |
| Module III | Digital Filters |
|  | * 1. Realization of digital filter   2. bilinear transformation,   3. FIR design   4. Linear phase conditions   5. Frequency sampling method. |
| Module IV | Multirate Sampling |
|  | * 1. Introduction   2. Decimation, |

|  |  |
| --- | --- |
|  | * 1. Interpolation   2. Sampling rate conversion, |
| Module V | DSP Hardware |
|  | * 1. Fixed point and floating Point arithmetic for DSP   2. Rapid DSP System Design Tools and Processes for FPGA.   3. General Architecture of DSP processor   4. Case Study of TMS320C67XX |
| Module VI | Wavelets |
|  | * 1. Review Fourier transform, Short-time Fourier transform   2. Introduce time frequency resolution, orthogonality and orthonormality,   3. Continuous time wavelet transform, discrete wavelet transform,   4. Analysis using Harr scaling and wavelet functions, refinement relations, |
| Text Books: |  |
| 1. | *Digital signal processing* 4th edition, 2007 by Proakis Monolakis. Pearson |
| 2 | *Digital Filters Analysis, Design and Applications* 2nd edition, 1999 by  Antoniou, Mc Graw Hill |
| 4 | *Digital Signal processor Architecture, Programming and applications* 2nd  edition,2002 by Venkateramani Bhasker. Mc Graw Hill |
| 5 | *Wavelets transforms*,1998 by R M Rao. A S Bopardikar Pearson |
| Reference Books: | |
| 1 | *Discrete Time signal processing* 3rd edition 2013 by Oppenheim  Schafer. Pearson |
| 2 | *Digital Signal processing A concept based Approach* 4e, 2016 by Mitra. Mc  Graw Hill |
| 3 | *Real Time digital signal processing Fundamentals, Algorithm and*  *implementation using TMS processor,*2010 by Udyyashankra. PHI. |
| 4 | *DSP based embedded and Real time systems*, 2012 by Oshana. Newnes |

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| **Programme Name** | **B. Tech. (Electronics & Telecommunication Engineering), SEMESTER - V** |
| **Course Code** |  |
| **Course Title** | **DIGITAL COMMUNICATION SYSTEMS** |

**COURSE OBJECTIVES**

1. Apply data compression techniques and calculate channel capacity

2. Design PCM systems

3. Design and analyse baseband signalling schemes

4. Design and analyse bandpass signalling schemes

**COURSE OUTCOMES**

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. 1. Apply data compression techniques and calculate channel capacity
2. 2. Design PCM systems
3. 3. Design and analyse baseband signalling schemes
4. 4. Design and analyse bandpass signalling schemes

**COURSE CONTENTS**

|  |  |
| --- | --- |
| Module I | Information Theory |
|  | * 1. Introduction   2. Entropy   3. Source coding Theorem   4. Lossless data compression Algorithm   5. Discrete memory less channels   6. Mutual Information   7. Channel capacity   8. Channel coding Theorem   9. Differential entropy and mutual information for continuous random ensembles   10. Information and implementation of capacity law   11. Information capacity of colored noisy channelRate distortion Theory |
| Module II | Digital Transmission of Analog Signal |
|  | * 1. Introduction to Digital Communication System: Why Digital?   2. Basic Digital Communication Nomenclature.   3. Digital Versus Analog Performance Criteria,   4. Sampling Process   5. PCM Generation and Reconstruction,   6. Quantization Noise   2.6. Non-uniform Quantization and Companding   * 1. PCM with noise: Decoding noise, Error Threshold   2. Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation   3. Differential Pulse Code Modulation |
| Module III | Baseband modulation and demodulation |
|  | * 1. Baseband systems   2. Messages, characters and symbols   3. Formatting analog information   4. Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers, Data formats and their spectra,   5. Source of corruption   6. Synchronization: Bit Synchronization, Scramblers, Frame Synchronization   7. Intersymbol interference   8. Equalization   9. Detection Theory: MAP, LRT, Minimum Error Test, Error Probability   10. Signal space representation :   Geometric representation of signal, Conversion of continuous AWGN channel to vector channel   * 1. Likelihood functions, Coherent Detection of binary signals in presence of noise   2. Optimum Filter, Matched Filter, Probability of Error of Matched Filter   3. Correlation receiver |
| Module IV | Pass Band modulation and demodulation |
|  | 4.1 Pass band transmission model, |

|  |  |
| --- | --- |
|  | * 1. Signal space diagram,   2. Digital passband modulation Techniques   3. Digital passband demodulation Techniques   4. Error Probability derivation   5. Coherent and non-coherent detection   6. Complex envelope   7. Power spectra of coherent BPSK, BFSK and QPSK and Geometric Representation   8. Generation and detection of - M-array PSK, M-array QAM and their error probability   9. Generation and detection of -Minimum Shift Keying, Gaussian MSK, Non-coherent BFSK, DPSK and DEPSK |
| Module V | Channel Coding |
|  | * 1. The channel   2. Received signal power and noise power   3. Link Budget analysis   4. Noise figure, Noise temperature and system temperature   5. Sample link analysis   6. Satellite repeaters   7. Waveform coding   8. Types of error control   9. Structural Sequences   10. Error detecting and correcting capability   11. Standard array   12. Interleaving and concatenated codes   13. Turbo codes |
| Module VI | Spread Spectrum Techniques |
|  | * 1. Allocation of the communication resource   2. Multiple access communication system and Architecture   3. Access Algorithm   4. Multiple access techniques employed with INTELSAT   5. Multiple access techniques for LAN   6. Spread spectrum overview   7. Pseudonoise sequences   8. Direct sequence spread spectrum systems   9. Frequency Hopping systems |
| Text Books: |  |
| 1. | *Digital Communications fundamentals and applications* 2nd edition, 2009 by  Bernard Sklar, Pabitra Kumar Ray. Pearson |
| 2 | *Digital Communication System*, 2014 by Simon Haykin. Wiley |
| Reference Books: | |
| 1 | *Digital Communications* 4th edition 2001 by John G. Proakis. Mc Graw Hill |
| 2 | *Principles of Digital communication*, 2008 by Robert G Gallager. Cambridge |
| 3 | *Digital Communication* 3rd edition 2004 byJohn R Barry Edward A. Lee  David G.Messevschmitt. Springer |

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| **Programme Name** | **B. Tech. (Electronics & Telecommunication Engineering), SEMESTER - V** |
| **Course Code** |  |
| **Course Title** | Computer Communication Networks |

COURSE OBJECTIVES**:**

* 1. To classify and model computer communication networks
  2. To get familiarized with various computer communication networks technologies
  3. To study and estimate various parameters of network layers, transport layer and application layer
  4. To study various routing protocols

COURSE OUTCOMES:

1. Model various computer communication networks with parameters.
2. Expertise in selection of optimized technologies for computer communication networks.
3. Estimate various parameters of network layers, transport layers and application layers.
4. Estimate parameters of parameters of various routingprotocols.

**COURSE CONTENTS**

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| Module I | Overview |
|  | * 1. Components   2. Networks: physical Structures   3. Network Types   4. OSI Model and TCP/IP Protocol suite   5. Switching:-      1. Circuit switching      2. Packet switching |
| Module II | Underlying Technologies |
|  | * 1. Connecting Devices: Hubs, Switches, Routers, Repeaters and Bridges   2. Virtual LANs   3. Random Access ALOHA,CSMA,CSMA/CD,CSMA/CA   4. Wireless LANs,IEEE802.11 project, BLUETOOTH, Point to point WANs |
| Module III | Network Layer |
|  | * 1. Network Layer services and issues   2. IPv4 Address Introduction, CLASSFUL and CLASSLESS ADDRESSING ,NAT   3. IPV4 protocol ,Introduction, Datagrams ,Fragmentation, Options   4. Address resolution protocol (ARP),Address Mapping, ARP Protocol   5. IPv6 Addressing and IPv6 Protocol |
| Module IV | Mobile IP |
|  | 4.1 Addressing   * 1. Agents   2. Three Phases   3. Inefficiency |
| Module V | Unicast Routing Protocols |
|  | * 1. Introduction   2. Intra and Interdomain routing   3. Distance Vector Routing   4. RIP, Message Format, Requests and Responses, Timers in RIP   5. Link State Routing algorithm   6. OSPF   7. Path Vector Routing   8. BGP |
| Module VI | Transport Layer |
|  | * 1. Transport layer Services   2. Transport layer Protocols   3. UDP services and Applications   4. TCP ,TCP Services, TCP Connection, State Transition Diagram ,Windows in TCP, Flow Control ,Error Control |
| Module VII | Application Layer |
|  | * 1. Host Configuration: DHCP, Introduction, DHCP operation, Configuration   2. Domain Name System (DNS)   3. Need for DNS   4. Name Space   5. DNS in internet   6. Resolution |
| Text Books: |  |
| 1 | *Computer Networks* 5th edition 2010 by Andrew Tanenbaum. Pearson |
| 2 | *Data communications and networking 5E*,5th edition 2013 by Forouzan. Mc  Graw Hill. |
| 3 | *TCP/IP Protocol Suite* 4th edition 2010 by Behrouz A. Forouzan. Tata Mc  Graw Hill. |
| Reference Books: | |
| 1 | *Communication networks Fundamental concepts and Key Architecture* 2nd  edition 2004 by Alberto Leon Garcia Indra Widjaja. Tata Mc Graw Hill |
| 2 | *Data Network Design* 3rd edition 2002 by Darren L Spohn. Tata Ma Graw Hill |
| 3 | *Internetworking with TCP/IP Volume 11: Design Implementation and*  *Internals* 3rd edition 1999 by D Comer D Stevens. PHI |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **TELECOM REGULATIONS** |

