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**Co-ordinators : Prof. Kishore Chatterjee, Prof. B.G. Fernandes**

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**Co-ordinators : Prof. S.C. Dutta Roy**

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Lecture 8 - Spectral Properties of Line Codes: On-off / Polar / Bipolar Signalling

Lecture 9 - Spectral Properties of Line Codes: Duobinary Manchester and HDB Codes

Lecture 10 - Baseband Pulse Shaping: Nyquist's First Criterion

Lecture 11 - Baseband Pulse Shaping: Raised Cosine Family of Pulses

Lecture 12 - Partial Response Signalling: Duobinary and Modified Duobinary Pulse Shaping

Lecture 13 - Precoding for Duobinary and Modified Duobinary Systems

Lecture 14 - Precoding for Modified Duobinary Systems (Continued...) and General Partial Response Signalling

Lecture 15 - Binary Baseband Digital Modulation Techniques

Lecture 16 - M-ary Baseband Digital Modulation Techniques

Lecture 17 - Passband Digital Modulations - I : PSK and QPSK

Lecture 18 - Passband Digital Modulations - II : Offset QPSK

Lecture 19 - Passband Digital Modulations - III : Minimum Shift Keying (MSK)

Lecture 20 - Passband Digital Modulations - IV : MSK (Continued...) : Passband Waveforms for M-ary Signalling

Lecture 21 - Passband Modulations for Band Limited Channels

Lecture 22 - Baseband and Passband Digital Demodulations : General Issues and Concepts

Lecture 23 - Digital Modulation Part - II Matched Filters

Lecture 24 - Matched Filters and Coherent Demodulation-I

Lecture 25 - Coherent Demodulation for Binary Wave Form

Lecture 26 - Demodulators for Binary Waveforms (Continued...) : Coherent and Noncoherent Receivers for Orthogonal Signalling (OOK and FSK)

Lecture 27 - Performance Analysis of Binary Digital Modulations: Signal and Noise Statistics in Coherent and Noncoherent Receivers

Lecture 28 - Error Rates for Binary Signalling : Coherent Receivers

Lecture 29 - Performance of Non Coherent FSK and Differential Phase Shift Keying

Lecture 30 - Demodulation of DPSK and M-ary Signals

[Lecture 31 - Performance of M'ary Digital Modulations](#)

[Lecture 32 - Performance of M'ary Digital Modulations \(Continued...\)](#)

[Lecture 33 - Introduction to Information Theory, Part-1](#)

[Lecture 34 - Source Coding](#)

[Lecture 35 - Error Free Communication Over a Noisy Channel](#)

[Lecture 36 - The Concept of Channel Capacity](#)

[Lecture 37 - Error Correcting Codes](#)

[Lecture 38 - Error Correcting Codes \(Continued...\)](#)

## **NPTEL : Introduction To Electronic Circuits (Electrical Engineering)**

**Co-ordinators : Prof. S.C. Dutta Roy**

- Lecture 1 - Introduction to the Course and Basic Electrical Quantity
- Lecture 2 - R.L.C. Components, Energy Considerations, Sources and Circuit Laws
- Lecture 3 - KCL, KVL and Network Analysis
- Lecture 4 - Networks Theorems ( Thevenin's Norton's )
- Lecture 5 - Source Transformation; Super Position Theorem and Non-Linear One-Ports
- Lecture 6 - Signal Wave Forms
- Lecture 7 - Periodic Wave Forms and Elements of Amplifiers
- Lecture 8 - Operational Amplifiers and Diodes
- Lecture 9 - Rectifiers and Power Supplies
- Lecture 10 - Wave Shaping Circuits
- Lecture 11 - More on Wave Shaping Circuits and Introduction to Natural Response of Circuits
- Lecture 12 - Natural Response (Continued...)
- Lecture 13 - Natural Response of 2nd Order Circuit
- Lecture 14 - Natural Response of 2nd Order Circuit (Continued...)
- Lecture 15 - Impedance Functions, Poles, Zeros and their Applications
- Lecture 16 - Natural Response and Poles and Zeros and Introduction to Forced Response
- Lecture 17 - Phasors and their Applications in AC Ckts, analysis
- Lecture 18 - More About Phasors and Introduction to Complete Response
- Lecture 19 - Complete Response of Electrical Circuits
- Lecture 20 - AC Circuit Analysis
- Lecture 21 - Filter Circuits and Resonance
- Lecture 22 - Resonance (Continued...)
- Lecture 23 - General Network Analysis
- Lecture 24 - Two-Port Networks
- Lecture 25 - Semiconductor Physics
- Lecture 26 - Semiconductor Physics (Continued...)
- Lecture 27 - More About Diodes Including Zener Diodes
- Lecture 28 - Bipolar Junction Transistors
- Lecture 29 - Transistors Characteristics and Biasing
- Lecture 30 - BJT Biasing and Introduction to Power Amplifiers
- Lecture 31 - BJT Power Amplifiers

