# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

## Regulation – R 21

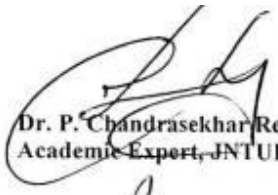
## COURSE STRUCTURE

## II YEAR I SEMESTER

| Sl. No. | Code | Group | Subject | L | T | P | Contact hrs/ wk | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 21PC0EC01 | PC | Electronic Devices and Circuits | 3 | 0 | 0 | 3 | 3 |
| 2 | 21PC0EC02 | PC | Digital System Design | 3 | 0 | 0 | 3 | 3 |
| 3 | 21PC0EC03 | PC | Signals and systems | 3 | 1 | 0 | 4 | 4 |
| 4 | 21ES0EC03 | ES | Network Theory | 3 | 1 | 0 | 4 | 4 |
| 5 | 21BS0MA03 | BS | Mathematics-III | 3 | 1 | 0 | 4 | 4 |
| 6 | 21PC0EC04 | PC | Electronic Devices Laboratory | 0 | 0 | 2 | 2 | 1 |
| 7 | 21PC0EC05 | PC | Digital System Design Laboratory | 0 | 0 | 2 | 2 | 1 |
| 8 | 21PC0EC06 | PC | Basic Simulation Laboratory | 0 | 0 | 2 | 2 | 1 |
| 9 | 21MC0EN01 | MC | Constitution of India | 3 | 0 | 0 | 3 | 0 |
| **Total Credits** | | | | | | | | **21** |

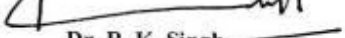
Dr. S. P. Yadav
HOD & BOS Chairman

Dr. K. Anitha Sheela
University Nominee, JNTUH

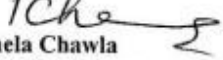


Dr. P. Chandrasekhar Reddy
Academic Expert, JNTUH

Mr. T. S. Rama Krishna
DDG (E), Dooradarshan, Hyd

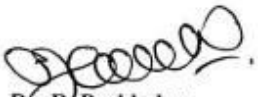


Dr. R. K. Singh
Prof. ECE & AD



Dr.Pamela Chawla
Dean ECE & Member

Dr.K. Chanthiresekaran
Dean Academics & Member



Dr. R. Prabhakar
Prof. ECE & Member

Dr. Binod Kumar Prasad
Assoc.Prof. ECE & Member

Mr. Sandeep Patil
Alumni (M. Tech)

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

## Regulation – R 21

## COURSE STRUCTURE

## II YEAR II SEMESTER

| Sl. No. | Code | Group | Subject | L | T | P | Contact hrs/wk | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 21PC0EC07 | ES | Analog and Digital Communications | 3 | 0 | 0 | 3 | 3 |
| 2 | 21PC0EC08 | PC | Analog Circuits | 3 | 0 | 0 | 3 | 3 |
| 3 | 21PC0EC09 | PC | Probability Theory and Stochastic Processes | 3 | 1 | 0 | 4 | 4 |
| 4 | 21ES0EE04 | PE | Control systems | 3 | 0 | 0 | 3 | 3 |
| 5 | 21BS0MA04 | OE | Mathematics-IV | 3 | 0 | 0 | 3 | 3 |
| 6 | 21SSMB02 | PC | Economics for Engineers | 3 | 0 | 0 | 3 | 3 |
| 7 | 21PC0EC10 | PC | Analog and Digital Communications Laboratory | 0 | 0 | 2 | 2 | 1 |
| 8 | 21PC0EC11 | ES | Analog Circuits Laboratory | 0 | 0 | 2 | 2 | 1 |
| **Total Credits** | | | | | | | | **21** |

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**II Year B.Tech. ECE I-Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## (18PC0EC01) ELECTRONIC DEVICES AND CIRCUITS

**Prerequisite:** Nil

**Course Objectives:**

Understand the structure of basic electronic devices and IC fabrication.
Familiarize the operation, characteristics and applications of transistor like BJT and FET.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor Physics.
2. Understand various types of diodes, characteristics of diodes.
3. Understand the working of transistors like BJT, FETs, and MOSFETs.
4. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.
5. Understand the Fabrication process.

**Syllabus**

**UNIT I: Introduction to Semiconductor Physics**

Introduction to Semiconductor Physics: Review of Quantum Mechanics, Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity. Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, Qualitative Theory of P-N Junction

**UNIT II: Semiconductor Diodes**

P-N Junction as a Diode, Diode Equation, Volt- Ampere Characteristics, Temperature dependence of VI characteristic, Ideal versus Practical–Resistance levels(Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis,
Breakdown Mechanisms in Semiconductor Diodes - Avalanche breakdown and Zener breakdown, Zener Diode Characteristics. **Special Purpose Diodes:** Tunnel diode, Varactor diode, Schottky diode, LED and photodiode

**UNIT III:Transistor Characteristics**

Bipolar Junction Transistor construction and operation , Transistor Current Components, , Ebers-Moll Model, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation , BJT Specifications, Transistor as an Amplifier - Comparison of CB, CE and CC Configurations. Introduction to JFET - MOS construction , I-V characteristics.

**UNIT IV: Biasing and Small Signal Model**

Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias

stability, Small signal models of BJT and MOS transistor, BJT Hybrid Model - Determination of h-parameters.

**UNIT V: Introduction to IC Fabrication Process**

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, Etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

**Text Books:**

1. Electronic Devices and Circuits – J. Millman, C.C.Halkias, and Satyabrata Jit,2 Ed.,1998, TMH.
2. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.
3. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
4. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley &Sons, 2006.

**Reference Books:**

1. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc,
1991.
2. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ.Press, 2011.
3.Integrated Electronics – J. Millman and Christos C. Halkias, 1991 Ed., 2008, TMH.
4. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9 Ed., 2006, PEI/PHI.

**II Year B.Tech. ECE I-Sem**

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## (18PC0EC02) DIGITAL SYSTEM DESIGN

**Prerequisite:** Nil

**Course Objective:**

Student will be able to Learn and apply logic in digital systems for design and analysis.

**Course outcomes:**

At the end of this course students will demonstrate the ability to

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. Design & analyze synchronous sequential logic circuits
4. Use HDL & appropriate EDA tools for digital logic design and simulation

**Syllabus**

**UNIT I: Boolean algebra and Logic Simplification**

Review of Boolean Algebra and DeMorgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps, tabulation method - up to 6 variables, Code Conversion, Binary codes, Introduction to Logic Gates.

**UNIT II: Combinational and Sequential Logic Design**

Combinational Logic design :Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Comparators, Multiplexers, Encoder, Decoder, Implementation of Boolean function using Multiplexers, decoders and universal gates.

Sequential Logic design : Latches and Flip-Flops, S-R, JK, D, T and Master-Slave JK Flip-Flop, Edge triggered Flip-Flop, Ripple and Synchronous counters, Shift registers,

**UNIT III: Sequential machine Design**

Finite State Machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.

**UNIT IV: Logic Families and Semiconductor Memories**

TTL NAND gate and Specifications: Noise margin, Propagation delay, fan-in, fan-out. Tristate TTL, ECL, CMOS families and their interfacing. Memory elements, Concept of Programmable logic devices: PAL, PLA, EPROM, FPGA. Logic implementation using Programmable Devices.

**UNIT V: Introduction to HDL**

HDL, different modeling styles in VHDL, Data types and objects, Dataflow. Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

**Text Books:**

1. Switching Theory And Logic Design-A. Anand Kumar PHI,2013
2. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012
3. Digital Design-Third Edition ,M.Morris Mano,pearson Education/PHI

**Reference Books:**

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition ,2006.
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989

**II Year B.Tech. ECE I-Sem**

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## (18PC0EC03) SIGNALS AND SYSTEMS

**Prerequisite:** Mathematics

**Course Objective:**

This gives the basics of signals and systems for all Electrical Engineering related courses.

**Course outcomes:**

1. At the end of this course students will demonstrate the ability to
2. Analyze different types of signals.
3. Represent continuous and discrete systems in time and frequency domain using different Transforms.
4. Investigate whether the system is stable.
5. Sampling and reconstruction of a signal.
6. Analyze continues-time and discrete-time signals using Laplace and Z-transforms.

### Syllabus

**UNIT I: Introduction to Signals and Systems**

Classification of Signals: Deterministic and Random Signals, Periodic and Non Periodic, Energy and power signals, Causal and Non-causal signals and Even and Odd signals, continuous and discrete time signals, Analog and Digital Signals. Classification of Systems, System properties: linearity: additively and homogeneity, shift-invariance, causality, stability, reliability, orthogonal signal space.

**UNIT II: Fourier series and Fourier Transform**

Fourier series representation, the Fourier Transform, properties of Fourier Transform, Fourier Transform of standard signals, convolution /multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

**UNIT III: Signal transmission through Linear systems**

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output, Behavior with a periodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response,

**UNIT IV: Laplace Transform and Z-Transform**

The Laplace Transform, notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system
behavior. The z-Transform for discrete time signals and systems- Eigen functions, region of convergence, z-domain analysis.

**UNIT V: State-space analysis and Sampling**

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems.

**Text books:**

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
3. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia)
Private Limited, c1998.
4. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
5. Signals and Systems- A.RamaKrishna Rao-2008, TMH.

**Reference books:**

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
2. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
3. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
4. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
5. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
6. Ashok Ambardar, "Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
7. Signals and Systems- Iyer and K. Satya Prasad, Cengage Learning.
8. Signals and Systems- A. Anand Kumar-2016, PHI.

**II Year B.Tech. ECE I-Sem**

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## (18ES0EE03) Network Theory

**Course Outcomes:**

1. At the end of this course students will demonstrate the ability to
2. Understand basics electrical circuits with nodal and mesh analysis.
3. Appreciate electrical network theorems.
4. Apply Laplace Transform for steady state and transient analysis.
5. Determine different network functions.
6. Appreciate the frequency domain techniques

**Syllabus**

**Unit I: Network Analysis:**

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality.

**Unit II: Network Theorems:**

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem.

**Unit III: Electrical Circuit Analysis Using Laplace Transforms**

Analysis of RC, RL, and RLC networks with and without initial conditions for standard inputs. Poles and Zeros. Behaviors of series and parallel resonant circuits.

**Unit IV: Transient Behavior**

Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem .

**Unit V: Two Port Network and Filters**

Two port network and interconnections, Introduction to band pass, low pass, high pass and band reject filters.

**Text Books:**

1. Van, Valkenburg, “Network analysis”; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, S. P. “Circuits and Network”; Tata McGraw-Hill New Delhi, 1994.

**Reference Books:**

1. A William Hayt, “Engineering Circuit Analysis” 8th Edition, McGraw-Hill Education, 2013.
2. G.K.Mittal, “Network Analysis”, Khanna Publications, 2010.

**II Year B.Tech. ECE I-Sem**

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## (18PC0EC04) ELECTRONICS DEVICES LABORATORY

Hands-on experiments related to the course contents of EC01

**Course Objectives**

1. To understand operation of semiconductor devices.
2. To identify the components and characteristics of various activedevices.

**Course Outcomes:**

1. Understand the current voltage characteristics of semiconductor devices.
2. Analyze dc circuits and relate ac models of semiconductor devices with their physical operation.
3. Design and analyze of electronic circuits.
4. Evaluate frequency response to understand behavior of Electronics circuits.

**Part A:** (Only for viva-voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 3 Laboratory sessions):

Identification, Specification, testing of R,L,C components (color codes), Potentiometers (SPDT, DPDT, and DIP),Coils, Gang Condensers, Relays, Bread Board, PCB's

Identification, Specification, testing of Active devices: Diodes, BJT, Low power JFET's, MOSFET's, Power

Transistors, LED's, LCD's, SCR,UJT.

Study and operation of:

1. Multimeters (Analog and Digital)
2. Function Generator
3. Regulated Power Supplies
4. CRO

**Part B:** (For Laboratoryoratory Examination – Minimum of 12 experiments)

1. Forward Bias V-I characteristics of PN junctionDiode
2. Reverse Bias V-I characteristics of PN junctionDiode.
3. Zener diode V-I characteristics .
4. Zener diode as voltageregulator.
5. Schottky diode V-I characteristics
6. Input and output Characteristics of a BJT in CE configuration.
7. Input and output Characteristics of a BJT in CB configuration.
8. Input and output Characteristics of a BJT in CC configuration.
9. FET characteristics in CS configuration.
10. FET characteristics in CDconfiguration.
11. FET characteristics in CGconfiguration.
12. N-MOSFET characteristics
13. P-MOSFET characteristics
14. Switching characteristics of photo diode

**II Year B.Tech. ECE I-Sem**

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## (18PC0EC05) DIGITAL SYSTEM DESIGN LABORATORY

1. To study and verify the truth table of logic gates.
2. To realize half and full adder
3. To realize half and full subtractor.
4. To study and verify the truth table of BCD to excess-3 code converter and vice versa.
5. To convert given binary numbers to gray codes and vice versa.
6. To verify the truth table of multiplexer using IC 74153 and de-multiplexer using IC 74139.
7. To verify the truth table of multiplexer and de-multiplexer using NAND gates.
8. To verify the truth table of one bit and two bit comparator using logic gates.
9. To verify the truth table of the following flip flop
    I. JK Master Slave
    II. D-type
    III. T-type

13. To store a set of data in a RAM using IC 2114
14. Design of basic Gates: AND, OR, NOT using Hardware Descriptive Language – (VHDL/Verilog/Equivalent)
15. Design of 2:1 Mix using basic gates using (VHDL/Verilog/Equivalent)
16. Design of Full Adder, Full Subtractor using 3 modeling styles in (VHDL/Verilog/Equivalent)
17.Design of all type of Flip-Flops using Sequential Constructs in (VHDL/Verilog/Equivalent)
18. Design counters (MOD 5, MOD 8) using (VHDL/Verilog/Equivalent)

Note: Minimum of 12 experiments to be conducted.