**COURSE OBJECTIVES**

1. To develop telecommunication planning and estimation skills with reference to national/ international regulation and standard.
2. To develop ability to manage telecommunication services with reference to national/ international regulation and standard.
3. To study the problems between vendors and customers.
4. To develop quality of service

**COURSE OUTCOMES**

1. To develop telecommunication planning and estimation skills with reference to national/ international regulation and standard.
2. Ability to manage telecommunication with reference to national/ international regulation and standard.
3. Provide solution for the problems raised between vendors and customers.
4. Develop quality of service

**COURSE CONTENTS**

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| Module I | Telecom Regulation Authority of India |
|  | * 1. The telecommunication(Broadcasting and cable services) interconnection regulations   2. Prohibition of Discriminating Tariffs for data services regulations   3. Regulations of Telecommunication consumers protection   4. The standard of quality of services of basic Telephone service and Cellular mobile telephone service.   5. Telecommunication mobile number portability   6. The telecommunication interconnection usage charges   7. The mobile banking regulations |
| Module II | Telecom Regulation Authority of India Spectrum |
|  | 2.1 Consultation paper on valuation and reserve price of the spectrum |

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|  | in 700,800, 900,1800,2100,2300.2500 MHz Bands   * 1. Recommendation on transfer from IPv4 to IPv6.   2. Recommendation on allocation and pricing of spectrum for 3G and broadband wireless access services   3. Recommendation on approach towards green telecommunication   4. Recommendation growth of the value added services and regulatory issues   5. Recommendation on issues related to telecommunication infrastructure policy |
| Module III | International Telecom Unit ITU Recommendation |
|  | * 1. Organization of the work of ITU-T   2. General principles   3. Overall network operation, telephone service, service operation and human factors   4. Non telephone telecommunication services   5. Transmission systems and media, digital systems and networks,   6. Integrated services digital networks, cable networks and transmission of television, sound program and other media signals   7. protection against interference   8. Environments and ICT’s climate change, ewaste, energy, efficiency construction installation and protection of cables and other elements of outside plant   9. Telecommunication management including TMN and network maintenance   10. Maintenance: International sound program Television transmission circuits   11. Specification of measuring equipment   12. Terminals and subjective and objective assessment methods   13. switching and signaling   14. Telegraph transmission   15. Telegraph services terminal equipments   16. Terminals for telematic services   17. Telegraph switching   18. Data communication over the telephone network   19. Data networks open system communication and security   20. Global infrastructure, internal protocols aspects and next generation network   21. Language and general software aspect for telecommunication systems |
| Module IV | ITU Amendments |
|  | 4.1 ITU-TY-4112/TY-2077 Requirements of the plug and play of the |
|  | IoT   * 1. ITU-TP.913 Methods for the subjective assessment of video quality, audio quality and audio and video quality for internet video and distribution quality of television in any environment   2. ITU-T Y.4411 Overview of application programming interference and protocols for the machine to machine service layer   3. ITU-T Y.2078 Application support model of the IoT |
| Module V | ISM band regulation |
|  | * 1. ISM band frequency range   2. Consultation paper on allocation of spectrum resources for residential and enterprise, intra telecommunication requirements/ cordless telecommunication system   3. ISM band regulation compliance in United states and Europe   4. FCC and ETSI regulations for ISM band or SRD for both Transmitters and receivers Texas Instruments.   5. International, regional and national regulation of SRDs |

**LEARNING WEBS**

**http://** [www.**trai**.gov.in/](http://www.trai.gov.in/) **http://** [www.**itu**.int](http://www.itu.int/)

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| **Programme Name** | **T.Y. B.Tech (Electronics Engineering), SEMESTER - VI** |
| **Course Code** |  |
| **Course Title** | **Digital Signal Processing LAB** |

**COURSE OBJECTIVES**

* + To analyze signals in time and frequency domain using different mathematical tools which are fundamental to all DSP techniques
  + To design, implement, analyze and compare digital filters for processing of discrete time signals.

**COURSE OUTCOMES**

* Students should be masters in analyzing discrete-time signals in the time domain and frequency domain, using z-transform, discrete time Fourier transform and discrete Fourier transform.
* Students should be able to design various types of Digital Filters like FIR and IIR and implement it.
* Students should be able work on different practical projects in signal processing like Speech processing, Image Processing, Biomedical Signal Processing

**COURSE CONTENTS**

|  |  |
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| **Module 1** | Frequency response of FIR and IIR system |
| **Module 2** | Transfer function and pole-zero plots of FIR and IIR systems |
| **Module 3** | Implementation DITFFT and DIFFFT |
| **Module 4** | **Linear Phase FIR filters** |
|  | Magnitude & phase response for Four types of Linear Phase systems |
| **Module 5** | **FIR Filter Design** |
|  | 1. Design of FIR filters by windowing technique: 2. Use of different windows: rectangular, triangular, hamming, hanning,   Kaiser   1. Design of FIR filters using Frequency sampling techniques |
| **Module 6** | **Design of IIR filters** |
|  | 1. Different types of analog approximations: Butterworth, Chebyshev, Inverse Chebyshev 2. Conversion techniques like bilinear transformation, impulse invariance, matched Z-transform |
| **Module 7** | Implementation of simple programs on DSP processors |
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|  | **TEXT BOOKS** |

|  |  |
| --- | --- |
| **1** | J. G. Proakis, D. G. Manolakis, Digital Signal Processing : Principles,  Algorithms and Applications, Prentice Hall of India, third edition, 1995 |
|  | **ADDITIONAL READING** |
| **1** | Oppenheim and Schafer with Buck, Discrete- Time Signal Processing,  Prentice Hall of India, 2000 |
| **2** | A. Nagoor Kani, Digital Signal Processing, McGraw-Hill Education Second  edition 2013 |
| **3** | A. Antoniou, Digital Filters: Analysis Design and Applications, Tata  McGraw-Hill, .2001. |
| **4** | Ashok Ambardar, Analog and Digital Signal Processing, Thomson Learning,  second edition, 2001 |

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| **Programme Name** | **B. Tech. (Electronics & Telecommunication Engineering), SEMESTER - V** |
| **Course Code** |  |
| **Course Title** | **DIGITAL COMMUNICATION SYSTEMS LAB** |

**COURSE OBJECTIVES**

1. To visualize the effects of sampling and perform reconstruction
2. To implement PCM & DM
3. To simulate Digital bandpass modulation
4. To simulate Error control coding schemes

**COURSE OUTCOMES (COs)**

The Lab should be conducted in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1.Simulate & validate the various functional modules of a communication system

2. Demonstrate their knowledge in bandpass modulation schemes

3. Apply various channel coding schemes

4. Demonstrate their ability to improve the noise performance of communication system

**LIST OF EXPERIMENTS:**

1. Signal Sampling and reconstruction

2. Time Division Multiplexing

5. Pulse Code Modulation and Demodulation

6. Delta Modulation and Demodulation

7. Line coding schemes

8. Simulation of ASK generation and detection scheme

9. Simulation of FSK generation and detection scheme

10. Simulation of BPSK generation and detection scheme

12. Simulation of Linear Block and Cyclic error control coding scheme

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| **Programme Name** | **B. Tech. (Electronics & Telecommunication Engineering), SEMESTER - V** |
| **Course Code** |  |
| **Course Title** | **Computer Communication Networks Lab** |

COURSE OBJECTIVES:

1. To study Computer network simulation software and examine performance of LANs
2. To simulate Ethernet network
3. To simulate Token ring network and implement routing algorithm
4. To simulate, design and measure parameters of TCP/IP network.