[Lecture 32 - Power Amplifier](#)

[Lecture 33 - Power Amplifiers \(Continued...\) and an Introduction to Small Signal Modelling of BJT](#)

[Lecture 34 - Small Signal Model and Small Signal Amplifiers](#)

[Lecture 35 - Small Signal Amplifiers \(Continued...\)](#)

[Lecture 36 - Small Signal Amplifier \(Continued...\)](#)

[Lecture 37 - Small Signal Amplifiers \(Continued...\)](#)

[Lecture 38 - Negative Feedback](#)

[Lecture 39 - Digital Circuits](#)

[Lecture 40 - Digital Circuits \(Continued...\)](#)

Lecture 1 - Introduction to Analog Circuits Introduction to the Diode

Lecture 2 - Diodes, Introduction to The Transistor

Lecture 3 - MOS Device, Characteristics

Lecture 4 - DC operating point

Lecture 5 - DC operating point, amplifier design

Lecture 6 - Common source amplifier, small signal analysis

Lecture 7 - Common gate, common drain

Lecture 8 - Common gate circuit

Lecture 9 - Source degenerated amplifier

Lecture 10 - Swing limits

Lecture 11 - Swing limits (Continued...), multi transistor amplifiers

Lecture 12 - Multi-transistor amplifiers

Lecture 13 - Introduction to current sources

Lecture 14 - Current sources/mirrors (Continued...)

Lecture 15 - Current sources, biasing

Lecture 16 - Differential circuits

Lecture 17 - Differential amplifiers-I

Lecture 18 - Differential amplifiers-II

Lecture 19 - Differential amplifiers-III

Lecture 20 - Self biased active load diff. amp

Lecture 21 - Diff. Cascode amplifier, two stage amplifiers

Lecture 22 - Two stage diff. amps, op-amps

Lecture 23 - Op-amps, OTAs

Lecture 24 - Circuits with op-amps

Lecture 25 - Capacitance in MOS devices

Lecture 26 - Common source, drain, gate-revisited

Lecture 27 - Common gate, common drain with capacitances

Lecture 28 - Cascode, cascade-revisit with capacitance

Lecture 29 - Cascade amplifier (with capacitance)

Lecture 30 - Diversion: 2-pole systems phase margin

Lecture 31 - Diversion Continued: Two Pole Systems

[Lecture 32 - Compensation](#)

[Lecture 33 - Op-amp Design with Compensation](#)

[Lecture 34 - Unity Gain Bandwidth](#)

[Lecture 35 - Power Amplification](#)

[Lecture 36 - Power Amplifiers-2](#)

[Lecture 37 - Power Amplifiers- Class A,B,AB,C ClassD](#)

[Lecture 38 - Class D Amplifiers, Push-pull Amplifiers](#)

[Lecture 39 - Introduction to Voltage Regulators](#)

[Lecture 40 - Voltage Regulators- line, load; Conclusion Regulation](#)

[Lecture 1 - Introduction](#)

[Lecture 2 - Preliminaries](#)

[Lecture 3 - Model Reference Adaptive Control - Part 1](#)

[Lecture 4 - Model Reference Adaptive Control - Part 2](#)

[Lecture 5 - Model Reference Adaptive Control - Part 3](#)

[Lecture 6 - Adaptive Command Tracking](#)

[Lecture 7 - Robust Model Reference Adaptive Control - Part 1](#)

[Lecture 8 - Robust Model Reference Adaptive Control - Part 2](#)

[Lecture 9 - Robust Model Reference Adaptive Control - Part 3](#)

[Lecture 10 - Robust Model Reference Adaptive Control - Part 4](#)