**II Year B.Tech. ECE I-Sem**

| L | T | P | C |
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## (18BS0MA03) MATHEMATICS-III

**Course Objectives**

1. To learn the Concepts & properties of Random variables and Probability distributions
2. To learn the concepts of correlations and regressions .
3. To understand Concepts & properties of the testing of hypothesis for large & small samples.
4. To provide basic concepts of Complex functions and Properties.
5. To learn the basics of Conformal & Bilinear Transformations.

**Course Outcomes**

At the end of the course, the student will be able to:

1. Identify the random variables involved in the probability models.
2. Calculate the Correlation and linear regression for a given data set.
3. Applying various statistical tests in testing of hypotheses on the given data.
4. Evaluation of integrals by using Cauchy's integral theorem & formula
5. Understanding the concepts of Conformal & Bilinear transformations.

**Syllabus**

**UNIT-I: Random variables and probability distributions.**

Random variables – Discrete and continuous. Probability distributions, mass function/ density function of a probability distribution. Mathematical Expectation, Moment generating function of probability distribution. Binomial, Poisson & normal distributions and their properties.

**UNIT-II: Multiple Random variables, Correlation & Regression**

Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions, Covariance of two random variables, Correlation -Coefficient of correlation, The rank correlation, Regression- Regression Coefficient, The lines of regression.

**UNIT-III: Sampling Distributions and Testing of Hypothesis**

Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and variances, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variances.

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, and Level of significance. One sided test, Two sided test,

Large sample tests: Test of Equality of means of two samples equality of sample mean and population mean.

**UNIT-IV: Functions of Complex Variables**

Complex functions and its representation on Argand plane, Concepts of limit Continuity, Differentiability, Analyticity, and Cauchy-Riemann conditions, Harmonic functions – Milne – Thompson method.

Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula

**UNIT – V: Conformal mapping.**

Power series expansions of complex functions : Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point –Isolated singular point – pole of order m – essential singularity. Residues– Residue theorem.

Conformal mapping: Transformation of z-plane to w-plane by a function, Conformal transformation. Standard transformations- Translation; Magnification and rotation; inversion and reflection, Transformations like $e^z$ , log z, $z^2$, and Bilinear transformation. Properties of Bilinear transformation, determination of bilinear transformation when mappings of 3 points are given .

**Suggested Text/Reference Books**


1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

**II Year B.Tech. ECE I-Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

## (18PC0EC06) BASIC SIMULATION LABORATORY

1. Basic Operations on Matrices
2. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as UNIT Impulse, UNIT Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5. Convolution for Signals and sequences.
6. Auto Correlation and Cross Correlation for Signals and Sequences.
7. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete system
8. Computation of UNIT sample, UNIT step and Sinusoidal responses of the given LTI system and verifying its physical realiazability and stability properties.
9. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
10. Waveform Synthesis using Laplace Transform.
11. Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
12. Sampling Theorem Verification.
13. Removal of noise by Autocorrelation / Cross correlation

Note: Minimum of 10 experiments to be conducted in the Laboratory

MATLAB, SkyLab or equivalent software to be used.

**II Year B.Tech. ECE I-Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 0 |

## (18MC0EN01) CONSTITUTION OF INDIA

**Course Objective:**

The course is structured and taught to enable a non social science students to appreciate and understand the evolution of the institutions and dynamics of functioning of the institutions. This constitutes itself as political process and affects and effects the individual and the society in its life as a person and citizen and develops and forms an attitude towards the political system. The main aim is to help individuals develop into responsible, critical, reflective and productive citizens.

**Course outcome**:

It facilitates the understanding of various Government of Indian acts their provisions and reforms. It helps to know the salient features in making of Indian constitution and appreciate the constitutional principles and institutional arrangements and makes them learn about the fundamental rights and duties and the directive principle of state policy. It inculcates skills to evaluate the evolution, functioning and consequences of political parties in India and to identify how electoral rules and procedure in India effect election outcomes.

**Syllabus:**

**Unit- I Evolution of Indian Constitution**

1. Constitutionalism
2. 1909, 1919 and 1935 Acts
3. Constituent Assembly- Composition and Functions

**UNIT-II Major features and Provisions**

1. Salient features
2. Fundamental Rights and Duties
3 Directive Principles of State Policy

**Unit-III Constitutional Institutions**

1. Union Government-Executive (President, Prime Minister and Council of Ministers)
   - Legislature (Parliament-Loksabha, Rajyasabha)
   - Judiciary- Supreme Court and High Court
2. State Government-Executive (Governor, Chief Minister and Council of Ministers)
   - Legislature (Legislative Assembly and Legislative Council)

3. Panchayat Raj institutions and Urban local bodies

**Unit- IV. Federalism**

- Union – State relations(Legislative, Administrative and Financial)
- Politics of federal governance and Frictions in Federal polity

**Unit-V- Political Process**

1. Political Parties-National and Regional
2. Pressure groups
3. Civil Society and Popular movements
4. Election Commission of India

**Reading List**:


1. D. D. Basu (2015) Introduction to the Constitution of India, New Delhi: LexisNexis.
2. Peu Gosh(2018) Indian Government and Politics, Delhi, PHI Pvt Ltd
3. Granville Austin (1999), The Indian Constitution – Corner Stone of a Nation, NewDelhi: Oxford.
4. P.M.Bakshi (2018),The Constitution of Indi-LexisNexis ,Delhi

**II Year B.Tech. ECE II-Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## (18PC0EC07) ANALOG AND DIGITAL COMMUNICATIONS

**Prerequisite:** Signals and Systems

**Course Objective:**

To master the student with different analog and digital modulation techniques and also to analyze the behavior of a communication system in presence of noise and errors.

**Course Outcomes:**

1. At the end of this course students will demonstrate the ability to
2. Describe the basic components of analog and digital communication system.
3. Explain and analyze various types of analog and digital modulation techniques.
4. Analyze the behavior of a communication system in presence of noise and errors.
5. Demonstrate optimal transmission and reception of digital signals

**Syllabus**

**UNIT I: Analog Modulation and Demodulation**

Need for modulation, Amplitude Modulation and Demodulation Techniques: AM-Square Law and Envelope Detector, DSB-Balanced Modulator and Synchronous Detector, SSB- Phase Discriminator and Sync Detector, VSB, Angle Modulation and Demodulation Techniques: FM-Direct FM Armstrong Method and PLL Method, PM, Frequency Division Multiplexing and Time Division multiplexing.

**UNIT II: Noise in Analog Modulation Systems**

Noise , Types of noise , Gaussian and white noise characteristics, Noise in amplitude and Frequency modulation systems, SNR and Figure of Merit calculations, Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

**UNIT III: Elements of Digital Communication Systems**

Model of Digital Communication System, Advantages of Digital communication systems, Sampling process, Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, ADM, Noise considerations in PCM and DM.

**UNIT IV:Base band and Pass band Transmission**

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation and Demodulation schemes- Minimum Shift Keying, Frequency Shift Keying, Phase Shift Keying, Quadrature Amplitude Modulation.

**UNIT V:Optimal Reception and Tradeoffs**

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

**Text Books:**

1. “Communication Systems” - B.P Lathi, BS Publication, 2004.
2. "Communications Systems", Simon Haykin., John Wiley and Sons, 2nd Edition, 2001.
3. “Principles of Communication Systems”- Herbert Taub, Donald L Schiling, Gautam Saha, 3rd Edition, McGraw-Hill, 2008.
4. “Digital and Analog Communication Systems”- Sam Shanmugam, John Wiley, 2005
5. “Digital Communications”- John G. Proakis, Masoud Saheli- 5th edition, Mcgraw-Hill, 2008

**Reference Books:**

1. “Analog and Digital Communication” – K. Sam Shanmugham, Wiiey, 2005.
2. “Electronic Communications” – Dennis Roddy and John Coolean,4th Edition,PEA,2004.
3. "Communication Systems Engineering", Proakis J. G. and Salehi M., Pearson Education, 2002.
4. ``Principles of Communication Engineering", Wozencraft J. M. and Jacobs I. M., John Wiley, 1965.
5.``Digital Communication", Kluwer , Barry J. R., Lee E. A. and Messerschmitt D. G., Academic Publishers, 2004.

**II Year B.Tech. ECE II-Sem**

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| 3 | 0 | 0 | 3 |

## (18PC0EC08) ANALOG CIRCUITS

**Prerequisite:** Electronic Devices

**Course Objectives:**

To gain thorough knowledge of amplifiers with low and high frequency analysis.
To gain knowledge of Op-amp and its applications and data converters.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Understand the characteristics of transistors
2. Design and analyze various amplifier circuits
3. Design sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

**Syllabus**

**UNIT I: Transistor Low Frequency Analysis**

Low frequency transistor models, Analysis of CE, CB, CC amplifier using h parameter model: estimation of voltage gain, input resistance, output resistance etc., multistage amplifiers, low frequency analysis of multistage amplifiers, design procedure for RC coupled amplifier.

**UNIT II: Transistor High frequency model and power amplifiers**

High frequency transistor models, CE short circuit current gain, relation between $f_\alpha$, $f_\beta$, $f_T$, frequency response of single stage and multistage amplifiers, cascode amplifier..Power Amplifiers - Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

**UNIT III: Feedback amplifiers and Oscillators**

Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., concept of stability, gain margin and phase margin..Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators : Phase Shift, Wien Bridge, LC oscillators: Hartley, Colpitts, Clapp, Crystal oscillators.

**UNIT IV: Basics of OP-AMP and its Applications**

Basic structure, principle and modes of operation, AC and DC characteristics. CMRR and PSRR. OP-AMP applications: Integrator and Differentiator, Summing amplifier, instrumentation amplifier, Schmitt trigger and its applications. Filters: Design of first order Low pass, high pass, band pass and band stop filters.

**UNIT V: A/D and D/A Convertors**

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, Inverted R-2R, Analog-to-digital converters (ADC): Flash, Single slope, dual slope, Successive approximation, Counter type, DAC/ADC Specifications.

**Text Books:**

1. Analog Electronics, A.K. Maini, Khanna Publishing House
2. Linear Integrated circuits, Roy Chowdary and Shail B. Jain 5th edition.
3. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits,
John Wiley, 3rd Edition

**Reference Books:**

1. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
2. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11, Publishing, Edition IV
3. Op - Amps and Linear Integrated Circuits,Ramakanth A.Gayakwad,Fourth edition,PHI Publication.

**II Year B.Tech. ECE II-Sem**

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## (18PC0EC09) PROBABILITY THEORY AND STOCHASTIC PROCESSES

**Prerequisite:** Nil

**Course Objective:**

Aim to understand random signal and system response

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

**Syllabus**

**UNIT I: Probability and Random Variable**

Probability: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, ayes' Theorem, Independent Events.Random Variable:
Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables

**UNIT II: Distribution &** Density Functions and Operation on One Random Variable **– Expectations**

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, and Properties.
Operation on One Random Variable – Expectations: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable

**UNIT III: Multiple Random Variables and Operations**

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum

of Several Random Variables, Central Limit Theorem (Proof not expected), Unequal Distribution, Equal Distributions..Operations on Multiple Random Variables: Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, And Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

**UNIT IV: Stochastic Processes – Temporal Characteristics**

The Stochastic Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationary and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, Nth Order and Strict-Sense Stationary, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties, Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, Cross-Correlation Functions, Gaussian Random Processes, Poisson Random Process.

**UNIT V: Stochastic Processes – Spectral Characteristics**

Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Spectral Density of Input and Output of a Linear System

**Text Books:**

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal
Processing," Third Edition, Pearson Education
2. A. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic
Processes," Fourth Edition, McGraw Hill.

**Reference Books:**

3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer
International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
5. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.
6.

**II Year B.Tech. ECE II-Sem**

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## (18PC0EC10) ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

1. Amplitude modulation and demodulation
1. DSB-SC Modulator & Detector
2. SSB-SC Modulator & Detector (Phase Shift Method)
3. Frequency modulation and demodulation.
4. Study of spectrum analyzer
5. Pre-emphasis & de-emphasis
6. Time Division Multiplexing & De multiplexing
7. Verification of Sampling Theorem
8. Pulse Amplitude Modulation & Demodulation
9. PCM Generation and Detection
10. Differential Pulse Code Modulation
11. Delta Modulation
12. Amplitude Shift Keying: Generation and Detection
13. Frequency Shift Keying: Generation and Detection
14. Phase Shift Keying: Generation and Detection

NOTE: Minimum of 12 experiments to be conducted.

**II Year B.Tech. ECE II-Sem**

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## (18PC0EC11) ANALOG CIRCUITS LABORATORY

(For Laboratory Examination – Minimum of 12 experiments)

**PART A:**

**1. Common Emitter Amplifier**
**2. Common Base Amplifier**
**3. Common Source Amplifier**
**4. Two stage RC Coupled Amplifier**
**5. Current Shunt and Voltage Feedback Amplifier**
**6. Cascode Amplifier**
**7. Wien Bridge Oscillator using Transistors**
**8. RC Phase Shift Oscillator using Transistors**
**9. Hartley and Colpitt's Oscillator**

**PART B:**

1. Inverting and Non-inverting Amplifiers using Op Amps.
2. Comparators using Op Amp.
3. Integrator Circuit using IC 741.
4. Differentiator circuit using Op Amp.
5. To plot the frequency response of Ist order LPF.
6. To plot the frequency response of Ist order HPF

**II Year B.Tech. ECE II-Sem**

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## (18ES0EE04) Control Systems

**Course Outcomes:**

At the end of this course, students will demonstrate the ability to

- Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Design simple feedback controllers.

### Module 1: Introduction to control problem

Industrial Control examples. Mathematical models of physical systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra, Transfer Function of Servo motor (AC&DC) Synchro transmitter and Receiver, Representation by Signal flow graphs.

### Module 2: Time Response Analysis

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

### Module 3: Frequency-response analysis

Relationship between time and frequency response, Frequency domain specifications Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin.

### Module 4: Introduction to Controller Design

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs.

### Module 5: State variable Analysis

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. State Transition Matrix and it's Properties. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems

**Text Books:**


1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.