COURSE OUTCOMES

1. Expertise in computer network simulation software.
2. Simulate and estimate parameters of Ethernet network.
3. Simulate and estimate parameters in Token ring network and Implement routing algorithm.
4. Design and test TCP/IP networks

**COURSE CONTENTS**

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| Module I | | Introduction to computer network simulator |
|  | | * 1. Introduction to computer network simulator Software   2. OSI Model   3. Routers   4. Switches   5. Simulation and examine performance of LANs in different scenarios |
| Module II | | Ethernet Network |
|  | | * 1. ALOHA   2. CSMA/CD   3. Simulation and examine performance of Ethernet Network in different scenarios using computer network simulator |
| Module III | | Token Ring Network |
|  | | 3.1 Introduction to shared media network |
|  | | * 1. Media Access control   2. Implantation and examine performance of Token Ring network using computer network simulator |
| Module IV | | Network Design |
|  | | * 1. Routers   2. Switches   3. Network Planning with different users, Host and services using computer network simulator |
| Module V | | Routing Protocol Based on Distance- Vector- algorithm and link state  algorithm |
|  | | * 1. Packet switching   2. Distance Vector algorithm   3. OSPF:- link state algorithm   4. Study of routing tables and observe how RIP is affected by link failures using computer network simulator |
| Module VI | | TCP: Transmission Control Protocol |
|  | | * 1. Congestion Control   2. TCP as end to end Transmission   3. Study of TCP and analyze the size of the congestion window using computer network simulator |
| Module VII | | Network simulation and communication between application layer of nodes  in LAN connection |
|  | | * 1. Introduction to Network simulation Software   2. TCP/IP suite   3. TCP/ UDP Protocol   4. OSI Model   5. implementation and examine two node network at application layer in LAN connection node using Network simulator software |
| Module VIII | | Design Of LAN Network |
|  | | * 1. Ethernet   2. CSMA/CD   3. Physical Topologies   4. Implementation and examine performance of designed network via LAN topology using Network simulator software. |
| Text Books: | |  |
| 1 | | *Computer Networks A Systems approach Network simulation Experiment*  *manual* 3rd edition 2003 by Emad Aboelela. Morgan Kuafmann Publishers |
| 2 | | *Data communications and networking 5E*,5th edition 2013 by Forouzan. Mc  Graw Hill |
| 3 | | *TCP/IP Protocol Suite* 4th edition 2010 by Behrouz A. Forouzan. Tata Mc  Graw Hill. |
| Reference Books: | | |
| 1 | *Communication networks Fundamental concepts and Key Architecture* 2nd  edition 2004 by Alberto Leon Garcia Indra Widjaja. Tata Mc Graw Hill | |
| 2 | *Data Network Design* 3rd edition 2002 by Darren L Spohn. Tata Ma Graw Hill | |
| 3 | *Internetworking with TCP/IP Volume 11: Design Implementation and*  *Internals* 3rd edition 1999 by D Comer D Stevens. PHI | |

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| **Programme Name** | **Third Year B. Tech. (EXTC), Semester-VI** |
| **Course Code** |  |
| **Course Title** | **Cellular Communication** |
| **Pre-requisite** | **Digital Communication Systems, Analog Communication** |

**COURSE OUTCOMES:**

After completion of this course, students will be able to

1. Design a cellular system.
2. Characterize different indoor and outdoor propagation models related to losses and different types of fading.
3. Describe GSM, CDMA concepts and architecture, frame structure, system capacity, services provided.
4. Compare the 2.5G, 3G and 4G technology evolution with characteristics and limitations.

# COURSE CONTENTS

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| **Module 1** | **Fundamentals of Mobile Communication** |
|  | Introduction to wire1ess communication.  Frequency Division Multiple access, Time Division Multiple access, Spread Spectrum Multiple access, Space Division Multiple access, and OFDM. Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trunking and grade of service, improving the capacity of cellular systems and related design problems. |
| **Module 2** | **Mobile Radio Propagation** |
|  | Study of indoor and outdoor propagation models.  Small scale fading and multi-path Small-scale multi-path propagation, parameter of multi-path channels, types of small scale fading, Raleigh and Ricean distribution. |
| **Module 3** | **Evolution of 1G-2G Technologies** |
|  | **AMPS GSM** Network architecture, signaling protocol architecture, identifiers, channels, introduction frame structure, speech coder RPE-LTP, authentication and security, call procedure, handoff procedure, services and features.  **GSM evolution in GPRS and EDGE:** Architecture and services offered.  **IS-95 A& B (CDMA-1):** Frequency and channel specifications of forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management. |
| **Module 4** | **3G Technology** |
|  | **IMT-2000/UMTS:** Network architecture, air Interface specification, forward and reverse channels in W-CDMA and CDMA 2000, spreading and modulation.  Cell search and synchronization, establishing a connection, hand off and power control in 3G system. |
| **Module 5** | **3GPP LTE 4G** |
|  | Introduction and system overview.  Frequency bands and spectrum ,network structure, and protocol structure Frame slots and symbols, modulation, coding, multiple antenna techniques  **Logical and Physical Channels:** Mapping of data on to logical sub- |

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|  | channels physical layer procedures, establishing a connection, retransmission and reliability, power control. 4G Introduction and vision.  Multi antenna Technologies: MIMO; software defined radio.  Adaptive multiple antenna techniques, radio resource management, QOS requirements. |
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| **Text Books:** | |
| 1. | Rappaport,T.S., “*Wireless communications*”, 2nd Edition, Pearson Education,  2010. |
| 2. | Clint Smith, P.E Daniel Collins, *“3G Wireless Networks”*,Mc Graw Hill, 2nd  Edition ,2014. |
| 3. | Vijay Garg , “*Wireless Communications and networking*”, 1st Edition,  Elsevier 2007. |
| **Additional Reading:** | |
| 1. | Young Kyun Kim and Ramjee Prasad, “*4 G Roadmap and Emerging*  *Communication Technologies*”, 3rd Edition ,Artech house.2006. |
| 2. | Raj Pandya, “*Mobile And Personal Communications Systems And Services*”,  Prentice hall, 3rd Edition , 2000. |
| 3. | Upena Dalal, “ *Wireless Communication*”, 1st Edition ,Oxford University  Press, 2009. |
| 4. | C.Y Lee , “*Mobile Communication*”, 2nd Edition Wiley,1992 |
| 5. | Andreas.F. Molisch, “*Wireless Communications*”, John Wiley – India, 2006. |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **MICROWAVE ENGINEERING** |

**COURSE OBJECTIVES**

1. To identify the use of microwave components and devices in microwave applications.
2. To understand the working principles of all the solid state devices
3. To analyze the microwave passive circuit components and design the tuning and matching networks.
4. To deal with the issues in the design of microwave amplifier, the microwave generation and microwave measurement techniques

**CORSE OUTCOMES**

The theory should be taught in such a manner that students are able to acquire different learning outcomes in

1. Identify the use of microwave components and devices in microwave applications.
2. Estimate parameters of all the solid state microwave devices
3. Analyze the microwave passive circuit components and design the tuning and matching networks
4. Design of microwave amplifier as well as expertise in microwave generation and microwave measurement.

**COURSE CONTENTS**

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| Module I | | Introduction |
|  | | Microwave bands, Characteristics of microwaves, Microwave system, traditional,  Industrial and Bio medical applications, Microwave hazards. |
| Module II | | Passive And Active Microwave Devices |
|  | | Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator. Crystal and Schottkey diode, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor  diode. |
| Module III | | Representation of Two-Port Networks |
|  | | Introduction, impedance, admittance, hybrid and ABCD matrices, travelling waves and transmission line concepts. Scattering matrix and the chain scattering matrix, shifting reference plans, properties of scattering parameters, generalized scattering parameters two-port network parameters conversions, scattering  parameters of transistors. Design of Matching Circuits Using Lumped Elements. |
| Module IV | | Microwave Transistor Amplifier |
|  | | Introduction, powers gain equations, Stability consideration, constant gain circles unilateral case, and unilateral figure of merit, simultaneous conjugate match bilateral case, constant gain circles-bilateral case, operating and available power gain circles DC bias networks. Introduction to noise in two port networks,  constant noise figure circles, broadband amplifier design |
| Module V | | Microwave Transistor Oscillator |
|  | | Introduction, compressed smith chart, Introduction, one part negative – resistance oscillators, two part negative resistance oscillator, oscillator design using large  signal measurements |
| Module VI | | Microwave measurements |
|  | | Measuring Instruments : Principle of operation and application of VSWR meter,  Power meter, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Attenuation. |
| Module VII | | Microwave devices and Generation |
|  | | Microwave tunnel diodes, microwave FETs, gunn effect diodes, RWH Theory, LSA diodes, InP diodes, CdTe diodes, Impatt diodes, PIN diodes, ruby laser, MESFETs and HEMT. Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Travelling wave tube amplifier, Magnetron, Forward  wave cross field Amplifiers. |
| Text Books: | |  |
| 1 | | *Microwave Devices and circuits* 3rd edition by Samuel Liao. PHI Publication. |
| 2 | | *Microwave Engineering* 4th edition 2012 by David Pozar. John Wiley and Sons  publication. |
| 3 | | *Microwave engineering passive circuits* 1988 by Peter A.Rizzi. PHI publication. |
| 4 | | *Microwave Engineering*”, 2005 by Annapurna Das and Sisir K Das. Tata  McGraw Hill Publishing Company Ltd, New Delhi, |
| 5 | | *Basic Microwave Techniques and laboratory manual* 1987 by M.L.Sisodia,  G.S.Raghuvamsi. Wiley Eastern Limited publication. |
| **Reference Books:** | | |
| 1 | *Microwave Transistor Amplifiers: Analysis and Design*; 2/e, 2007 by G. Gonzalez  Prentice Hall of India, | |
| 2 | *Electromagnetic Field theory fundamentals-*1998 by Guru and Hisiroglu.  Thomson Learning publication | |
| 3 | *Modern RF and Microwave measurement Techniques*, by Valeria Teppati.  Cambridge | |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication**  **Engineering), SEMESTER - VI** |
| **Course Code** |  |
| **Course Title** | **Principles of VLSI** |

**COURSE OBJECTIVES**

1. To introduce VLSI design.
2. To understand CMOS fabrication process and layout.
3. To understand basic MOSFET physics so as to understand its structure, operation, characteristics, physical effects, scaling and the dependences of different vital parameters.
4. To learn, analyze and design various MOSFET circuits using different MOSFET based topologies (especially CMOS topology) functionally as well as for different parameter (delay, power, noise) constraints.

**COURSE OUTCOMES**

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Students should be able to describe basic VLSI design flow, hierarchy, styles and design quality parameters.
2. Students should be able to describe semiconductor grade silicon production, CMOS fabrication process and should be able to draw and describe layout.
3. Students should be able to describe MOSFET structure, operation, characteristics, physical effects and scaling and should be able to calculate vital parameters related to MOSFET.
4. Students should be able to describe, analyze and design various MOSFET circuits using different MOSFET based topologies (especially CMOS topology) functionally as well as for different parameter (delay, power, noise) constraints.

**COURSE CONTENTS**

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| --- | --- |
| **1. Introduction** | |
|  | Moore’s law; VLSI Design flow; design hierarchy; concepts of regularity,  modularity and locality; VLSI design styles; design quality. |
| **2. Fabrication and Layout of CMOS Integrated Circuits** | |
|  | Semiconductor grade silicon production; CMOS fabrication process – photolithography, diffusion, ion-implantation, CMOS process flow, isolation – LOCOS and STI; modern CMOS process trends such as lightly doped drain, copper interconnects, low-k and high-k dielectrics, three dimensional IC; layout, |

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|  | layout design rules, CMOS inverter layout design; latchup and latchup prevention  techniques. |
| **3. Physics and Modeling of MOSFETs** | |
|  | Energy band diagram view of MOS system under external bias; MOSFET structure and operation; first order V-I characteristics of MOSFET; channel length modulation; substrate bias effect; MOSFET modeling – drain-source resistance, MOSFET capacitance, junction leakage currents; MOSFET scaling; Short channel effects such as classical short channel effect, reverse short channel effect, mobility degradation, velocity saturation, hot carrier effect, DIBL, subthreshold leakage;  Narrow channel effect; Current equations for velocity saturated MOSFETs. |
| **4. CMOS inverter: Analysis and Design** | |
|  | VTC of ideal inverter; noise margin; CMOS digital logic inverter – different regions of operation, calculation of critical voltage points on VTC; CMOS inverter switching characteristics; design of CMOS inverter; power dissipation in CMOS inverter; comparison of various MOSFET based inverter topologies with CMOS  inverter; ratioed and ratioless designs. |
| **5. Static Logic Circuits** | |
|  | CMOS based gates such as NAND, NOR, XOR, XNOR and complex logic circuits; transistor sizing for gates; adder, SR latch and D latch circuits; CMOS SRAM cell; Schmitt trigger and tri-state output circuits; implementation of logic  gates using other MOSFET based topologies such as pseudo nMOS etc. |
| **6. Transmission Gate & Dynamic Logic Circuits** | |
|  | nMOS and pMOS pass transistors; CMOS transmission gate; clock feedthrough, charge leakage, charge sharing; bootstrapping; dynamic CMOS logic; high performance dynamic CMOS circuits such as domino CMOS logic, NORA and  TSPC CMOS logic; DRAM cell. |
| **Recommended Books:-** | |
| 1 | Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits-Analysis  and Design, 3rd edition, McGraw Hill |
| 2 | Jan M. Rabaey, Anantha Chandrakasan & Borivoje NIkolic, Digital Integrated  Circuits-A Design Perspective, 2nd edition, PHI |
| 3 | David A Hodges, Horace G Jackson & Resve A Saleh, Analysis and Design of  Digital Integrated Circuits in deep submicron technology, 3rd edition, McGrawHill |
| 4 | Neil H E Weste & Kamran Eshragian, Principles of CMOS VLSI Deisgn- A  systems perspective, Addison- Wesley |
| 5 | John P. Uyemura, CMOS Logic Circuit Design, Springer International Edition |
| 6 | Adel S. Sedra & Kenneth C. Smith, Microelectronic Circuits, 5th edition, Oxford  University Press |
| 7 | S. M. Sze, VLSI Technology, 2nd edition, Bell Laboratories. |

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| **Programme Name** | **Third Year B. Tech. (EXTC), Semester-VI** |
| **Course Code** |  |
| **Course Title** | **Cellular Communication Lab** |
| **Pre-requisite** | **Course on Digital Communication Systems, Analog**  **Communication** |

**COURSE OUTCOMES**

After completion of this course, students will be able to

1. Model the indoor and outdoor propagation.
2. Test the working of GSM and CDMA transmitter and receiver system.
3. Design and simulate modules like inter leaver , Equalizer.

# COURSE CONTENTS

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| **Module 1** | **Wireless Path loss- Study of Propagation Path loss Models: Indoor & Outdoor** |
|  | * 1. Free Space Propagation – Path Loss Model.   2. Multipath Fading in Cellular Mobile Communication.   3. Link Budget Equation for Satellite Communication.   4. Carrier to Noise Ratio in Satellite Communication.   5. Outdoor Propagation – Okumura Model.   6. Outdoor Propagation – Hata Model. |
| **Module 2** | **GSM Technology** |
|  | * 1. Study of the Tx IQ/Rx IQ signals.   2. Performance of SIM Detection.   3. GSM Data services & capability.   4. Radio Resource Allocations and Scheduling in Cellular Mobile Communication. |
| **Module 3** | **CDMA** |
|  | * 1. Generation of Direct sequence spread spectrum (DS-SS).   2. Reception of Direct sequence spread spectrum (DS-SS).   3. Generation of frequency hoped spread spectrum (FH-SS).   4. Reception of frequency hoped spread spectrum (FH-SS).   5. Generation of Hadamard Codes. |
| **Module 4** | **Design and Implementation** |
|  | Equalizer. |
| **Text Books:** |  |
| 1. | Iti Saha Misra, “*Wireless Communications and Network*”, McGraw Hill  Education Pvt. Ltd, 3rd Edition,2009. |
| **Additional Reading:** | |
| 1. | GSM Manual. |
| 2. | CDMA Manual. |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **MICROWAVE ENGINEERING LAB** |

**COURSE OBJECTIVES**

1. To measure the parameters of waveguide and waveguide component.
2. To understand various microwave semiconductor devices and various methods of microwave measurement.
3. To design planar-line sections for Microwave circuits.
4. To become proficient with computer skill.