**References Books:**


1. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

# School of Engineering & Technology

**II Year B.Tech. ECE II-Sem**

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## (18BS0MA04) MATHEMATICS IV

**Course Objectives:**

1. To learn the Concepts & properties of Laplace Transforms solving differential equations using Laplace transform techniques.
2. To provide Numerical approximation to the roots of an equation by various methods.
3. To provide the concepts of Fourier series & Fourier Transform.
4. To provide the concepts of solutions of linear & Non-Linear Partial differential equations and solutions to various applications in Engineering e.g., wave equation, heat equation and Laplace equations.

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Understand the concept of Laplace Transform and its applications
2. Understand the concept of Inverse Laplace Transform and its applications
3. Visualize relationship between Fourier series & Fourier transforms and its Engineering applications.
4. Find the solutions of Engineering Applications such as wave equation; heat equation and Laplace equations by using partial differential equation.

**Syllabus**

**UNIT–I: Laplace Transform**

Definition of integral transform, Domain of the function and kernel for the Laplace transform, Laplace transform of standard functions , First shifting theorem, Laplace transform of functions when they are multiplied or divided by t. Laplace transform of derivatives and integrals-Unit step function-second shifting theorem-Dirac delta function ,Periodic function.

**UNIT-II: Inverse Laplace Transform and applications**

Inverse Laplace transform by partial fractions, Inverse Laplace transform of functions when they are multiplied or divided by s, Inverse Laplace transform of derivatives and integrals ,Convolution theorem-Solving differential equation by Laplace transforms.

**UNIT-III: Fourier series**

Definition of periodic function .Fourier expansion of periodic function in a given interval of 2π,Determination of Fourier coefficients-Fourier series of even and odd functions-Fourier series in any arbitrary interval-even and odd functions-Half-range Fourier Sine and Cosine expansions

**UNIT-IV: Fourier Transforms**

Fourier integral theorem- Fourier Sine and Cosine integrals, Fourier transforms, Fourier Sine and Cosine transforms –properties of Fourier transforms-Inverse Fourier transforms-Finite Fourier transforms.

**UNIT-V: Partial Differential Equations**

Introduction and formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions ,solutions of first order linear equations(Lagrange's) and non linear equations (Charpit's method) Method of separation of variables for second order equations.

**Text Books:**

1. Higher Engineering Mathematics By B S Grewal, Khanna Publications.
2. Engineering Mathematics By Erwin Kreyszig, Wiely Publications

**Reference Books:**

1. Engineering Mathematics By Srimantapal & Subodh C. Bhunia, Oxford University Press.
2. Advanced Engineering Mathematics By Peter V O'neil, Cengage Learning
3. Mathematical Methods By Dr. S. Sivaiah, University Science Press 2013.
4. Mathematical Methods By T. K. V. Iyengar & B. Krishna Gandhi, S. chand. Publishing.

# School of Engineering & Technology

**II Year B.Tech. ECE II-Sem**

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## (18SS0MB02) ECONOMICS FOR ENGINEERS

**Course Objective:**
To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Budget and understand the employment.

**Course Outcome:**
1. The students will understand the various Forms economic variables.
2. The students will understand the importance of Capital Budgeting, Demand, and Supply.
3. The Students can study the Commercial Banks, Cost & Cost Control, Employment - Informal, Organized, Unorganized Sectors.

**Syllabus**

**UNIT-1**
Basic Principles and Methodology of Economics. Demand/Supply-Elasticity-Government Policies and Application. Theory of the firm and Market Structure. Aggregate Demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates.

**UNIT-2**
Central Bank Monetary Aggregates; Commercial Banks & Their functions: Capital and debt markets. Monetary and Fiscal Policy Tools & their impact on the economy-Inflation and Phillips curve.

**UNIT-3**
Elements of Business / Managerial Economics and forms of organizations. Cost & Cost Control -Techniques, Types of costs, Budgets even analysis, Statement - cash flow, financial. Case study method.

**UNIT-4**
Capital Budgeting. Investment Analysis – NPV, ROI, IPR Payback period, Depreciation, Time Value of money. Business forecasting - Elementary techniques.

**UNIT- 5**
Employment - Informal, Organized, Unorganized, Public, Private, Challenges and Policy debates, Fiscal, Social, External sectors.

**Reference Books**

1. Mankiw Gregory N (2002) , Principles of Economics Thompson Asia.
2. V Mote, S Paul, G Gupta (2004) , Managerial Economics, Tata Mc Graw Hill.
3. Misra, S.K. and Puri (2009) , Indian Economy, Himalaya.
4. Pareek Saroj (2003), textbook of Business Economics, Sunrise Publishers.

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

## Regulation – R 21

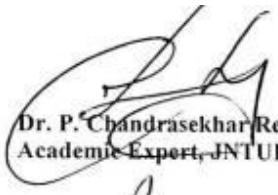
## COURSE STRUCTURE

## III YEAR I SEMESTER

| Sl. No. | Code | Group | Subject | L | T | P | Contact hrs/ wk | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 21SS0MB16 | HS | Management Science | 3 | 0 | 0 | 3 | 3 |
| 2 | 21PC0CS01 | ES | Computer Organization & Architectures | 3 | 0 | 0 | 3 | 3 |
| 3 | 21PC0EC12 | PC | Electromagnetic Waves and Transmission Lines | 3 | 1 | 0 | 4 | 4 |
| 4 | 21PC0EC13 | PC | VLSI Design | 3 | 0 | 0 | 3 | 3 |
| 5 | 21PE0EC1C | PE | Information Theory and Coding [PE – I] | 3 | 0 | 0 | 3 | 3 |
| 6 | 21OEOCY01 | OE | Python Programming for Emerging Technologies | 3 | 0 | 0 | 3 | 3 |
| 7 | 21PC0EC14 | PC | VLSI Design Laboratory | 0 | 0 | 3 | 3 | 2 |
| 8 | 21HS0EN03 | H&S | Advanced Communication Skills Lab | 0 | 0 | 2 | 2 | 1 |
| 9 | 21MC0CH01 | MC | Environmental science | 3 | 0 | 0 | 3 | 0 |
| **10** | **21MC0CS02** | **MC** | Fundamentals of Cyber Security | **3** | **0** | **0** | **3** | **0** |
| **Total Credits** | | | | | | | | **22** |

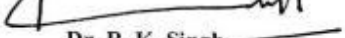
Dr. S. P. Yadav
HOD & BOS Chairman

Dr. K. Anitha Sheela
University Nominee, JNTUH

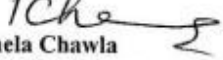


Dr. P. Chandrasekhar Reddy
Academic Expert, JNTUH

Mr. T. S. Rama Krishna
DDG (E), Dooradarshan, Hyd

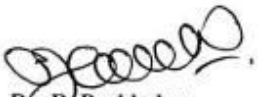


Dr. R. K. Singh
Prof. ECE & AD



Dr.Pamela Chawla
Dean ECE & Member

Dr.K. Chanthiresekaran
Dean Academics & Member



Dr. R. Prabhakar
Prof. ECE & Member

Dr. Binod Kumar Prasad
Assoc.Prof. ECE & Member

Mr. Sandeep Patil
Alumni (M. Tech)

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

## Regulation – R 21

## COURSE STRUCTURE

## III YEAR II SEMESTER

| Sl. No. | Code | Group | Subject | L | T | P | Contact hrs/wk | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 21PC0CS14 | ES | Computer Networks | 3 | 1 | 0 | 4 | 4 |
| 2 | 21PC0EC15 | PC | Microcontrollers and Applications | 3 | 0 | 0 | 3 | 3 |
| 3 | 21PC0EC16 | PC | Digital Signal Processing | 3 | 1 | 0 | 4 | 4 |
| 4 | 21PE0EC2x | PE | Professional Elective -2 | 3 | 0 | 0 | 3 | 3 |
| 5 | 21OE0EC2x | OE | Open Elective -2 | 3 | 0 | 0 | 3 | 3 |
| 6 | 21PC0EC17 | PC | Microcontrollers and Applications Laboratory | 0 | 0 | 2 | 2 | 1 |
| 7 | 21PC0EC18 | PC | Digital Signal Processing Laboratory | 0 | 0 | 2 | 2 | 1 |
| 8 | 21PC0CS17 | ES | Computer Networks Lab | 0 | 0 | 3 | 3 | 1 |
| 9 | 21MC0EN02 | MC | Gender Sensitization Lab | 0 | 0 | 2 | 2 | 0 |
| **10** | 21MC0CS01 | **MC** | Fundamentals of Artificial Intelligence | **3** | **0** | **0** | **3** | **0** |
| **Total Credits** | | | | | | | | **20** |

Dr. S. P. Yadav
HOD & BOS Chairman

Dr. K. Anitha Sheela
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Dr. R. K. Singh
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Dr.Pamela Chawla
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Dr.K. Chanthiresekaran
Dean Academics & Member

Dr. B. Prabhakar
Prof. ECE & Member

Dr. Binod Kumar Prasad
Assoc.Prof. ECE & Member

Mr. Sandeep Patil
Alumni (M. Tech)

# III YEAR B.Tech. I SEMESTER

# Guru Nanak Institutions Technical Campus (Autonomous)
# School of Engineering & Technology

## Department of Electronics and Communication Engineering

**III Year B.Tech. ECE I-Sem**

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|---|---|---|---|
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**(18PC0EC12) ELECTROMAGNETIC WAVES AND TRANSMISSION LINES**

**Prerequisite: Vector Calculus**

**Course Objectives:**

To introduce the student to the fundamental theory and concepts of Electromagnetic waves and transmission lines, and their practical applications

**Course Outcomes:**

1. At the end of this course students will be able to State the Maxwell's equations.
2. Distinguish the plane waves and their propagation in different media.
3. Compute the transmission lines parameters
4. Analyze the Rectangular waveguides
5. Define the Basics of Antenna

**Syllabus**

**UNIT I:**

**Electrostatics and Magneto statics**

Maxwell's Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Coulomb's Law, Electric Field Intensity – Fields due to line and surface Charge Distributions, Electric Flux Density, Gauss Law , Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields. Continuity Equation, Relaxation Time

Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law , Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Illustrative Problems Maxwell's Equations (Time Varying Fields), Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. .Maxwell's Equations, Boundary conditions at Media Interface.

**UNIT-II:**

**Uniform Plane Wave-I**

Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

**Uniform Plane Wave-II**

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total Credits internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

**UNIT III:**

**Transmission Lines**

Transmission Lines- Types, Parameters, Transmission Line Equations, Primary & Secondary Constants Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

**UNIT IV:**

**Waveguides**

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

**UNIT V:**

**Antenna Basics**

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna,

**Text Books:**

1. Elements of Electromagnetic-Mathew N.O.Sadiku, 5ed, Oxford Univ.Press

2. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

3. Network Lines and Fields by John D Ryder, 2nd edition, PHI, 2003

**Reference Books:**

1.E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India

2. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

3. David Cheng , Electromagnetics, Prentice Hall

# Guru Nanak Institutions Technical Campus (Autonomous)
# School of Engineering & Technology

## Department of Electronics and Communication Engineering

**III Year I SEMESTER**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**(18PC0EC13) VLSI DESIGN**

**Course Objectives:**

At the end of this course students will demonstrate the ability to

1. To understand the IC fabrication and performance analysis, with concepts and techniques MOS devices with their electrical characteristics.
2. Analyze the VLSI Design Process for verification and testability.

**Course Outcomes:**

1. Students will be able to remember fundamentals MOS devices.
2. Students will be able to understand the concepts of Electrical characteristics
3. Students will be able to emphasize VLSI Design process
4. Students will be able to compare various IC design process
5. Students will be able to evaluate testing, system noise and performance analysis

**UNIT I:**

**Introduction & Basic Electrical Properties of MOS**

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS Technologies; Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and Capacitors, CMOS Nanotechnology. Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit ωo; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

**UNIT II:**

**VLSI Circuit Design Processes**

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

**UNIT III:**

**Gate Level and Data Path Subsystems Design**

Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out, Choice of layers. Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

**UNIT IV:**

**Memory Array Subsystems and Semiconductor IC Design**

SRAM, DRAM, ROM, Serial Access Memories, Content Addressable Memory. PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.

**UNIT V:**

**CMOS Testing**

CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System Level Test Techniques, Layout Design for improved Testability.

**Text books:**

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A circuits and systems perspective, Neil H. E Weste, David Harris, Ayan Banerjee, person, 2009.

**Reference books:**

1. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
2. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
3. VLSI Design – A.Albert Raj, Latha, PHI, 2008
4. Introduction to VLSI – Mead & Convey, BS Publications, 2010

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**(18PC0EC14) VLSI DESIGN LABORATORY**

List of Experiments:

**Part A: Pre synthesis Experiments:**

1. Write the HDL code to realize all the logic gates and verify the pre synthesis simulation results.
2. Design of 8 – to – 3 encoder (without and with parity) and verify the pre synthesis simulation results.
3. Design of 8 – to – 1 multiplexer and verify the pre synthesis simulation results.
4. Design of 4 bit binary to gray converter and verify the pre synthesis simulation results.
5. Design of Full Adder using Dataflow, Behavioural and Structural Modeling styles and verify the pre synthesis simulation results.
6. Design of flip flops: SR, D, JK, T and verify the pre synthesis simulation results.
7. Design of BCD counters (synchronous / asynchronous reset) and verify the pre synthesis simulation results.
8. Finite State Machine Design for Sequence counter (synchronous reset) and verify the pre synthesis simulation results.

**Part B: Post Synthesis Experiments:**

1. Write XDC file for 1st experiment and verify the post synthesis simulation and FPGA Implementation results.
2. Write XDC file for 2nd experiment and verify the post synthesis simulation and FPGA Implementation results.
3. Write XDC file for 3rd experiment and verify the post synthesis simulation and FPGA Implementation results.
4. Write XDC file for 4th experiment and verify the post synthesis simulation and FPGA

Implementation results.

5. Write XDC file for 5th experiment and verify the post synthesis simulation and FPGA Implementation results.
6. Write XDC file for 6th experiment and verify the post synthesis simulation and FPGA Implementation results.
7. Write XDC file for 7th experiment and verify the post synthesis simulation and FPGA Implementation results.
8. Write XDC file for 8th experiment and verify the post synthesis simulation and FPGA Implementation results.

# III YEAR B.Tech II SEMESTER

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**(18PC0EC15) MICROCONTROLLERS AND APPLICATIONS**

**Prerequisite: Digital System Design**

**Course objective:**

1. Make familiar with the architecture and the instruction set of an Intel microprocessor
2. Assembly language programming will be studied as well as the design of various types of digital and analog interfaces with understanding the architecture of Microcontrollers.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Do assembly language programming
2. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
3. Develop systems using different microcontrollers
4. Understand RSIC processors and design ARM microcontroller based systems

## Syllabus

**UNIT 1:**

**Introduction to Microprocessor**

**8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

**Instruction Set and Assembly Language Programming of 8086**: Instruction formats, Addressing modes, Instruction Set and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations

**UNIT II:**

**Introduction to Microcontrollers:** Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

**8051 Real Time Control:** Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

**UNIT III:**

**I/O And Memory Interface:** LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

**Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

**UNIT IV:**

**ARM Architecture:** ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

**UNIT V:**

**Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

**Text Books:**

**1.** Douglas V Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.

2. Microcontrollers programming by TularamM.Bansod Pratik Tawde.

**Reference Books:**

3. D A Patterson and J H Hennessy, "Computer Organization and Design Thehardware and software interface. Morgan Kaufman Publishers.

4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

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## (18PC0EC16) DIGITAL SIGNAL PROCESSING

**Prerequisite:** Signals & Systems

**Course Objective:**

To provide fundamental relationships between time, frequency domain signals and systems and analyze the IIR & FIR filters.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications
4. Understand the effects of finite word lengths and their precautions
5. Study and analyze the Multi rate signal processing methods

**Syllabus**

**UNIT I:**

**Introduction to Discrete time signals and Systems**

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Application of DSP, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems,

**UNIT II:**

**Discrete Fourier Transform and Fast Fourier Transform**

Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of Over-Lap Add Method, Over-Lap Save Method.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) – Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix-N.

**UNIT III:**

**FIR Digital Filters**

Characteristics of FIR Digital Filters, Frequency Response, Design of FIR Digital filters: Fourier Method, Window method, Park-McClellan's method.

**UNIT IV:**

**IIR Filters**

Design of IIR analog filters – Butterworth and Chebyshev, Elliptic Approximations, Design of IIR Digital Filters from Analog Filters by using Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformation: Low pass, Band pass, Band stop and High pass filters. Comparison of FIR and IIR filters.

**UNIT V:**

**Finite Word length Effects and Multirate Rate Signal Processing**

Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing, Decimation, Interpolation, Sampling Rate Conversion.

**Text Books:**

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. .Ramesh Babu, Digital Signal Processing, 4th Edition.

**Reference Books:**

1. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
2. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
3. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

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**(18PC0EC17) MICROCONTROLLERS AND APPLICATIONS LABORATORY**

Hands-on experiments related to the course contents EC11

1. 8086 Arithmetic Operations (Addition, Subtraction, multiplication and division)
2. Ascending order/descending order of an array of numbers.
3. Stepper motor interfacing to 8086.
4. 8051 Arithmetic Operations (Addition, Subtraction, multiplication and division)
5. Implementation of Timers and Counters using 8051.
6. Interrupt handling in 8051.
7. UART operation in8051.
8. LCD interfacing to 8051
9. I/O control of robot (ROBOTICS)
10. Speed control of robot (ROBOTICS)
11. Obstacle detection for robots (ROBOTICS)
12. Appliance control using robot (ROBOTICS)
13. Arduino controller based LED interfacing (IOT)
14. Arduino controller based relay switching (IOT)
15. Arduino controller based switch interfacing (IOT)

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**(18PC0EC18) DIGITAL SIGNAL PROCESSING LABORATORY**

(The programs shall be implemented in software using MATLABORATORY)

1. Generation of elementary discrete time signals.
2. To find DFT / IDFT of given DT signal.
3. To find frequency response of a given system given in (Tr. Function/ Diff. equation form).
4. Implementation of FFT of given sequence.
5. Determination of Power Spectrum of a given signal(s).
6. Implementation of LP FIR filter for the given specifications.
7. Implementation of HP FIR filter for the given specifications.
8. Implementation of LP IIR filter for the given specifications.
9. Implementation of HP IIR filter for the given specifications.
10. Implementation of Decimation Process.
11. Implementation of Interpolation Process.
12. Implementation of I/D sampling rate converters.
13. Impulse response of first order and second order systems.

# PROFESSIONAL ELECTIVE SUBJECTS

# Professional Elective-I

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**(18PE0EC1A) NANO ELECTRONICS**

**Prerequisites: Nil**

**Course Objective :**
The course aims to give exposure on theory of nano electronics and the structure of nano electronics devices

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making Nano components and material.
2. Understand the basic theory of Quantum electronics in support of Nano electronics
3. Understand and Analysis of how various MOS devices supports in design of Nano systems.
4. Understand and Analysis of how various semiconductor devices supports in design of Nano systems.
5. Leverage advantages of the Nano-materials and appropriate use in solving practical problems.

**Syllabus**

**UNIT I:**

**Introduction to Nanotechnology**

Introduction to nanotechnology, meso structures,

**UNIT II:**

**Basics of Quantum Electronics**

Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.

**UNIT III:**

**MOS Based Nanotechnology**

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

**UNIT IV: Nano Semiconductor Devices**

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, , 1D & 2D semiconductors and electronic devices

**UNIT V:**

**Applications of Nano Semiconductor Devices**

Band structure and transport, devices, applications, Graphene, 1D and 2D atomistic simulation

**Text Books:**

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.

**Reference Books:**

1. K.E. Drexler, Nanosystems, Wiley, 1992.

2. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

3. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

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**(18PE0EC1B) BIO-MEDICAL ELECTRONICS**

**Prerequisite:** Electronic devices and Circuits, Instrumentation

**Course Objective:**

1. To understand applications and practical limitations of electronic components and systems in biological and medical applications.
2. To analyze the biological processes like other electronic processes.

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.
4. Understand the principles underlying in Biological measurements
5. Understand medical imaging process and usage of Prostheses and aids

**Syllabus**

**UNIT I:**

**introduction to Biomedical Instrumentation**

Development of Biomedical lnstrumentation, Brief introduction to human physiology. Problems Encountered in Measuring a Living System, Medical Measurement Constraints, Design Criteria, Commercial Medical Instrumentation Development Process

**UNIT II:**

**Basic Transducer Principles**

The Transducer and Transduction, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Biomedical transducers for displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.

**UNIT III:**

**Sources of Bioelectric Potentials and Electrodes**

Resting and Action Potentials, Propagation of Action Potentials, Bioelectric Potentials Electrode Theory, Biopotential Electrodes, Biochemical Transducers, Bio-electrodes

**UNIT IV:**

**Biopotential Amplifiers & Measurements**

The Heart and Cardiovascular System, Blood Pressure, Characteristics of blood flow, Heart Sounds, The Electrocardiograph, Problems Frequently Encountered, biopotential amplifiers for ECG, Amplifiers for Other Biopotential Signals EMG, EEG, Measurement of blood temperature, pressure and flow

**UNIT V:**

**Medical Imaging Systems & Prostheses and aids**

Impedanceplethysmography. Ultrasonic, X-ray and nuclear imaging.

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

**Text Books:**

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. Handbook of biomedical instrumentation by RS khandpur

**Reference Books:**

1. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.
2. Biomedical Instrumentation and Measurements, Second Edition, Leslie Cromwell

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**(18PE0EC1C) INFORMATION THEORY AND CODING**

**Prerequisite: Matrix Algebra**

**Course Objective:**

To impart the knowledge of Information Theory and Coding and Decoding of Source and Channel Codes

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply Source coding techniques.
5. Apply Cyclic and Convolution coding techniques

**Syllabus**

**UNIT I:**

**Introduction**

Basics of information theory, Shannon theorem, Channel capacity, Measure of Information, Average Information-Entropy, Entropy of a Source with Memory.

**UNIT II:**

**Entropy for different codes**

Entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources.

**UNIT III:**

**Source Coding**

Markov sources; Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

**UNIT IV:**

**Techniques of coding and decoding**

Huffman codes, Extended Huffman coding and uniquely detectable codes

**UNIT V:**

**Cyclic and Convolutional Codes**

Linear block codes, Cyclic codes, Convolutional arithmetic codes, Viterbi algorithm

**Text Books:**

1. N. Abramson, Information and Coding, McGraw Hill, 1963.

2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

**Reference Books:**

1. R.B. Ash, Information Theory, Prentice Hall, 1970.

2. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

3. Taub and Schilling, Principles of Communication System, McGraw Hill,2000

# Professional Elective-II

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**(18PE0EC2A) ANTENNAS AND PROPAGATION**

**Prerequisite: Electromagnetic Waves**

**Course Objectives:**

Understand the basic terminology, concept of radiation, design antennas and understand the propagation of waves

**Course Outcomes:**

At the end of the course, students shall be able to:

1. Define the basics of antenna.
2. Characterize the antennas based on frequency.
3. Analyze the Microstrip patch antenna and reflector antenna.
4. Design Broadside array and End fire array antenna.
5. Classify the Smart Antennas and wave propagation mechanism

**UNIT I:**

**Antenna Basics**

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-andfar-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Wire and Loop Antennas: Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linearelements near conductors, dipoles for mobile communication, small circular loop.

**UNIT II:**

**Aperture and Reflector Antennas**

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

**UNIT III:**

**Micro strip Antennas Antennas**

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

**UNIT IV:**

**Antenna Arrays**

Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

**UNIT V:**

**Smart Antennas and Wave Propagation**

Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming. Different modes of Radio Wave propagation used in current practice.

**Text Books:**

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.

**Reference Books:**

1. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
2. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill, 1984.
3. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
4. R.E. Crompton, Adaptive Antennas, John Wiley

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### (18PE0EC2B) SPEECH AND AUDIO PROCESSING

**Prerequisite: Nil**

**Course Objective:**

1.The course aims to give exposure on the speech modeling and processing
2.The course aims to give exposure on the speech coding and reproduction

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.
4. Understand the speech coding and standards

**Syllabus**

**UNIT I:**

**Introduction to Speech**

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs – quality, coding delays, robustness. Speech Signal Processing- Pitch-period estimation,

**UNIT II:**

**Speech Mathematical modeling**

all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

**UNIT III:**

**Speech Quantization**

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

**UNIT IV:**

**Linear Prediction Coding**

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model. Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis;

**UNIT V:**

**Speech Coding standards**

Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zerostate method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards.

**Text Books:**

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students_ *Edition), 2004.*

2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, Wiley Inter science, 2003.

**Reference Books:**

1. Video, Speech, and Audio Signal Processing and Associated Standards (The Digital Signal Processing Handbook, Second Edition) by Vijay Madisetti-CRC Press

2. Discrete Time Processing of Speech Signals by Deller, Hansen and Proakis

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## (18PE0EC2C) Telecom Network Management

**Prerequisite: Nil**

**Course Objective:**

1. The course aims to give exposure on the telecom Network Management.
2. The course aims to give exposure on Internet, Broadband Network Management.

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Understand how to manage Telecom Networks
2. Analyze the quality and properties of Internet Management.
3. Modify and enhance the Telecom Networks.

**Syllabus**

**UNIT I:**

**Overview of Network Management:**

Case histories on network, system and service management, challenges of IT managers, Network Management: Goals, organization and functions, Network management architecture and organization network management perspectives

**UNIT II:**

**OSI Network Management:**

Network management standards, Network management models, Organization model, Information model, Communication model and functional model, Abstract syntax notation – encoding structure, macros functional model CMIP/CMISE

**UNIT III:**

**Internet Management:**

SNMP-organizational model, System overview, Information model, communication model, functional model, SNMP proxy server, Management information, Protocol, SNMPv1,v2 and V3, Remote monitoring. RMON.

**UNIT IV:**

**Broadband Network Management:**

Broadband networks and services, ATM Technology – VP, VC, ATM Packet, Integrated service, ATM LAN emulation, Virtual LAN, ATM Network Management – ATM network reference model, integrated local management interface. ATM management information base, role of SNMP and ILMI in ATM management, M1, M2, M3, M4 interface. ATM digital exchange interface management

**UNIT V:**

**Network Management Applications:**

Configuration management, Fault management, Performance management, Event correlation techniques, Security management, Accounting management, report management, policy based management services, Level management

**Text Books:**

1. "Telecommunication Network Management Paperback – 1 Jan 2011 by V S Bgad
.

**2.** Telecommunications Network Management (McGraw Hill Series on Telecommunications) Hardcover – Import, 16 Jul 1999 by Haojin Wang**.**

**Reference Books:**

1. Telecommunication Networks-CMC Press by Eugenio Iannone.

2. Telecommunication Switching Systems And Networks 2nd Edition, Kindle Edition by Thiagarajan and Manav Bhatnagar

# OPEN ELECTIVE SUBJECTS

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**(18OE0EC1A) ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**

**Prerequisite :** Basic Electrical and Electronics Engineering

**Course Objectives:**

It provides an understanding of various measuring systems functioning and metrics for performance analysis, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment

Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

**Course Outcomes:**

On completion of this course student can be able to

Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.

Measure various physical parameters by appropriately selecting the transducers.

Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals

.

**UNIT I:**

**Block Schematics of Measuring Systems:** Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag ;Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

**UNIT II:**

**Signal Analyzers**: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

**UNIT III:**

**Oscilloscopes:** CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

**Special Purpose Oscilloscopes**: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

**UNIT IV:**

**Transducers:** Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

**UNIT V**:

**Bridges:** Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

**Measurement of Physical Parameters**: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature - Measurements, Data Acquisition Systems.

**TEXT BOOKS:**

1. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

**REFERENCES:**

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

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### (18OE0EC1B) BIO-MEDICAL ELECTRONICS

**Prerequisite:** Electronic devices and Circuits, Instrumentation

**Course Objective:**

1. To understand applications and practical limitations of electronic components and systems in biological and medical applications.
2. To analyze the biological processes like other electronic processes.