# CORSE OUTCOMES

1. Ability to measure the parameters of waveguide and waveguide component.
2. The students will able to measure various parameters of microwave semiconductor devices and expertise in microwave measurement.
3. The students will able to design planar-line sections for Microwave circuits.
4. Become proficient with microwave simulator tools

# COURSE CONTENTS

|  |  |
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| Module I | Microwave Measurements |
|  | Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric  constant, Attenuation. |
| Module II | Microwave devices parameter measurements |
|  | S-parameter measurements of two port network, H-plane tee, Magic Tee,  isolator directional coupler |
| Module III | Microwave software design tools |
|  | Introduction to Microwave circuit simulator, CADGFEKO, SONNET,  MULTISIM, SMITHV etc. |
| Lab  Instructions | At least 2 experiments should be conducted on each module |
| Text Books: |  |
| 1. | *Microwave Engineering* 4th edition 2012 by David Pozar. John Wiley and  Sons publication. |
| 2 | *Microwave engineering passive circuits* 1988 by Peter A.Rizzi. PHI  publication |
| 3 | *Basic Microwave Techniques and laboratory manual* 1987 by M.L.Sisodia,  G.S.Raghuvamsi. Wiley Eastern Limited publication |
| Reference Books: | |
| 1 | *Microwave Transistor Amplifiers: Analysis and Design*; 2/e, 2007 by G.  Gonzalez Prentice Hall of India, |
| 2 | *Modern RF and Microwave measurement Techniques*, by Valeria Teppati.  Cambridge |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication**  **Engineering), SEMESTER - VI** |
| **Course Code** |  |
| **Course Title** | **Principles of VLSI Lab** |

**COURSE OBJECTIVES**

* To learn CAD tool for MOSFET circuit simulation.
* To learn layout tool for drawing layout of digital circuits.
* To learn fabrication process.
* To learn HDL and use it for digital circuit description.

**COURSE OUTCOMES**

* Student should be able to simulate MOSFET based digital circuits.
* Student should be able to draw and simulate the layout of MOSFET based digital circuits.
* Student should be able to simulate fabrication process.
* Student should be able to describe the hardware of digital circuits in HDL.

**Course Contents:-**

1. To plot MOSFET I-V Characteristics.
2. To plot CMOS inverter VTC.
3. To plot CMOS Inverter Switching Characteristics.
4. To study pMOS, nMOS and CMOS Transmission Gate Characteristics.
5. To implement simple circuits using Domino logic.
6. To design Schematic and Layout of CMOS complex gates, adders, latches etc.
7. To simulate entire process of CMOS Fabrication.
8. Hardware description of combinational logic circuits such as –
   1. Full adder b. Multiplexer c. Decoder
9. To write the HDL code for –
   1. D Flip Flop b. J-K Flip Flop c. T Flip Flop
10. To write the HDL code for a given synchronous sequential counter.
11. To write the HDL code for a given FSM.
12. To write the HDL code for a given ALU.
13. To implement 16X8 bit memory using HDL.
14. To implement a digital circuit HDL code on an FPGA.

**Recommended Text Books:-**

1. Douglas L Perry, VHDL programming by example, 4th edition, McGraw Hill
2. Jayaram Bhaskar, VHDL Primer, Prentice Hall
3. Zainalabedin Navabi, Verilog Digital system Design, 2nd edition, McGraw Hill

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| **Programme Name:** | | **T Y B Tech EXTC, Electronics, Computer, IT Sem VI** |
| **Course Code :** | |  |
| **Course Title :** | | **Professional Communication Skills** |
| **Scheme** | | **1L 2P 2 Credits** |
|  | **Course Objectives**:   * To enable students to become effective communicators through gaining knowledge and skills in professional communication. * To develop the communicative abilities of students making them industry- ready. | |
|  | **Course Outcomes:**  Students will be able to:  1. Apply the principles and practices of business communication for communicating in a professional environment.  2. Design a technical document with correctness of language, appropriate vocabulary and style.  3. Display competence in oral and visual communication.  4. Demonstrate capabilities for self -assessment and development. | |
| **Unit** | **Course Contents** | |
|  | Basics of Business Communication   1. Concept and meaning of communication 2. Verbal and non-verbal communication 3. barriers to the process of communication 4. Channels of communication 5. Role of communication in the age of information technology | |
|  | Technical Writing   1. Technical writing process 2. Style and organization in technical writing 3. objectivity, clarity, precision as defining features of technical communication   d. Language and format of various types of business letters, reports; proposals, e-mails, minutes of meeting, research papers | |
|  | Self Development & Assessment   1. Time Management 2. Perception & Attitude 3. Personal Goal Setting 4. Emotional Intelligence 5. Team work 6. Creativity | |
|  | Spoken Communication   1. Public Speaking 2. Group Discussion 3. Presentation 4. Interviews 5. None verbal Communication 6. Using Visual Aids | |
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| 5 | Business Ethics & Etiquettes   1. Business & Corporate Ethics 2. Social and Business Etiquettes 3. Interview Etiquettes | |

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| **Text Books:** | | |
| **1.** | *Business Communication* | Hory Shankar Mukharjee,OUP |
| **2.** | *Effective Technical Communication* | Asharaf Rizvi, The McGraw Hill |
| **3.** | *Business Communication* | Meenakshi Raman, Prakash Singh,OUP |
| **References:** | | |
| **1.** | Basic Managerial Skills for All | E.H. McGrath, PHI Learning Pvt Ltd |
| **2.** | Professional Ethics | R. Subramanian,OUP |
| **3.** | *https://learnenglish.britishcouncil.org/en/english-grammar* | |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **TELECOM NETWORK MANAGEMENT** |

**COURSE OBJECTIVES**

1. To understand general concepts and architecture behind standards based network management
2. To understand concepts and terminology associated with SNMP and TMN
3. To expertise in network management as a typical distributed application
4. To study current trends in network management technologies and planning of network.

**COURSE OUTCOMES**

1. Verify TNM Standards and fundamental infrastructure of overall network architecture
2. Expertise in SNMP V1,V2 and V3 model interfacing to TNM
3. Expertise in Interoperable Network Management
4. Implement network using Sub netting technique for given requirement

**COURSE CONTENTS**

|  |  |
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| Module I | Foundations |
|  | Network management standards, network management model, organization model, information model abstract syntax notation 1 (ASN.1), encoding structure, macros, functional model. Network management application functional requirements: Configuration management, fault management, performance management, Error correlation technology, security management, accounting management, common management, report management, polity based management, service level management, management service, community definitions, capturing the requirements,  simple and formal approaches, semi formal and formal notations |
| Module II | Telecommunication management network (TMN) architecture |
|  | Terminology, functional architecture, information architecture, physical  architecture, TNN cube, TMN and OSI |
| Module III | Management of Emerging Networks and Services |
|  | Next Generation Networking, Wireless Networks, Optical Networks, Overlay Networks, Grid Architectures ,Multimedia Networks, Satellite Networks, Storage Networks, Cognitive Networks, Autonomic Computing,  Self-management, Automatic Network Management |
| Module IV | Information Modeling for TMN |
|  | Rationale for information modeling, management information model, object oriented modeling paradigm, structure of management information, managed  object class definition, management information base (MIB) |
| Module V | Simple network management protocol |
|  | (SNMP):SNMPv1: managed networks, SNMP models, organization model,  information model, SNMPv2 communication model, functional model, |

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|  | major changes in SNMPv2, structure of management information (SMI), MIB, SNMPv2 protocol, compatibility with SNMPv1, SNMPv3, architecture, applications, MIB security, remote monitoring (RMON) SMI  and MIB, RMQN1 and RMON2. |
| Module VI | Network management examples |
|  | ATM integrated local management interface, ATM MIB. M1, M2,M3, M4, interfaces, ATM digital exchange interface management, digita1 subscriber loop (DSL) and asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management Network management tools: Network statistics management, network management system,  management platform case studies: OPENVIEW, ALMAP |
| Text Books: |  |
| 1. | *Network Management: Principles and Practice,* 2000 by Mani Subramanian.  Addison Wesley |
| 2 | *Fundamentals of Telecommunication Network Management* 1999 by Lakshmi Raman. IEEE Communication Society, Prentice Hall of India  Edition |
| 3 | *Telecommunication Network Management: Technologies and Implementations* 1997 by Airdarous Salah, Plevyak Thomas. Prentice Hall  of India |
| 4 | *Advances in Network Management*:2009 by Jianguo Ding. CRC Taylor and  Francis |
| Reference Books: | |
| 1 | *Telecommunication Network Management* 1999 by Haojin Wang. TMH. |
| 2 | *Advances in Network Management*: 2009 by Jianguo Ding. CRC Taylor and  Francis |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **TELECOM NETWORK MANAGEMENT LAB** |