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling biosubstances.
3. Understand and analyze the biological processes like other electronic processes.
4. Understand the principles underlying in Biological measurements
5. Understand medical imaging process and usage of Prostheses and aids

**Syllabus**

**UNIT I:**

**introduction to Biomedical Instrumentation**

Development of Biomedical lnstrumentation, Brief introduction to human physiology. Problems Encountered in Measuring a Living System, Medical Measurement Constraints, Design Criteria, Commercial Medical Instrumentation Development Process

**UNIT II:**

**Basic Transducer Principles**

The Transducer and Transduction, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Biomedical transducers for displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.

**UNIT III:**

**Sources of Bioelectric Potentials and Electrodes**

Resting and Action Potentials, Propagation of Action Potentials, Bioelectric Potentials Electrode Theory, Biopotential Electrodes, Biochemical Transducers, Bio-electrodes

**UNIT IV:**

**Biopotential Amplifiers & Measurements**

The Heart and Cardiovascular System, Blood Pressure, Characteristics of blood flow, Heart Sounds, The Electrocardiograph, Problems Frequently Encountered, biopotential amplifiers for ECG, Amplifiers for Other Biopotential Signals EMG, EEG, Measurement of blood temperature, pressure and flow

**UNIT V:**

**Medical Imaging Systems & Prostheses and aids**

Impedanceplethysmography. Ultrasonic, X-ray and nuclear imaging.

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

**Text Books:**

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. Handbook of biomedical instrumentation by RS khandpur

**Reference Books:**

1. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.
2. Biomedical Instrumentation and Measurements, Second Edition, Leslie Cromwell

# Guru Nanak Institutions Technical Campus (Autonomous)
# School of Engineering & Technology

## Department of Electronics and Communication Engineering

**III Year B.Tech. ECE II-Sem**

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**(18OE0EC2A) EMBEDDED SYSTEMS**

**Prerequisites:** Microprocessors and microcontrollers, DLD, Computer Organisation

**Course Objectives:**

1.To introduce the basic principles of all measuring instruments

2. To deal with the measurement of voltage, current Power factor, power, energy and magnetic measurements.

Course Outcomes:

1. Gets a thorough knowledge on, different types of measuring instruments their construction operation and characteristics
2. Measurements of electrical quantities through potentiometers, instrument transformers, watt meters, energy meters, DC bridges and AC bridges
3. To understand the operation of different types of transducers.
4. To understand the measurement of non-electrical quantities like velocity, acceleration, temperature etc.
5. Applies the above concepts to real-world electrical and electronics problems and applications.

**Syllabus**

**UNIT I:**

**Introduction to Embedded Systems**

Definition of Embedded System, The concept of embedded systems design, Embedded microcontroller cores, Embedded Systems Vs General Computing Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Examples of embedded systems, technological aspects of embedded systems: interfacing between analog and digital blocks, signal conditioning, digital signal processing, sub system interfacing , interfacing with external systems, user interfacing.

**UNIT II:**

**Typical Embedded System**

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces. Design trade-offs due to process compatibility, Thermal considerations.

**UNIT-III:**

**RTOS Based Embedded System Design**

Operating System Basics, Types of Operating Systems, Vx works, MicroC/os-II, Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE, How to Choose an RTOS

**UNIT IV**

**Task Communication**

Shared Memory, Semaphores, Mutex, Message Passing, Remote Procedure Call and Sockets, Mailboxes , Message Queues, Event Registers, Pipes, Signals, Tasks, Process and Threads,

**UNIT -V**

**Task Synchronization**

Software aspects of embedded systems, Real time programming languages, Multiprocessing and Multitasking, Task Scheduling. Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers,

Text Books:

1. Electronic instrumentation: H.S.Kalsi - TMH, 2nd Edition 2004.

2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI, 5th Edition, 2003.

References Books:

1.Electronic Instrumentation and Measurements - David A. Bell, Oxford Uiv. Press, 1997.

2.Electronic Measurements and Instrumentation: B. M. Oliver, J. M. Cage TMH Reprint.

3.Measurement Systems - Emest O. Doebelin and Dhanesh N Manik, 6th Ed., TMH.

4.Electronic Measurements and Instrumentations by K. Lal Kishore, Pearson Education - 2010.

5.Industrial Instrumentation: T. R. Padmanabham Spiriger 2009.

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# School of Engineering & Technology

## Department of Electronics and Communication Engineering

**III Year B.Tech. ECE II-Sem**

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**(18OE0EC2B) PRINIPLES OF ELECTRONIC COMMUNICATIONS**

**Course Objectives:**

Introduce the students to modulation and various analog and digital modulation schemes.

**Course Outcomes:**

By completing this subject, the student can

1. Work on various types of modulations.

2. Should be able to use these communication modules in implementation.

3. Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

**Syllabus**

**UNIT I:**

**Introduction**

Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

**UNIT II:**

**Simple description on Modulation**

Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation anddemodulation schemes.

**UNIT III:**

**Telecommunication Systems**

Telephones Telephone system, Paging systems, Internet Telephony. Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

**UNIT IV:**

**Satellite Communication**

Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems. Optical Communication: Optical Principles, Optical Communication Systems, Fiber – Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

**UNIT V:**

**Cellular and Mobile Communications**

Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA. Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

**Text Books:**

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.

2. Electronic Communications systems, Kennedy, Davis 4e, Mc Graw hill Education, 1999

**Reference Books:**

1. Theodore Rapp port, Wireless Communications – Principles and practice, Prentice Hall, 2002.

2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.

3. Introduction to data communications and networking, Wayne Tomasi, Pearson Education, 2005.

# SERVICE SUBJECTS

# Guru Nanak Institutions Technical Campus (Autonomous)
# School of Engineering & Technology

## Department of Electronics and Communication Engineering

| III Year B.Tech. EEE II-Sem | L | T | P | C |
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(18ES0EC30) **MICROCONTROLLERS AND APPLICATIONS**

**Prerequisite: Digital System Design**

**Course objective:**

3. Make familiar with the architecture and the instruction set of an Intel microprocessor
4. Assembly language programming will be studied as well as the design of various types of digital and analog interfaces with understanding the architecture of Microcontrollers.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Do assembly language programming
2. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
3. Develop systems using different microcontrollers
4. Understand RSIC processors and design ARM microcontroller based systems

## Syllabus

**UNIT 1:**

**Introduction to Microprocessor**

**8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

**Instruction Set and Assembly Language Programming of 8086**: Instruction formats, Addressing modes, Instruction Set and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations

**UNIT II:**

**Introduction to Microcontrollers:** Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

**8051 Real Time Control:** Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

**UNIT III:**

**I/O And Memory Interface:** LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

**Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

**UNIT IV:**

**ARM Architecture:** ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

**UNIT V:**

**Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

**Text Books:**

**1.** Douglas V Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.

2. Microcontrollers programming by TularamM.Bansod Pratik Tawde.

**Reference Books:**

3. D A Patterson and J H Hennessy, "Computer Organization and Design Thehardware and software interface. Morgan Kaufman Publishers.

4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

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## Department of Electronics and Communication Engineering

**III Year B.Tech. EEE II-Sem**

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(18ES0EC31) **MICROCONTROLLERS AND APPLICATIONS LABORATORY**

Hands-on experiments related to the course contents EC11

1. 8086 Arithmetic Operations (Addition, Subtraction, multiplication and division)
2. Ascending order/descending order of an array of numbers.
3. Stepper motor interfacing to 8086.
4. 8051 Arithmetic Operations (Addition, Subtraction, multiplication and division)
5. Implementation of Timers and Counters using 8051.
6. Interrupt handling in 8051.
7. UART operation in8051.
8. LCD interfacing to 8051
9. I/O control of robot (ROBOTICS)
10. Speed control of robot (ROBOTICS)
11. Obstacle detection for robots (ROBOTICS)
12. Appliance control using robot (ROBOTICS)
13. Arduino controller based LED interfacing (IOT)
14. Arduino controller based relay switching (IOT)
15. Arduino controller based switch interfacing (IOT)

# Guru Nanak Institutions Technical Campus (Autonomous)
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## Department of Electronics and Communication Engineering

**III Year B.Tech. EEE II Sem**

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(18ES0EC32) **DIGITAL SIGNAL PROCESSING**

**Prerequisite:** Signals & Systems

**Course Objective:**

To provide fundamental relationships between time, frequency domain signals and systems and analyze the IIR & FIR filters.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications
4. Understand the effects of finite word lengths and their precautions
5. Study and analyze the Multi rate signal processing methods

**Syllabus**

**UNIT I:**

**Introduction to Discrete time signals and Systems**

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Application of DSP, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems,

**UNIT II:**

**Discrete Fourier Transform and Fast Fourier Transform**

Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of Over-Lap Add Method, Over-Lap Save Method.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) – Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix-N.

**UNIT III:**

**FIR Digital Filters**

Characteristics of FIR Digital Filters, Frequency Response, Design of FIR Digital filters: Fourier Method, Window method, Park-McClellan's method.

**UNIT IV:**

**IIR Filters**

Design of IIR analog filters – Butterworth and Chebyshev, Elliptic Approximations, Design of IIR Digital Filters from Analog Filters by using Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformation: Low pass, Band pass, Band stop and High pass filters. Comparison of FIR and IIR filters.

**UNIT V:**

**Finite Word length Effects and Multirate Rate Signal Processing**

Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing, Decimation, Interpolation, Sampling Rate Conversion.

**Text Books:**

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. .Ramesh Babu, Digital Signal Processing, 4th Edition.

**Reference Books:**

1. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
2. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
3. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

## Regulation – R 21

### COURSE STRUCTURE

**IV YEAR I SEMESTER**

| Sl. No. | Code | Group | Subject | L | T | P | Contact hrs/wk | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 18PE0EC3B | PE | Adaptive Signal Processing | 3 | 0 | 0 | 3 | 3 |
| 2 | 18PE0EC4A | PE | Mobile Communication and Networks | 3 | 0 | 0 | 3 | 3 |
| 3 | 18PC0EC19 | PC | Microwave and Optical Communications | 3 | 0 | 0 | 3 | 3 |
| 4 | 18OE0CS2B | OE | Data Base Management Systems | 3 | 0 | 0 | 3 | 3 |
| 5 | 18PC0EC20 | PC | Internet of Things and Sensors | 3 | 0 | 0 | 3 | 3 |
| 6 | 18PC0EC21 | PC | Microwave and Optical Communications Laboratory | 0 | 0 | 2 | 2 | 1 |
| 7 | 18PROJECT1 | PROJ | Project Stage-I | 0 | 0 | 6 | 6 | 3 |
| 8 | 18PC0EC22 | | Summer Internship | 0 | 0 | 4 | 4 | 2 |
| 9 | 18PC0EC23 | | Seminar | 0 | 0 | 2 | 2 | 1 |
| **Total Credits** | | | | | | | | **22** |

| | | |
|---|---|---|
| Dr. S. P. Yadav<br>HOD & BOS Chairman | Dr. K. Anitha Sheela<br>University Nominee, JNTUH | Dr. P. Chandrasekhar Reddy<br>Academic Expert, JNTUH |
| Mr. T. S. Rama Krishna<br>DDG (E), Dooradarshan, Hyd | Dr. R. K. Singh<br>Prof. ECE & AD | Dr.Pamela Chawla<br>Dean ECE & Member |
| Dr. K.Chanthiresekaran<br>Dean Academics & Member | Dr. R. Prabhakar<br>Prof. ECE & Member | Dr. Binod Kumar Prasad<br>Assoc.Prof. ECE & Member |
| Mr. Sandeep Patil<br>Alumni (M. Tech) | | |

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

## Regulation – R 21

## COURSE STRUCTURE

## IV YEAR II SEMESTER

| Sl. No. | Code | Group | Subject | L | T | P | Contact hrs/wk | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 18PE0EC5A | PE | Embedded Systems | 3 | 0 | 0 | 3 | 3 |
| 2 | 18PE0EC6A | PE | Satellite Communications | 3 | 0 | 0 | 3 | 3 |
| 3 | 18PE0EC4A | OE | Information Security | 3 | 0 | 0 | 3 | 3 |
| 4 | 18PROJECP2 | PROJ | Project Stage-II | 0 | 0 | 14 | 14 | 7 |
| **Total Credits** | | | | | | | | **16** |

Dr. B. Kedarnath
HOD & BOS Chairman

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Alumni & Member

Guru Nanak Institutions Technical Campus (Autonomous)
School of Engineering & Technology

Department of Electronics and Communication Engineering

# IV YEAR B.Tech. I SEMESTER

# Guru Nanak Institutions Technical Campus (Autonomous)
# School of Engineering & Technology

## Department of Electronics and Communication Engineering

**IV Year B.Tech. ECE I-Sem**

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### (18PC0EC19) MICROWAVE AND OPTICAL COMMUNICATIONS

**Pre–requisites:** Foundation level knowledge of EMF theory, Electronic Circuit theory, and Communication Systems.

**Course Objective:** Impart the knowledge of signal propagation through microwave devices and optical fibers, its design principles, measurement parameters and its sources and detectors

**Course Outcomes:** At the end of the course the students will be able to-

1. Understand the basic concept of microwave engineering and analyze the characteristics of microwave transmission line, strip and micro strip lines, Study about the S – matrix of MW junctions and devices.
2. Illustrate the working principles of microwave active and passive components, their typical characteristics and applications.
3. Illustrate the working principles of O type and M type tubes such as Klystrons and Magnetrons.
4. Understand and analyze the constructional, operational parameters of optical fibers and discuss its types.
5. Compare various optical Sources and optical detectors and various applications.

**UNIT I: Introduction to Microwaves and Transmission Lines:** Introduction to Microwaves, EMI/EMC. Features of TEM, TE and TM modes. Concept of impedance in Microwave transmission. Wave propagation in Rectangular waveguide Strip Lines, Micro strip lines

**Microwave Components:** Scattering Matrix- significance, formulation and properties, S Matrix for 2 Port junctions, E Plane and H plane Tees, Magic Tee. Ferrite Devices: Concept of Faraday rotation: Isolator and Circulator. Illustrative Problems.

**UNIT II: Microwave Active Components:** Gunn Diode: Principle, RWH Theory, V- I Characteristics, Basic Modes of Operation, PIN Diode: Construction, Principle of operation and applications.
**Microwave Tubes:** O type tube: Reflex Klystrons- Structure, velocity modulation and Applegate diagram, Bunching process, Efficiency. Effect of Repeller voltage on power output, Illustrative problems.

**UNIT III: Microwave Devices Design Principles:** Impedance transformation, Impedance matching, Microwave Filter design, RF and Microwave Amplifier design, Microwave Power Amplifier design, Microwave mixer and Oscillator design. Principle and Applications of MIMO.
**Microwave Antennas and Measurement:** Antenna Parameters, Antenna for Ground base stations, Airborne and Satellite borne systems, Planar Antennas. Power frequency and Impedance Measurement. Measurement of S-parameters and MW Antenna Parameters, Spectrum Analyzer.

**UNIT IV: Overview of Optical Fiber Communication:** Introduction, Elements of an optical fiber Communication, Advantages of Optical Fiber Communication, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays, Cylindrical Fibers- Modes, V-number, Mode Coupling, Step Index Fibers, Graded Index Fibers.
**Fiber Materials:** Glass, Halide, Active Glass, Chalgenide Glass, Plastic Optical Fibers.

**UNIT V: Optical Sources:** LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Injection Laser Diodes- Modes, Threshold Conditions, External Quantum Efficiency.
**Optical Detectors:** The PIN Photo detector and Avalanche Photo Detector, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Applications of Optical Fiber Communication

**Text Books:**

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,2003.
2. RE Collins, Microwave Circuits, McGrah Hill
3. Optical Fiber Communications – Gerd Keiser, TMH, 4th Edition, 2008.
4. Optical Fiber Communications – John M. Senior, Pearson Education, 3rd Edition, 2009.

**References Books:**

1. Microwave Engineering – David M. Pozar Wiley Publications
2. Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004.
3. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.
4. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Edition, 2004.

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# Guru Nanak Institutions Technical Campus (Autonomous)
## School of Engineering & Technology

## Department of Electronics and Communication Engineering

**IV Year B. Tech. ECE I - Sem**

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### (18PC0EC20) INTERNET OF THINGS AND SENSORS

**Course Objectives:** To explore various components of Internet of things and design and implement IoT circuits for key applications.

**Course Outcomes:** At the end of the course the student will be able to -

1. Understand the vision of IoT from a global context.
2. Design Principles for Connected Devices and Data Management.
3. Use of Devices, Gateways and Data Management in IoT
4. Interfacing of Sensors and Actuators.
5. Implementation of key applications of IoT.

**UNIT I: Overview of Internet of Things (IoT) and its Architecture:** Introduction, Conceptual Framework, Architectural View, Sources of IoT, Enabling Technologies –Sensors, Fog/Edge and Cloud Computing, Embedded Computing Boards, Communication Protocols, User Interfaces.

**UNIT II: Design Principles for Connected Devices and Data Management:** IoT/M2M Systems Layers, Communications Technologies, IoT Devices- Arduino, Raspberry Pi, Intel Edison. Data management - Data Acquiring, Organizing, Processing and Analytics, Device management,

**UNIT III: IoT Protocols:** Messaging Protocols - Message Queuing Telemetry Transport (MQTT), Constraint Application Protocol (CoAP), Transport Protocols- Bluetooth Low Energy, Light Fidelity, Addressing and Identification Protocol- Internet Protocol Version 4, - Internet Protocol Version 6, 6LowPAN, Uniform Resource Identifier, Routing Protocol for Low-Power and Lossy Networks (RPL), ZigBee, ZigBee Smart Energy2.0.

**UNIT IV: Sensors and their Interfacing:** Introduction, Principle of Sensing, Types of Sensors- Pressure Sensor, Flow Sensor, Acoustic Sensor, Humidity Sensor, Moisture Sensor, Gas Sensor, Obstacle Sensor, Heartbeat Sensor, Ultrasonic Sensor, Gyro Sensor, LDR Sensor, Color Sensor, pH Sensor, interfacing of these sensors with IoT Devices. Radio Frequency Identification Technology, Wireless Sensor Networks Technology, Actuators, Interfacing of sensor and actuator.

**UNIT V: Key Applications of IoT:** Introduction, Smart Grid Management, Smart Home Management, Smart City Management, Smart Perishable Tracking, Smart Healthcare Management, Smart Warehouse Monitoring, Smart Retail Management, Electric Vehicle Charging, Vehicle Collision Avoidance.

**Text Books:**

1. Internet of Things: Architecture and Design Principles by Rajkamal, 1st Edition, 2nd reprint, Mc Graw Hill Publications.

2. Internet of Things (A Hands-on-Approach), by Vijay Madisetti , Arshdeep Bahga, 1st Edition, VPT Publications.

3. Internet of Things by S K Vasudevan, A S Nagrajan, RMD Sundaram, 1st Edition, Wiley Publications.

**Reference Books:**

1. Designing the Internet of Things, by Adrian McEwen (Author), Hakim Cassimally, Wiely Publications.

2. The Internet of Things- Key Applications and Protocols by Olivier Hersent, David Boswarthick & Omar Elloumi, Wiely Publications.

3. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, 1st Edition, Apress Publications.

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# Guru Nanak Institutions Technical Campus (Autonomous)
## School of Engineering & Technology

## Department of Electronics and Communication Engineering

**IV Year B.Tech. ECE I-Sem**

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**(18PC0EC21) MICROWAVE AND OPTICAL COMMUNICATIONS LABORATORY**

1. Reflex Klystron characteristics
2. Gunn Diode Characteristics
3. Directional coupler characteristics
4. Measurement of scattering Parameters of E Plane TEE
5. Measurement of scattering Parameters of H Plane TEE
6. Measurement of scattering Parameters of HYBRID TEE
7. Measurement of scattering Parameters of Circulator
8. Attenuation Measurement: Fixed and Variable
9. Microwave Frequency Measurement
10. VSWR Measurement
11. Characteristics of LASER Diode
12. Characteristics of Light Emitting Diode (LED)

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# Guru Nanak Institutions Technical Campus (Autonomous)
## School of Engineering & Technology

## Department of Electronics and Communication Engineering

### (18PROJECT1) PROJECT

**Guidelines:**

1. The project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The project may be a complete hardware or a combination of hardware and software. The software part in project should be less than 50% of the Total Credits work.
3. Project should cater to a small system required in Laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of the project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed project and documentation in the form of project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

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# PROFESSIONAL ELECTIVE SUBJECTS

## Professional Elective - 3

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### (18PE0EC3A) ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

**Course Objectives:** To impart the knowledge of Artificial Neural Networks, Deep Learning Networks and their learning algorithms with applications.

**Course Outcomes:** At the end of the course the student will be able to -

1. Understand Artificial Neural Networks and different learning rules.
2. Learn algorithms of Single Layer and Multilayer Perceptrons.
3. Understand Self-Organization Maps and some special Networks
4. Apply Convolutional Neural Networks in Deep learning applications.
5. Apply Recurrent Neural Networks in Deep learning applications.

**UNIT-I: Introduction to Artificial Neural Networks:** Introduction, Artificial Neural Networks, Biological Neural Networks, Basic building blocks of Artificial Neural Networks, Important terminology, feedback networks, Feed forward network, supervised learning, unsupervised learning, reinforced learning, Learning rules: Hebbian learning, Perceptron learning, Delta learning, Competitive learning, Boltzmann learning, Memory based learning.

**UNIT-II: Single Layer and Multilayer Perceptrons:** Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Schedules, Perceptron Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment, Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Feature Detection.

**UNIT-III: Self-Organization Maps (SOM) and Some special Networks:** Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature, Learning Vector Quantization, Adaptive Patter Classification, Special Networks: Probabilistic Neural Network, Cognitron, Neocognitron, Boltzmann Machine, Gaussian Machine, Cauchy Machine.

**UNIT IV: Introduction to Convolutional Neural Networks**: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications

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**UNIT V: Introduction to Recurrent Neural Networks and Deep Learning applications:** Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications, Application of Deep learning in Image Processing, Speech Recognition.

**Text Books:**


1. Neural Networks A Comprehensive Foundation, Simon Haykin, Pearson Education Asia, Second Edition
2. Introduction to Neural Networks Using Matlab 6.0, S N Sivanandam, S Sumathi, S N Deepa, TMH
3. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
4. Neural Networks and Deep Learning A Textbook, Charu C. Aggarwal, Springer, 2018


**Reference Books:**


1. Bishop, C.,M., Pattern Recognition and Machine Learning, Springer, 2006.

2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.

4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

5. MATLAB Deep Learning with Machine Learning, Neural Networks and Artificial Intelligence, Phil Kim, Apress, 2017


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**(18PE0EC3B) ADAPTIVE SIGNAL PROCESSING**

**Prerequisite:** Probability Theory, Signals and systems

**Course Objective:** To develop adaptive systems on recursive models based on estimation methods and analyze the performance.

**Course Outcomes:** At the end of the course, students will demonstrate the ability to:

1. Understand the non-linear control and the need and significance of changing the control parameters w. r. t. real-time situation.
2. Mathematically represent the 'adaptability requirement'.
3. Understand the mathematical treatment for the modeling and design of the signal processing systems.
4. Get the knowledge of different estiation methods
5. Study and analyze the RLS algorithm

**Syllabus**

**UNIT I: Introduction to Adaptive Signal Processing:** General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

**UNIT II: Adaptive Filters:** Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued, The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment.

**UNIT III: LMS algorithms and Structures:** Sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, Orthogonality, Gram-Schmidt Orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

**UNIT IV: Estimation and Prediction Methods:** Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

**UNIT V: State Estimators: RLS Algorithm:** Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters.

Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR

decomposition and systolic array.

**Text Books:**

1. Adaptive Signal Processing - Bernard Widrow, Samuel D.Strearns, 2005, PE.
2. Adaptive Filter Theory - Simon Haykin-, 4 ed., 2002,PE Asia.
3. Digital Signal Processing: A Practitioner's Approach, Kaluri V. Rangarao, Ranjan K. Mallik ISBN: 978-0-470-01769-2, 210 pages, November 2006, John Weley (UK)

**Reference Books:**

1. Optimum signal processing: An introduction - Sophocles. J. Orfamadis, 2 ed., 1988, McGraw-Hill, Newyork
2. Adaptive signal processing-Theory and Applications, S.Thomas Alexander, 1986,Springer –Verlag.
3. Siganl analysis – Candy, Mc Graw Hill Int. Student Edition
4. James V. Candy, Signal Processing: A Modern Approach, McGraw-Hill, International Edition, 1988.

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### (18PE0EC3C) HIGH SPEED ELECTRONICS

**Prerequisite: Nil**

**Course Objective:** The course aims to give exposure on the properties of high speed electronics, design of amplifiers and mixers

**Course Outcomes:** At the end of the course, students will demonstrate the ability to:

1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high speed electronics
3. Design High-speed electronic system using Amplifiers.
4. Design High-speed electronic system using Amplifiers
5. Design of electronic systems on PCD

**Syllabus**

**UNIT I: Basics of High Speed Electronics:** Transmission line theory (basics) crosstalk and no ideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses;

**UNIT II: Noise:** Radiated emissions and minimizing system noise; Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Inter modulation, Cross-modulation, Dynamic range Devices: Passive and active, Lumped passive devices (models), Active (models, low vs High frequency)

**UNIT III: Large Signal Amplifiers:** RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages

**UNIT IV: Mixers** Mixers –Up conversion Down conversion, Conversion gain and spurious response. Oscillators Principles.PLL Transceiver architectures.

**UNIT V: PCB Design Technology:** Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

**Text Books:**

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press
2. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004, ISBN 0521835399.

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**Reference Books:**


1. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
2. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
3. Kai Chang, "RF and Microwave Wireless systems", Wiley.
4. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011


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# Professional Elective-IV

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**(18PE0EC4A) MOBILE COMMUNICATION AND NETWORKS**

**Course Objective:** To understand the basic cellular system, fading, antennas, multiplexing, modulation and standards of digital cellular system.

**Course Outcomes:** After completing the course the students shall be able to

1. Understand the basic structure of Cellular Systems
2. Understand how the various signal processing and fading models
3. Understand the concepts of various antennas used in mobile communication.
4. Understand various multiplexing and modulation techniques.
5. Introduce various wireless systems and standards.

**Syllabus**

**UNIT I: Introduction to cellular systems :** Wireless Standards, Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff interference, capacity, power control. Overview of 2G, 3G and 4G cellular standards.

**UNIT II: Signal Propagation and fading:** Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

**UNIT III: Antennas at mobile UNIT and base station:** Capacity of flat and frequency selective channels, Antennas: Antennas for mobile terminal monopole antennas, RMA, GMA, PIFA, base station antennas, disc-cone antennas, setup channel antennas and antenna arrays.

**UNIT IV: Multiplexing, Modulation and Diversity Receivers:** Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM. Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

**UNIT V: Signal Processing and Digital Cellular Standards:** MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average SNR, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

**Text Books:**

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

**Reference Books:**

1. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
2. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
3. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.

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### (18PE0EC4B) ERROR CORRECTING CODES

**Prerequisite: Concept of Matrix Algebra**

**Course Objective:** Impart the knowledge of different types of Error-Control Coding and decoding

**Course Outcomes:** At the end of the course, students will demonstrate the ability to:

1. Understand the error sources
2. Understand Linear Block Coding and decoding
3. Apply Hamming and Perfect Codes
4. Understand BCH and Generalized BCH coding and decoding
5. Apply Convolution codes

**Syllabus**

**UNIT 1: Linear block codes:** Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels,

**UNIT 2: Hamming and Perfect Codes:** Hamming codes; Weight enumerators and the McWilliams identities; Perfect codes, Introduction to finite fields and finite rings; factorization of (X^n-1) over a finite field; Cyclic Codes, Spectral properties of cyclic codes

**UNIT 3: BCH Codes and generalized BCH codes:** BCH codes; Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes

**UNIT 4: Decoding of BCH codes:** Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm.

**UNIT 5: Convolution codes:** Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.

**Text Books:**

1. F.J. McWilliams and N.J.A. Slone, The theory of error correcting codes, 1977.
2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

**Reference Books:**

3. Shu Lin and Daniel J. Costello,Jr., Error Control Coding: Fundamentals and Applications, Prentice-Hall, Inc.,1983
4. Simon Haykin, Communication Systems, 4th edition, John Wiley and Sons, Inc. 2001.