**COURSE OBJECTIVES**

1. To study network management systems
2. To measure performance of motion in communication networks
3. To estimate performance in simple network management protocol
4. To estimate performance of Web based management services
5. To study policies in network management
6. To study SLA based management and automation in network management

**COURSE OUTCOMES**

1. Student can achieve competency in telecommunication wired networks
2. Student can achieve competency in telecommunication wireless networks
3. Estimate performance of various networked systems
4. Improve performance of network systems
5. Study and decide various policies in network management
6. Implement automation in network systems

**COURSE CONTENTS**

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| Module I | Study of a foundation for Network Management |
|  | Remote operation of equipment, Collection of information which helps faults to be dealt with proactively before a complete failure.  Easier interworking of equipment from different manufacturers, Abstract view of information |
| Module II | Study of performance of changes in motion in Communication Networks. |
|  | Traffic flow theories   1. Definition of performance measures. 2. Mobility models for ns-2 3. Simulation Implementation |
| Module III | Study of performance in Simple Network Management Protocol (SNMP) |
|  | Get request   1. Set request 2. Get next request 3. Get bulk request 4. Response 5. Trap 6. Inform Request |
| Module IV | Study of performance of Web Based Enterprise Management ( WBEM) |
|  | Desktop Management (DASH)  -Network Management(Net Man)  -Storage Management (SMI)  -Systems Management (SMASH) |

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|  | -Virtualization Management(VMAM) |
| Module V | Study of performance Web Services Distributed Management (WSDM) |
|  | - Management using of Web-Services (MUWS)  -Management of web-services (MOWS) |
| Module VI | Study of policy based management |
|  | 1. Setting individual policies for such things as access to files or applications 2. Various levels of access (read-only) or permission to update or delete files. 3. The appearance and make-up of individual users desktops and so on. |
| Module VII | Study of Foundation for Network management---II |
|  | Remote operation of equipment, Collection of information which helps faults to be dealt with proactively before a complete failure easier  interworking of equipment from different from different manufacturers abstract view of information. |
| Module VIII | Study of x tensible markup language |
|  | 1. Stream oriented APIs accessible from a programming language for e.g. SAX and StAX. 2. Tree- traversal API's is accesssible from a programming language for   e.g. DOM.   * 1. XML data binding which provides an automated translation between an XML document and Programming-language objects.   2. Declarative transformation languages such as XSLT and XQUERY. |
| Module IX | Study of SLA based management |
|  | 1. Develop a framework for negotiationg and establishing contact (SLA) between service providers and users. 2. Develop a resource management system and optimal scheduling algorithms that support SLA- based allocation of resources to meent users QOS requirem management Automation |
| Text Books: |  |
| 1. | *Network Management: Principles and Practice* 2000 by Mani Subramanian  Addison Wesley |
| 2 | *Fundamentals of Telecommunication Network Management* 1999 by Lakshmi Raman. IEEE Communication Society, Prentice Hall of India  Edition |
| 3 | *Telecommunication Network Management: Technologies and Implementations* 1997 by Airdarous Salah, Plevyak Thomas. Prentice Hall  of India |
| Reference Books: | |
| 1 | *Telecommunication Network Management* 1999 by Haojin Wang. TMH. |
| 2 | *Advances in Network Management*: 2009 by Jianguo Ding. CRC Taylor and  Francis |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **DATA COMPRESSION AND ENCRYPTION** |

**COURSE OBJECTIVES**

1. To evaluate various Lossless and Lossy compression techniques for different types of data.
2. To develop coding for text compression and audio compression techniques
3. To develop image and video compression techniques
4. To analyze various quantization techniques

**COURSE OUTCOMES**

1. Implement and evaluate various lossless and lossy compression methods.
2. Develop codes for text compression and estimate audio compressions
3. Develop and estimate image and video compressions
4. Analyze various quantizations

**COURSE CONTENTS**

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| --- | --- |
| Module I | Data Compression Techniques |
|  | * 1. Loss less compression, Lossy compression, Entropy Measures of performance, Modeling and Coding   2. Text Compression: Minimum variance Huffman coding, Extended Huffman coding, Adaptive Huffman coding, Shannon Fano Coding, Arithmetic coding   3. Dictionary coding techniques, LZ 77, LZ 78, LZW   4. File compression |
| Module II | Audio Compression |
|  | * 1. High quality digital audio, Frequency, Spectral and Temporal masking, Lossy sound compression, Format of Compressed Data   2. M-law and A-law companding, MPEG audio standard   3. DPCM and ADPCM audio compression, Frequency Domain coding |
| Module III | Image and Video Compression |
|  | * 1. Two D Image Transforms, Lossless Image compression techniques, PCM, DPCM, JPEG, JPEG –LS and JPEG 2000 standards   2. Video Compression, Intra frame coding, motion estimation and compensation,   3. Introduction to MPEG - 2 H-264 encoder and decoder, MPEG Industry Standards |
| Module IV | Quantization |
|  | * 1. Problems in quantization   2. Uniform, adaptive, forward adaptive, backward adaptive, nonuniform quantization |

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|  | | 4.3 Vector quantization and algorithms (Linde Buzo Gray algorithm, tree,  pyramid, polar, lattice spherical quantization |
| Module V | | Encryption |
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| Text Books: | |  |
| 1 | | *Data Compression: The Complete reference*, 4th edition 2007 by David  Salomon. Springer Publication. |
| 2 | | *Introduction to Data Compression*: 3rd Edition 2006 by Khalid Sayood.  Morgan Kaufmann Series, |
| Reference Books: | | |
| 1 | *The Data Compression Book* 2nd Edition: by Mark Nelson. BPB publication, | |
| 2 | *Handbook of data compression*, 2010 Salomon, David, Motta, Glovanni.  Spriger Publications | |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **DATA COMPRESSION AND ENCRYPTION LAB** |

**COURSE OBJECTIVES**

1. To implement Lossless and Lossy compression algorithms in JAVA for different types of data
2. To implement text compression algorithms in JAVA
3. To implement audio compression algorithm in JAVA
4. To implement Image and video compression algorithms in JAVA
5. To detect errors in various quantization

**COURSE OUTCOMES**

1. Implement Lossless and Lossy compression algorithms and estimate parameters
2. Implement text compression algorithms and estimate parameters
3. Implement audio compression algorithm and estimate parameters
4. Implement Image and video compression algorithms and estimate parameters
5. Measure parameters of various quantization

**COURSE CONTENTS**

|  |  |
| --- | --- |
| Module I | Data Compression Techniques |
|  | * 1. Loss less compression and Lossy compression Implementation   2. Entropy Measures of Performance Simulation   3. Modeling and Coding Simulation   4. Text Compression Coding |
| Module II | Audio Compression |
|  | * 1. Frequency, Spectral and Temporal masking Coding   2. M-law and A-law companding coding,   3. DPCM and ADPCM Implementation   4. Audio compression Implementation   5. Frequency Domain coding |
| Module III | Image and Video Compression |
|  | * 1. Image Compression Implementation   2. Video Compression Implementation   3. MPEG encoder and decoder Simulation |
| Module IV | Quantization |
|  | * 1. LBG algorithm   2. Estimation of parameters in quantization |
| Lab  Instructions | At least 2 experiments should be conducted on each module |
| Text Books: |  |
| 1 | *Data Compression: The Complete reference*, 4th edition 2007 by David  Salomon. Springer Publication, |
| 2 | *Introduction to Data Compression*: 3rd Edition 2006, by Khalid Sayood. |

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|  | | Morgan Kaufmann Series, |
| Reference Books: | | |
| 1 | *The Data Compression Book*, 2nd Edition by Mark Nelson, BPB publication, | |
| 2 | *Handbook of data compression*, 2010 by Salomon, David, Motta, Glovanni.  Springer Publications | |

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| **Programme Name** | **Third Year B. Tech. (EXTC), Semester-VI** |
| **Course Code** |  |
| **Course Title** | **Digital Image Processing** |
| **Pre-requisite** | **Signal processing** |

**COURSE OUTCOME**

After completion of this course, students will be able to

* 1. Analyze image enhancement techniques in spatial and frequency domain.
  2. Apply transform theory for image analysis.
  3. Implement methods of image segmentation and examine textural properties.
  4. Describe feature extraction methods in video processing.
  5. Implement object detection methods in video analysis.