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### (18PE0EC4C) INTRODUCTION TO MEMS

**Prerequisite: VLSI Design**

**Course objectives:** To provide knowledge of various sensors & actuators used in MEMS, Semiconductors & solid mechanics to Fabricate MEMS devices

**Course Outcomes:** At the end of the course the students will be able to

1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.
3. Know different materials used in MEMS
4. Apply MEMS to Disciplines beyond Electrical & Mechanical Engineering
5. Analyze Fabrication Process

**Syllabus**

**UNIT I : Introduction To MEMS:** Definition of MEMS, MEMS history and development. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

**UNIT II: Micro Sensors and Actuators:** Working principle of Microsystems - micro actuation techniques - micro sensors – types – Micro actuators – types – micro pump – micro motors – micro – valves – micro grippers – micro accelerometers.

**UNIT III: Fabrication Process:** Review of basic MEMS fabrication modules, Substrates - single crystal silicon wafer formation – Photolithography: LIGA – SLIGA, – Ion implantation – Diffusion – Oxidation – CVD - Physical vapor deposition - Deposition epitaxy - etching process.

**UNIT IV: Micro System Manufacturing:** Bulk Micro manufacturing - surface micro machining – Sacrificial Layer Processes, Stiction, Bulk Micro Machining, Isotropic Etching and Anisotropic Etching, Wafer Bonding, Micro machining: packaging techniques – die preparation – surface bonding - wire bonding – sealing. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect.

**UNIT V: Electro Mechanical Systems:** Linear thermal expansion, bending, energy methods, overview of finite element method, modelling of coupled electromechanical systems.

**Text Books:**

1. Mohamed Gad – el – Hak, "MEMS Handbook", CRC Press, 2002.
2. Rai - Choudhury P. "MEMS and MOEMS Technology and Applications", PHI Learning Private Limited, 2009.
3. Sabrie Solomon, "Sensors Handbook," Mc Graw Hill, 1998.
4. Marc F Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd Edition, 2002.

**Reference Books:**

1. Francis E.H. Tay and Choong .W.O, "Micro fluidics and Bio mems application", IEEE Press New York, 1997.
2. Trimmer William S., Ed., "Micromechanics and MEMS", IEEE Press New York, 1997.
3. Maluf, Nadim, "An introduction to Micro electro mechanical Systems Engineering", AR Tech house, Boston 2000.
4. Julian W.Gardner, Vijay K.Varadan, Osama O. Awadel Karim, "Micro sensors MEMS and Smart Devices", John Wiby & sons Ltd., 2001.

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# Professional Elective-V

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**(18PE0EC5A) EMBEDDED SYSTEMS**

**Prerequisites:** Microprocessors and microcontrollers, DLD, Computer Organisation

**Course Objectives:** To provide an overview of Design Principles of Embedded System and clear understanding about the role of firmware, operating systems in correlation with hardware systems.

**Course Outcomes:** The students are

1. Expected to understand the selection procedure of Processors in the Embedded domain.
2. Expected to learn design procedure for Embedded Firmware.
3. Expected to visualize the role of Real time Operating Systems in Embedded Systems.
4. Expected to evaluate the Correlation between task synchronization and latency issues

**Syllabus**

**UNIT I: Introduction to Embedded Systems:** Definition of Embedded System, The concept of embedded systems design, Embedded microcontroller cores, Embedded Systems Vs General Computing Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Examples of embedded systems, technological aspects of embedded systems: interfacing between analog and digital blocks, signal conditioning, digital signal processing, sub system interfacing , interfacing with external systems, user interfacing.

**UNIT II: Typical Embedded System:** Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces. Design trade-offs due to process compatibility, Thermal considerations.

**UNIT-III: RTOS Based Embedded System Design:** Operating System Basics, Types of Operating Systems, Vx works, MicroC/os-II, Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE, How to Choose an RTOS

**UNIT IV: Task Communication:** Shared Memory, Semaphores, Mutex, Message Passing, Remote Procedure Call and Sockets, Mailboxes , Message Queues, Event Registers, Pipes, Signals, Tasks, Process and Threads,

**UNIT –V: Task Synchronization:** Software aspects of embedded systems, Real time programming languages, Multiprocessing and Multitasking, Task Scheduling. Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers,

**Text Books:**

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

**References Books:**

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.

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### (18PE0EC5B) DIGITAL IMAGE AND VIDEO PROCESSING

**Prerequisite:** Digital Signal Processing

**Course Objectives:** To study the digital image fundamentals, pre-processing techniques, segmentation and to learn the fundamentals of video processing & standards.

**Course Outcomes:** At the end of the course, students will be able to

1. Understand the Digital images fundamentals and its uses.
2. Apply different Pre-processing techniques for improving the quality of the images.
3. Explain the concepts of Segmentation and various Compression techniques.
4. Understand the basics of Colour image processing.
5. Analyze the different Video Processing Standards.

**Syllabus**

**UNIT I: Digital Image Fundamentals:** Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

**UNIT 2: Image Enhancement and Restoration:** Basic gray level transformations – Histogram equalization – Histogram matching – spatial filtering– smoothing spatial filters – sharpening spatial filters - model of the image degradation / Restoration process - mean filters – order - statistics filters - Adaptive filters – Inverse filtering – minimum mean square error filtering – constrained least squares filtering – Geometric mean filter – geometric transformations.

**UNIT 3: Image Segmentation & Image Compression:** Image Segmentation - Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

**Image Compression-Redundancy** – inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression - predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

**UNIT 4: Color Image Processing:** Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

**UNIT 5: Video Processing:** Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full search,fast search strategies, forward and backward motion prediction, frame

classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X. Video Segmentation- Temporal segmentation–shot boundary detection, hard-cut sand soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

**Text Book:**

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2015.

**Reference Books:**

1.A.K. Jain, Fundamentals of Digital Image Processing, New Edition, Prentice Hall of India, 2011.

2. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2013.

3. Al.Bovik, "The Essential Guide to Image Processing", Academic Press, 2009.

4. William K. Pratt, "Digital Image Processing", Third Edition, John Wiley, 2001.

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### (18PE0EC5C) MIXED SIGNAL DESIGN

**Course Objective:** To impart the knowledge of mixed signals and their interconversions

**Course Outcomes:** At the end of the course, students will demonstrate the ability to:

1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals

**UNIT 1: Analog and discrete-time signal processing:** Introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

**UNIT II: Switched-capacitor filters:** Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

**UNIT III: Basics of data converters:** Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

**UNIT IV: Mixed-signal layout:** Interconnects and data transmission; Voltage-mode signalingand data transmission; Current-mode signaling and data transmission.

**UNIT V: Introduction to frequency synthesizers and synchronization:** Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

**Text Books:**

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.

**Reference Books:**

1. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
2. Rudy V. de Plassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.

3. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
4. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
5. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

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# Professional Elective-VI

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### (18PE0EC6A) SATELLITE COMMUNICATIONS

**Prerequisite: Nil**

**Course Objectives:**

1. The main objective of the course is to prepare the students to excel in basic knowledge of satellite communication principles, link design of satellite, multiple access systems and earth station technology with design examples.

2. Provide the students with solid foundation in orbital mechanics and launches for the satellite communication

**Course Outcomes:** At the end of this course students will demonstrate the ability to-

1. Visualize the architecture of satellite systems and state various aspects related to orbital mechanics.
2. Visualize the architecture of satellite subsystems and phenomenon in satellite communication.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.
4. Have knowledge in various modulation and multiple access schemes.
5. Have knowledge in earth station technology, satellite navigation and GPS.

**Syllabus**

**UNIT I: Introduction to Satellite Communication and Orbital Mechanics:** Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

**Orbital Mechanics:** Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

**UNIT II: Satellite sub-systems:** Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

**Typical Phenomena in Satellite Communication:** Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena

and expression for Doppler shift.

**UNIT III: Satellite Link:** Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

**UNIT-IV: Modulation and Multiple Access Schemes:** Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

**UNIT-V: Earth Station Technology and Satellite Navigation:** Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Power Test Methods, Lower Orbit Considerations.

Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers, GPS C/A Code Accuracy, Differential GPS.

**Text Books:**

1. Satellite Communications —Timothy Pratt, Charles Bostian, Jeremy Allnutt, 2nd Edition, 2003, John Wiley & Sons.
2. Satellite Communications Engineering — Wilbur, L. Pritchand, Robert A. Nelson and Heuri G. Suyderhoud, 2nd Ed., Pearson Publications.
3. Digital Satellite Communications..Tri–Ha 2nd Edition, 1990, Mc.Graw Hill.

**Reference Books:**

1. Satellite Communications Dennis Roddy, 2nd Edition, 1996, McGraw Hill.
2. Satellite Communications: Design Principles — M. Richcharia, 2nd Ed., BSP, 2003.
3. Fundamentals of Satellite Communications — K. N. Raja Rao, PHI, 2004.

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**(18PE0EC6B) CMOS DESIGN**

**Prerequisite: VLSI Design**

**Course Objective:** Design and layout basic CMOS integrated circuits and Apply the common design techniques for optimization and understand the tradeoffs and issues in modern CMOS Circuit design

**Course Outcomes:** At the end of the course the students will be able to

1. Understand the characteristics of MOS transistors.
2. Design and analysis of CMOS Circuits including challenges in timing optimization.
3. Understand the Methods for optimizing the area, speed, and power of circuits.
4. Design Combinational logic circuits using different CMOS logics
5. Analysis and design techniques in Conventional CMOS Flip-flop circuit design

**Syllabus**

**UNIT I: Review of MOS transistor model:** Non-ideal behavior of the MOS Transistor-Channel Length Modulation-Threshold voltage effects-Body effect-Drain induced Barrier Lowering (DIBL)-Short Channel effects-High Field Effects-Mobility Degradation-Velocity Saturation-Leakage-Sub-threshold Leakage-Gate Leakage- Junction Leakage-Process and Environmental Variations-MOS Transistor as a switch-N channel-P channel-ON Resistance-OFF Resistance-Static CMOS Inverter characteristics-Beta ratio effects.

**UNIT II: Delay Concepts in CMOS :** Introduction-Definitions-Timing Optimization-Transient Response-RC Delay Model-Effective Resistance-Gate and Diffusion Capacitance-Equivalent RC Circuits-Transient Response-Elmore Delay-Layout Dependence of Capacitance-Determining Effective Resistance-Linear Delay Model-Logical Effort-Parasitic Delay-Delay in a Logic Gate-Drive-Extracting Logical Effort from Datasheets-Limitations to the Linear Delay Model-Logical Effort of Paths-Delay in Multistage Logic Networks-Choosing the Best Number of Stages-Example and Observations-Limitations of Logical-Iterative Solutions for Sizing

**UNIT III: Power, Interconnect and Robustness Concepts in CMOS:** Power-Introduction-Definitions-Example: CMOS Inverter -Sources of Power Dissipation-Dynamic Power-Activity Factor-Capacitance-Voltage-Frequency-Short-Circuit Current-Static Power-Static Power Sources-Power Gating-Multiple Threshold Voltages and Oxide Thicknesses- Interconnect- Introduction-Interconnect Modeling-Resistance Capacitance-Inductance-Skin Effect -Interconnect Impact-Delay-Energy-Crosstalk-Inductive Effect -Interconnect Engineering-Width, Spacing, and Layer-Repeaters - Robustness-Introduction-

Variability-Supply Voltage-Temperature-Process Variation-Design Corners-Reliability-Reliability Terminology-Oxide Wearout-Interconnect Wearout-Soft Errors-Overvoltage Failure-Latchup-Scaling-Transistor Scaling-Interconnect Scaling-Impacts on Design

**UNIT IV: Designing Combinational Logic Gates in CMOS:** Introduction-Static CMOS Design-Complementary CMOS-Ratioed Logic-Pass-Transistor Logic-Dynamic CMOS Design-Dynamic Logic: Basic Principle-Speed and Power Dissipation of Dynamic Logic-Issues in Dynamic Design-Cascading Dynamic Gates- Domino Logic-Dual rail logic networks-Case study: AND/NAND-OR/NOR gates Design.

**UNIT V: Sequential Circuit Design in CMOS:** Introduction-Sequencing Static Circuits-Sequencing Methods-Max-Delay Constraints-Min-Delay Constraints-Time Borrowing-Clock Skew-Circuit Design of Latches and Flip-Flops-Conventional CMOS Latches-Conventional CMOS Flip-Flops-Pulsed Latches-Resettable Latches and Flip-Flops-Enabled Latches and Flip-Flops-Incorporating Logic into Latches-Klass Semidynamic Flip-Flop (SDFF)-Differential Flip-Flops

**Text Books:**

1. N.H.E. Weste and D.M. Harris, "CMOS VLSI design: A Circuits and Systems Perspective", 4thEdition, Pearson Education India, 2015.
2. J. Rabaey, "Digital Integrated Circuits: A Design Perspective", Prentice Hall India, 2009.

**Reference Books:**

1.R. Jacob Baker,CMOS Circuit Design, Layout, and Simulation (3rd edition), IEEE & Wiley, 2010
2.Gray& Meyer, Analysis and Design of Analog Integrated Circuits (5th edition), Wiley, 2009.
3.C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
4. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

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### (18PE0EC6C) WIRELESS SENSOR NETWORKS

**Course Objective(s):** To understand the basic WSN technology, supporting protocols, medium access control protocols, design and architecture of WSNs.

**Course Outcomes:** After completing the course the students shall be able to

1. Describe and explain radio standards and communication protocols on the link and networking layers for wireless personal area networks.
2. Describe and explain the different protocols
3. Describe and explain the MAC protocol and types.
4. Explain the design principles of WSNs.
5. Be familiar with architectures, functions and performance of wireless sensor networks systems.

**Syllabus**

**UNIT I: Introduction and types of WSNs :** Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks,

**UNIT II: Medium Access Control (MAC):** Protocol Technologies for Wireless Sensor Networks, Issues and challenges in wireless sensor networks, Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol,

**UNIT III: Other protocols and standards:** IEEE 802.15.4 standard, ZigBee, Dissemination protocol for large sensor network, Data dissemination, data gathering, data fusion, Quality of a sensor network, Real-time traffic support and security protocols.

**UNIT IV: Design principles of WSNs:** Design Principles, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

**UNIT V: Architecture of WSNs:** Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

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**Text Books:**

1. Waltenegus Dargie , Christian Poel Laboratoryauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications ,2011
2. Protocols and Architectures for Wireless Sensor Networks,H. Karl and A. Willig, Wiley Publishers, 2005.
3. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009.

**Reference Books:**

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications,2004
2. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science
3. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009

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# OPEN ELECTIVE SUBJECTS

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**(18OE0EC3A) DIGITAL SIGNAL PROCESSING**

**Prerequisite:** Signals & Systems

**Course Objective:** To provide fundamental relationships between time, frequency domain signals and systems and analyze the IIR & FIR filters.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications
4. Understand the effects of finite word lengths and their precautions
5. Study and analyze the Multi rate signal processing methods

**Syllabus**

**UNIT I: Introduction to Discrete time signals and Systems:** Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Application of DSP, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems,

**UNIT II: Discrete Fourier Transform and Fast Fourier Transform:** Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of Over-Lap Add Method, Over-Lap Save Method.

**Fast Fourier Transforms**: Fast Fourier Transforms (FFT) – Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix-N.

**UNIT III: FIR Digital Filters:** Characteristics of FIR Digital Filters, Frequency Response, Design of FIR Digital filters: Fourier Method, Window method, Park-McClellan's method.

**UNIT IV: IIR Filters:** Design of IIR analog filters – Butterworth and Chebyshev, Elliptic Approximations, Design of IIR Digital Filters from Analog Filters by using Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformation: Low pass, Band pass, Band stop and High pass filters. Comparison of FIR and IIR filters.

**UNIT V: Finite Word length Effects and Multirate Rate Signal Processing:** Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing, Decimation, Interpolation, Sampling Rate Conversion.

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**Text Books:**


1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. .Ramesh Babu, Digital Signal Processing, 4th Edition.


**Reference Books:**


1. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall,1997.
2. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
3. D.J.DeFatta, J. G. Lucas and W.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.


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**(18OE0EC3B) VLSI DESIGN**

**Course Objectives:** At the end of this course students will demonstrate the ability to

1. To understand the IC fabrication and performance analysis, with concepts and techniques MOS devices with their electrical characteristics.
2. Analyze the VLSI Design Process for verification and testability.

**Course Outcomes:** Students will be able to

1. Remember fundamentals MOS devices.
2. Understand the concepts of Electrical characteristics
3. Emphasize VLSI Design process
4. Compare various IC design process
5. Evaluate testing, system noise and performance analysis

**UNIT I: Introduction & Basic Electrical Properties of MOS:** Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS Technologies; Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and Capacitors, CMOS Nanotechnology. Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit ωo; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

**UNIT II: VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

**UNIT III: Gate Level and Data Path Subsystems Design:** Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out, Choice of layers. Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

**UNIT IV: Memory Array Subsystems and Semiconductor IC Design:** SRAM, DRAM, ROM, Serial Access Memories, Content Addressable Memory. PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.

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**UNIT V: CMOS Testing:** CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System Level Test Techniques, Layout Design for improved Testability.

**Text books:**

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A circuits and systems perspective, Neil H. E Weste, David Harris, Ayan Banerjee, person, 2009.

**Reference books:**

1. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
2. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
3. VLSI Design – A.Albert Raj, Latha, PHI, 2008
4. Introduction to VLSI – Mead & Convey, BS Publications, 2010

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### (18OE0EC4A) CELLULAR AND MOBILE COMMUNICATIONS

**Prerequisite:** Digital Communications

**Course Objectives:** The course objectives are:

1. To provide the student with an understanding of the Cellular concept, Frequency reuse, Hand-off strategies, Co-channel and Non-Co-channel interferences
2. To enable the student to analyze and understand wireless and mobile cellular communication systems over a stochastic fading channel.

**Course Outcomes:** By the end of the course, the students will be able to

1. Analyze and design wireless and mobile cellular systems.
2. Understand Co-channel and Non Co-channel interferences
3. Be familiar with cell coverage for signal and traffic, diversity techniques and mobile antennas.
4. Understand frequency management, Channel assignment
5. Learn different types of handoff and evaluate dropped call rate

**Syllabus**

**UNIT-I: Introduction to Cellular Mobile Radio Systems:** Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems, Uniqueness of Mobile Radio Environment- Fading -Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

**Fundamentals of Cellular Radio System Design**: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni Directional Antenna System, System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

**UNIT-II: Co-Channel Interference:** Measurement Of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and Their Effects, Diversity Techniques-Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity.

**Non-Co-Channel Interference:** Adjacent Channel Interference, Near End Far End Interference, Cross Talk, Effects on Coverage and Interference by Power Decrease, Antenna Height Decrease, Effects of Cell Site Components.

**UNIT-III: Cell Coverage for Signal and Traffic:** Signal Reflections in Flat And Hilly Terrain, Effect of Human Made Structures, Phase Difference Between Direct and Reflected Paths, Constant Standard Deviation, Straight Line Path Loss Slope, General Formula for Mobile Propagation Over Water and Flat Open Area, Near and Long Distance Propagation, Path Loss From a Point to Point Prediction Model in Different Conditions, Merits of Lee Model.

**Cell Site and Mobile Antennas:** Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas.

**UNIT-IV: Frequency Management and Channel Assignment:** Numbering And Grouping, Setup Access And Paging Channels, Channel Assignments to Cell Sites and Mobile Units, Channel Sharing and Borrowing, Sectorization, Overlaid Cells, Non Fixed Channel Assignment.

**UNIT-V: Handoffs and Dropped Calls:** Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem Handoff, Introduction to Dropped Call Rates and their Evaluation.

**Text Books:**

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Mc Graw Hill, 2nd Edn., 1989.
2. Wireless Communications - Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.
3. Mobile Cellular Communication - Gottapu sashibhushana Rao, Pearson, 2012.

**Reference Books:**

1. Principles of Mobile Communications – Gordon L. Stuber, Springer International, 2nd Edn., 2001.
2. Modern Wireless Communications-Simon Haykin, Michael Moher, Pearson Eduction, 2005.
3. Wireless Communications Theory and Techniques, Asrar U. H .Sheikh, Springer, 2004.
4. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.
5. Wireless Communications – Andrea Goldsmith, Cambridge University Press, 2005.

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### (18OE0EC4B) DIGITAL IMAGE PROCESSING

**Prerequisites:**

Knowledge in linear signals and systems, Fourier Transform, basic linear algebra, basic probability theory and basic programming techniques; knowledge of Digital Signal Processing is desirable.

**Course Objectives**

1. Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.
2. The topics include image acquisition; sampling and quantization; preprocessing; enhancement; restoration; segmentation; and compression.

**Course Outcomes:**

1. Demonstrate the knowledge of the basic concepts of two- dimensional signal acquisition, sampling, and quantization.
2. Demonstrate the knowledge of filtering techniques.
3. Demonstrate the knowledge of 2D transformation techniques.
4. Demonstrate the knowledge of image enhancement, segmentation, restoration and compression techniques.

**Syllabus**

**UNIT I: Digital Image Fundamentals:** Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

**UNIT II: Image Enhancement in Spatial Domain:** Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

**UNIT III: Image Restoration Degradation Model**: Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

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**UNIT IV: Image Segmentation Detection of Discontinuities:** Edge Linking, and Boundary Detection, Thresholding, Region Oriented Segmentation.

**UNIT V: Image Compression Redundancies and their Removal Methods:** Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression

**Text Book:**

Digital Image Processing: R.C. Gonzalez & R.E. Woods, Addison Wesley/ Pearson Education, 2nd Ed, 2004.

**Reference Books:**


1. Fundamentals of Digital Image Processing: A.K.Jain, PHI.
2. Digital Image Processing using MAT LABORATORY: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wilely, 3rd Edition, 2004


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**Department of Electronics and Communication Engineering**

# SERVICE SUBJECTS

# Guru Nanak Institutions Technical Campus (Autonomous)
# School of Engineering & Technology

## Department of Electronics and Communication Engineering

**IV Year B.Tech. EEE I-Sem**

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**(18ES0EC33) EMBEDDED SYSTEMS**

**Prerequisites:** Microprocessors and microcontrollers, DLD, Computer Organisation

**Course Objective:**

To provide an overview of Design Principles of Embedded System and clear understanding about the role of firmware, operating systems in correlation with hardware systems.

**Course Outcomes:** The students are

1. Expected to understand the selection procedure of Processors in the Embedded domain.
2. Expected to learn design procedure for Embedded Firmware.
3. Expected to visualize the role of Real time Operating Systems in Embedded Systems.
4. Expected to evaluate the Correlation between task synchronization and latency issues.

**Syllabus**

**UNIT I: Introduction to Embedded Systems:** Definition of Embedded System, The concept of embedded systems design, Embedded microcontroller cores, Embedded Systems Vs General Computing Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Examples of embedded systems, technological aspects of embedded systems: interfacing between analog and digital blocks, signal conditioning, digital signal processing, sub system interfacing, interfacing with external systems, user interfacing.

**UNIT II: Typical Embedded System:** Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces. Design trade-offs due to process compatibility, Thermal considerations.

**UNIT-III: RTOS Based Embedded System Design:** Operating System Basics, Types of Operating Systems, Vx works, MicroC/os-II, Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE, How to Choose an RTOS

**UNIT IV: Task Communication:** Shared Memory, Semaphores, Mutex, Message Passing, Remote Procedure Call and Sockets, Mailboxes , Message Queues, Event Registers, Pipes, Signals, Tasks, Process and Threads,

**UNIT –V: Task Synchronization:** Software aspects of embedded systems, Real time programming languages, Multiprocessing and Multitasking, Task Scheduling. Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers,

**Text Books:**

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

**References Books:**

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.

| | | |
|---|---|---|
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# Guru Nanak Institutions Technical Campus (Autonomous)
## School of Engineering & Technology

## Department of Electronics and Communication Engineering

## Transitory Regulation

## Details of Substitute Subjects

## Students seeking readmission in III Yr. II Semester

## From R16 regulation to R18 regulation

| Sl. No. | Branch | Year | Sem. | List of subjects already studied | | Details of substitute subject | |
|---|---|---|---|---|---|---|---|
| | | | | Name of Subject | Credits | Name of Subject | Credits |
| 1 | ECE | III | II | Gender Sensitization Laboratory | MC (0) | Nil | Nil |

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## School of Engineering & Technology

## Department of Electronics and Communication Engineering

## Transitory Regulation

## Details of Substitute Subjects

## Students seek readmission in IV Yr. I Semester

## From R16 regulation to R18 regulation

| Sl. No. | Branch | Year | Sem. | List of subjects already studied | | Details of substitute subject | |
|---|---|---|---|---|---|---|---|
| | | | | Name of Subject | Credits | Name of Subject | Credits |
| 1 | ECE | III | II | Nil | Nil | Nil | Nil |

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# Guru Nanak Institutions Technical Campus (Autonomous)
## School of Engineering & Technology

## Department of Electronics and Communication Engineering

## Transitory Regulation

## Details of Substitute Subjects

## Students seek readmission in IV Yr. II Semester

## From R16 regulation to R18 regulation

| Sl. No. | Branch | Year | Sem. | List of subjects already studied | | Details of substitute subject | |
|---|---|---|---|---|---|---|---|
| | | | | Name of Subject | Credits | Name of Subject | Credits |
| 1 | ECE | III | II | Nil | Nil | Nil | Nil |

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# Guru Nanak Institutions Technical Campus (Autonomous)
## School of Engineering & Technology

## Department of Electronics and Communication Engineering

### Comparison of Credits

| Sl No | Subject Category | 1st Semester | | 2nd Semester | | 3rd Semester | | 4th Semester | | 5th Semester | | 6th Semester | | 7th Semester | | 8th Semester | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | JNTUH Au JNTUH Aff | GNITC | Suggested by AICTE |
| 1 | HS | | | 3 | 3 | | | | 3 | 4 | 4 | | | 2 | | | | 9 | 10 | 12 |
| | | | | 3 | | | | | | | | | | | | | | | | |
| 2 | BS | 9.5 | 9 | 9.5 | 9 | | 4 | 4 | 3 | | | | | | | | | 23 | 25 | 25 |
| | | 9.5 | | 9.5 | | | | | | | | | | | | | | | | |
| 3 | ES | 8.5 | 11 | 6.5 | 6 | 4 | 4 | | 3 | | 3 | | 5 | | | | | 19 | 32 | 24 |
| | | 8.5 | | 6.5 | | | | | | | | | | | | | | | | |
| 4 | PC | | | | | 17 | 13 | 17 | 12 | 15 | 9 | 16 | 9 | 4 | 7 | | | 69 | 50 | 48 |
| | | | | | | | | | | | | | | | | | | | | |
| 5 | PE | | | | | | | | | 3 | 3 | 3 | 3 | 6 | 6 | 6 | 6 | 18 | 18 | 18 |
| | | | | | | | | | | | | | | | | | | | | |
| 6 | OE | | | | | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 9 | 12 | 18 |
| | | | | | | | | | | | | | | | | | | | | |
| 7 | PW, S | | | | | | | | | | | | | 6 | 6 | 7 | 7 | 13 | 13 | 15 |
| | | | | | | | | | | | | | | | | | | | | |
| 8 | MC | | | | | 0 | 0 | | 0 | | 0 | 0 | 0 | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 9 | Total | 18 | 20 | 19 | 18 | 21 | 21 | 21 | 21 | 22 | 22 | 22 | 20 | 21 | 22 | 16 | 16 | 160 | 160 | 160 |
| | | 18 | | 19 | | | | | | | | | | | | | | | | |

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