# COURSE CONTENTS

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| **Module 1** | **Digital Image fundamentals** |
|  | Digital Image Representation, Elements of digital Image processing systems, Elements of Visual Perception, Sampling and Quantization, Basic  relationships between pixels. |
| **Module 2** | **Image Transforms** |
|  | 2D DFT and its properties, Walsh Transform, Hadamard Transform, Haar Transform, Discrete Cosine Transform, Slant Transform, Hotelling  Transform. |
| **Module 3** | **Image Restoration and Enhancement** |
|  | Model of Image degradation and Restoration Process, Noise models, Spatial filtering, Frequency Domain Filtering, Modeling the degradation function, Inverse Filtering, Wiener Filtering.  Spatial Domain Methods, Point Processing Neighbourhood Processing, spatial domain filtering, Zooming, Enhancement based on Histogram modeling, Enhancement in Frequency domain, Frequency domain filters,  Generation of spatial mask from frequency domain. |
| **Module 4** | **Image Compression** |
|  | Fundamentals, Image compression model, Redundancy, Error Criteria,  Information Theory for Image compression, Lossy and lossless compression techniques, Image compression standards. |
| **Module 5** | **Image Segmentation** |
|  | Image segmentation based on discontinuities (Point, Line & Edge detection), Edge Linking, Thresholding (Global, Local, Optimum), Region  based Segmentation. |
| **Module 6** | **Spatial feature extraction and classifiers** |
|  | Filtering techniques- Localized feature extraction- Boundary Descriptors- Moments- Texture, Descriptors- Co-occurrence features- Run length features- Feature selection, Maximum Likelihood Estimation- Bayesian  approach- Pattern Classification by distance functions-BPN. |
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| **Text Books:** | |
| 1. | R. Gonzales, R. Woods, *“Digital Image Processing”,* Pearson Education.  2009 |
| 2. | Anil K. Jain, *“Fundamentals of Image Processing”,* Prentice Hall of India  Publication. 2010 |
| **Additional Reading:** | |
| 1. | Milan Sonka, Viciav Hivac, Roger Boyle “ *Image Processing Analysis and*  *Machine vision*”, Thomson Learning Publication. 2008 |
| 2. | Pratt, “*Digital Image Processing”,* Wiley India. 3rd edition. 2001 |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **ADVANCED DIGITAL COMMUNICATION** |

**COURSE OBJECTIVES**

1. To analyze digital information and implement coding techniques required for data transmission and storage devices.
2. To analyze various equalizers in digital communication and characterize fading channels.
3. To learn parameters of MIMO communication
4. To characterize OFDM

**COURSE OUTCOMES**

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Analyze digital information and implement coding techniques required for data transmission and storage devices.
2. Analyze various equalizers in digital communication and characterize fading channels.
3. Characterize MIMO communication channels
4. Characterize OFDM

**COURSE CONTENTS**

|  |  |  |
| --- | --- | --- |
| Module I | | DIGICOM and DSP overview |
|  | | * 1. Overview of Digital communication   2. ISDN   3. Speech coding algorithms and vector detection   4. Echo cancellation in speech and digital detection   5. DSI systems   6. Digital TV processing techniques   7. Digital modulation Correlative coding |
| Module II | | Source coding |
|  | | * 1. Sources   2. Amplitude quantization   3. Differential pulse code modulation   4. Advanced Prediction   5. Block coding   6. Transform coding   7. Source coding for digital data   8. Examples of source coding   9. Coding for analog sources |
| Module III | | Equalization |
|  | | * 1. Optimum Receiver for channel with ISI and AWGN   2. Linear Equalization   3. Decision Feedback equalization   4. Reduced complexity detectors   5. Iterative Equalization and decoding –Trubo equalization   6. Adaptive Linear Equalizer   7. Adaptive Decision Feedback Equalizer   8. Adaptive Equalization for Trellis coded signals   9. Recursive Least squares algorithm for Adaptive equalization   10. Self recovering equalization |
| Module IV | | Fadding Channels |
|  | | * 1. Characterization of fading multipath channels   2. Channel models and characteristics   3. Signal time spreading   4. Diversity Techniques for Fading multipath channels |
|  | | * 1. Digital signaling over frequency selection   2. Coded waveform for fading channels   3. Time variance of the channel caused by motion   4. Mitigating the degradation effects of fading and application |
| Module V | | MIMO communication |
|  | | * 1. Basics   2. The Gaussian MIMO channels   3. Memoryless MIMO channel   4. MIMO detection with channel memory   5. Code division multiple access   6. The RAKE receiver and multipath diversity   7. Random access methods   8. Multiple access and demand assignments in satellites   9. Multiple scanning beam systems in satellite |
| Module VI | | OFDM |
|  | | * 1. OFDM concept   2. Channel capacity   3. Basic OFDM   4. Other multicarrier modulation   5. Channel partitioning   6. Loading of parallel channels   7. Optimizing through coding   8. Synchronization schemes   9. Introduction to channel estimation   10. OFDM transmission over Gaussian channels   11. OFDM transmission over wideband channels |
| Text Books: | |  |
| 1. | | *Digital Communications fundamentals and applications* 2nd edition 2009 by  Bernard Sklar Pabitra Kumar Ray. Pearson |
| 2 | | *Digital Communications* 4th edition 2001 by John G. Proakis. Mc Graw Hill |
| 3 | | *OFDM and MC-CDMA A primer 2006* by L-Hanzo T keller John Wiley  &Sons Ltd |
| Reference Books: | | |
| 1 | *Digital Communication System* ,2014 by Simon Haykin. Wiley | |
| 2 | *Principles of Digital communication*, 2008 by Robert G Gallager.  Cambridge | |
| 3 | *Digital Communication* 3rd edition 2004 by John R Barry Edward A. Lee  David G.Messevschmitt. Springer | |
| 4 | *Orthogonal Frequency Division Multiplexing for wireless communication*  2006 by YE LI and Gordon Stuber Springer | |

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| **Programme Name** | **T Y B. Tech. (Electronics & Telecommunication Engineering), SEMESTER VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **ADVANCED DIGITAL COMMUNICATION LAB** |

**COURSE OBJECTIVES**

1. To study details of Simulators for Advanced digital communication
2. To simulate source codes using Simulators
3. To simulate equalizers using Simulators
4. To simulate fading in the channels using Simulators
5. To simulate MIMO communication system using Simulators
6. To simulate spread spectrum and OFDM communication systems using Simulators

COURSE CONTENTS:

* 1. Expertise in advanced digital communication simulators
  2. Implement source coding algorithm using JAVA/ simulators.
  3. Implement various equalizers using JAVA/Simulators.
  4. Implement fading in the channels using Simulators
  5. Implement MIMO channels using simulators
  6. Implement spread spectrum and OFDM channels using simulators

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| Module I | DIGICOM and DSP overview |
|  | * 1. Study of Simulators   2. Study of ISDN system   3. Speech coding algorithms and vector detection using Simulator   4. DSI systems using Simulator   5. Study of Digital TV systems   6. Correlative coding using Simulator |
| Module II | Source coding |
|  | 2.1 Differential pulse code modulation using Simulator/ JAVA |
|  | * 1. Block coding using Simulator/JAVA   2. Transform coding using Simulator/JAVA   3. Coding for analog sources using Simulator |
| Module III | Equalization |
|  | * 1. Zero forcing equalizer using Simulator   2. Iterative Equalization and decoding –Trubo equalization using Simulator   3. MMSE equalizer using Simulator   4. Adaptive Linear Equalizer using Simulator   5. Adaptive Decision Feedback Equalizer using Simulator   6. Adaptive Equalization for Trellis coded signals using Simulator   7. Recursive Least squares algorithm for Adaptive equalization using Simulator   4.10 Self recovering equalization using Simulator |
| Module IV | Fadding Channels |
|  | * 1. Characterization of fading multipath channels using Simulator   2. Signal time spreading simulation using Simulator   3. Coded waveform simulation for fading channels using Simulator |
| Module V | MIMO communication |
|  | * 1. The Gaussian MIMO channels using Simulator   2. Memoryless MIMO channel using Simulator   3. MIMO detection using Simulator   4. Code division multiple access using Simulator   5. The RAKE receiver using Simulator |
| Module VI | Spread Spectrum and OFDM |
|  | * 1. Pseudo Noise Sequence using Simulator   2. Direct sequence spread Spectrum using Simulator   3. Frequency Hopping Spread Spectrum using Simulator   4.4 CDMA –DS-SS system simulation using Simulator   * 1. Slow frequency hopping –SS system simulation using Simulator   2. Basic OFDM simulation using Simulator   3. Carrier frequency offset (CFO) estimation using Simulator   4. CFO estimation and compensation using Simulator   5. Symbol time offset estimation using Simulator   6. course frame synchronization using Simulator   7. Channel estimation and compensation using Simulator   8. Scrambling and descrambling using Simulator   9. OFDM based 16 QAM communication system simulation using Simulator |
| Lab  Instructions | At least 2 experiments should be conducted on each module |
| Text Books: |  |
| 1. | *Digital Communications fundamentals and applications* 2nd edition 2009 by  Bernard Sklar Pabitra Kumar Ray. Pearson |
| 2 | *Digital Communications* 4th edition 2001John G. Proakis. Mc Graw Hill |
| 3 | *OFDM and MC-CDMA A primer 2006* by L-Hanzo T keller John Wiley  &Sons Ltd |
| 4 | *MATLAB/Simulink for Digital Communication* 2nd edition 2009 by Won Y  Yang A Jin. Publishing Co Korea |

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| Reference Books: | |
| 1 | *Digital Communication System* , 2014 by Simon Haykin Wiley |
| 2 | *Principles of Digital communication*, 2008 by Robert G Gallager.  Cambridge |
| 3 | *Digital Communication* 3rd edition 2004 by John R Barry Edward A. Lee  David G.Messevschmitt. Springer |
| 4 | *Orthogonal Frequency Division Multiplexing for wireless communication*  2006 by YE LI and Gordon Stuber. Springer |

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| **Programme Name** | **T Y B Tech EXTC, SEMESTER - VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **NEURAL NETWORK AND FUZZY LOGIC** |

**COURSE OUTCOME**

After completion of course, the students should be able to:

* + Summarize the concepts of supervised and unsupervised learning, and different application areas of ANNs.
  + Design suitable network architecture and use appropriate learning algorithm (supervised and unsupervised) for a given application.
  + Summarize different learning methods and their application areas, including graphical and MEM models.

## COURSE CONTENTS

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| Module 1 **Introduction: Biological neurons and memory** | |
|  | Motivations for Studying ML, Supervised and Unsupervised learning, Machine Learning in the Large  Structure and function of a single neuron; Artificial Neural Networks (ANN); Typical applications of ANNs: Classification, Clustering, Vector Quantization, Pattern Recognition, Function Approximation, Forecasting, Control, Optimization. |
| Module 2: **Supervised Learning** | |
|  | Single-layer networks; Perceptron-Linear separability, Training algorithm, Limitations; Multi-layer networks-Architecture, Back Propagation Algorithm (BTA) Adaptive Multi-layer networks-Architecture, training algorithms; Recurrent Networks; Feed-forward networks; Radial-Basis-Function (RBF) networks; |
| Module 3: **Unsupervised Learning** | |
|  | Winner-takes-all networks; Hamming networks; Maxnet; Simple competitive learning; Vector-Quantization; Counter propagation networks; Adaptive Resonance Theory; Kohonen's Self-organizing Maps; Principal Component Analysis; |
| Module 4: **Classical and Theoretical ML Topics** | |
|  | Concept Learning (also called Learning from Examples), Learning from Analogy, Explanation Based Learning, Structure Learning, Reinforcement Learning, Decision Tree Learning, Decision List Learning , Oracle Based Learning, Probably Approximately Correct (PAC) Model, Boosting, Bayesian Learning: Maximum Likelihood Estimates, Parameter Estimation, Bayesian Belief Networks |

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| Module 5: **Introductory Graphical Models Based Learning** | |
|  | Expectation Maximization as a fundamental technique, Hidden Markov Models (HMM): Motivation for Generative Models, Forward-backward Algorithm, Baum Welch Iteration, Feature Enhanced HMM. |
| Module 6: **Maximum Entropy Markov Models (MEMM)** | |
|  | Motivation for Discriminative Models, Training of MEMMs (v) Introductory Optimization Based Methods: Neural Nets, Support Vector Machines, Genetic Algorithms (v) Applications: Text Learning, Speech Processing, Data Mining, Bioinformatics. |
|  | **TEXT BOOKS** |
| **1** | Simon Haykin, “Neural Networks - A Comprehensive Foundation”, Macmillan Publishing Co., New York, 1994. |
| **2** | A Cichocki and R. Unbehauen, “Neural Networks for Optimization and Signal Processing”, John Wiley and Sons, 1993. |
| **3** | J. M. Zurada, “Introduction to Artificial Neural Networks”, (Indian edition) Jaico Publishers, Mumbai, 1997. |

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| **Programme Name** | **T Y B Tech EXTC, SEMESTER - VI** |
| **Course Code** |  |
| **Course Title** | **PROGRAM ELECTIVE COURSE 1**  **NEURAL NETWORKS AND FUZZY LOGIC LAB** |

**COURSE OUTCOME**

After completion of course, the students should be able to:

* Implement linear, polynomial and logarithmic regression
* Implement gradient descent algorithm with boosting
* Implement gradient descent algorithm with boosting
* Implement back propagation and radial basis function based neural net
* Implement various clustering nets

## Course Contents

I- Linear and Polynomial Regression II- Logarithmic Regression

1. Gradient Descent Algorithm with Boosting
2. Back propagation and Radial basis function based neural net implementation V- k-means, fuzzy c- means clustering
3. ISO data map unsupervised methods

## Text Book

Simon Haykin, “Neural Networks and Learning Machines”, Pearson Publiction, New Delhi, 2012.

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| **Programme Name** | **T Y B Tech EXTC, SEMESTER - VI** |
| **Course Code** |  |
| **Course Title** | **OPEN ELECTIVE COURSE 1**  **INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS** |

**COURSE OUTCOME**

After completion of course, the students should be able to:

* + Summarize the concepts of supervised and unsupervised learning, and different application areas of ANNs.
  + Design suitable network architecture and use appropriate learning algorithm (supervised and unsupervised) for a given application.
  + Summarize different learning methods and their application areas, including graphical and MEM models.

## COURSE CONTENTS

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| Module 1 **Introduction & Industry 4.0** | |
|  | Sensing & actuation, Communication-Part I, Communication-Part II, Networking-Part I, Networking-Part II.  Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories |
| Module 2: **Cybersecurity in Industry 4.0** | |
|  | Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis Cybersecurity in Industry 4.0,  Basics of Industrial IoT: Industrial Processes-Part I, Industrial Processes-Part II, Industrial Sensing & Actuation, Industrial Internet Systems. |
| Module 3: **Basics of Industrial IoT** | |
|  | IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture:  IIoT-Business Models-Part I, IIoT-Business Models -Part II,  IIoT Reference Architecture-Part I, IIoT Reference Architecture- Part II; |
| Module 4: **Industrial IoT- Layers** | |
|  | Industrial IoT- Layers: IIoT Sensing-Part I, IIoT Sensing-Part II,  IIoT Processing-Part I, IIoT Processing-Part II, IIoT Communication-Part I.  IIoT Communication-Part II, IIoT Communication-Part III, IIoT Networking-Part I, IIoT Networking-Part II, IIoT Networking-Part III. |

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| Module 5: **Big Data Analytics and Software Defined Networks** | |
|  | Industrial IoT Analytics - Introduction, Machine Learning and Data Science - Part I, Data Science - Part II,  R and Julia Programming, Data Management with Hadoop.  Industrial IoT Software Defined Networks-Part I, Industrial IoT Software Defined Networks-Part II, Data Center Networks,  Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II. |
| Module 6: **Security and Fog Computing** | |
|  | Industrial IoT: Security and Fog Computing - Fog Computing in IIoT,  Security in IIoT-Part I, Security in IIoT-Part II,  Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry  Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. |
|  | **TEXT BOOKS** |
| **1** | “Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress) |
| **2** | “Industrial Internet of Things: Cyber manufacturing Systems” by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer). |
| **3** | Research papers |