Lecture 1 - Introduction to Information Theory

Lecture 2 - Entropy, Mutual Information, Conditional and Joint Entropy

Lecture 3 - Measures for Continuous, Random Variable, Relative Entropy

Lecture 4 - Variable Length Codes, Prefix Codes

Lecture 5 - Source Coding Theorem

Lecture 6 - various source coding Techniques: Huffman, Arithmetic, Lempel Ziv, Run Length

Lecture 7 - Optimum Quantizer, Practical Application of Source Coding: JPEG Compression

Lecture 8 - Introduction to Super Information

Lecture 9 - Channel Models and Channel Capacity

Lecture 10 - Noisy Channel Coding Theorem

Lecture 11 - Gaussian Channel and Information Capacity Theorem

Lecture 12 - Capacity of MIMO Channels

Lecture 13 - Introduction to Error Control Coding

Lecture 14 - Introduction to Galois Field

Lecture 15 - Equivalent Codes, Generator Matrix and Parity Check Matrix

Lecture 16 - Systematic Codes, Error Detections and Correction

Lecture 17 - Erasure and Errors, Standard Array and Syndrome Decoding

Lecture 18 - Probability of Error, Coding Gain and Hamming Bound

Lecture 19 - Hamming Codes, LDPC Codes and MDS Codes

Lecture 20 - Introduction to Cyclic Codes

Lecture 21 - Generator Polynomial, Syndrome Polynomial and Matrix Representation

Lecture 22 - Fire Code, Golay Code, CRC Codes and Circuit Implementation of Cyclic Codes

Lecture 23 - Introduction to BCH Codes: Generator Polynomials

Lecture 24 - Multiple Error Correcting BCH Codes, Decoding of BCH Codes

Lecture 25 - Introduction to Reed Solomon (RS) Codes

Lecture 26 - Introduction to Convolutional Codes

Lecture 27 - Trellis Codes: Generator Polynomial Matrix and Encoding using Trellis

Lecture 28 - Viterbi Decoding and Known good Convolutional Codes

Lecture 29 - Introduction to Turbo Codes

Lecture 30 - Introduction to Trellis Coded Modulation (TCM)

Lecture 31 - Ungerboeck's Design Rules and Performance Evaluation of TCM Schemes

[Lecture 32 - TCM for Fading Channel and Space Time Trellis Codes \(STTC\)](#)

[Lecture 33 - Introduction to Space Time Block Codes \(STBC\)](#)

[Lecture 34 - Space Time Codes](#)

[Lecture 35 - Space Time Codes \(Continued...\)](#)

[Lecture 36 - Introduction to Cryptography: Symmetric key and Asymmetric Key Cryptography](#)

[Lecture 37 - Some Well-Known Algorithms: DES, IDEA, PGP, DH Protocol](#)

[Lecture 38 - Introduction to Physical Layer Security: Notion of Secrecy Capacity](#)

[Lecture 39 - Secrecy Outage Capacity, Secrecy Outage Probability, Cooperative Jamming](#)

Lecture 1 - Introduction

Lecture 2 - Transmission Lines : Wave Propagation

Lecture 3 - Transmission Lines : Reflection,Transmission; Travelling Waves

Lecture 4 - Transmission Lines : Travelling Waves (Continued...); Sinusoidal Signals; Impedence Transformation

Lecture 5 - Transmission Lines : Standing Wave Ratio:Measurement of Impedence

Lecture 6 - Transmission Lines : General Transmission Lines Equations,Low loss,Transmission Lines,Transmission Lines as Circuit Elements

Lecture 7 - Transmission Lines : Section as Circuit Elements

Lecture 8 - Transmission Lines : Velocities of Propagation, Transmission Lines Charts

Lecture 9 - Transmission Lines : Smith Chart

Lecture 10 - Transmission Lines : Impedance Matching using Stub-Lines

Lecture 11 - Transmission Lines : Transmission Lines Parameters; (primary Constants)

Lecture 12 - Wave Propagation

Lecture 13 - Wave Propagation (Continued...)

Lecture 14 - Wave Propagation : Polarisation,Poynting Vector

Lecture 15 - Wave Propagation : Power Flow,Complex Poynting vector,wave equation for a conducting Medium

Lecture 16 - Wave Propagation : Conducting Medium;Conductors and Dielectrics Depth of Penetration;Surface Impedance

Lecture 17 - Wave Propagation : Surface Impedance; Power Loss in a Conductor Reflection at a Perfect conductor (Normal Inc.)

Lecture 18 - Reflection and Refraction of waves : Reflection at the Surface of a Conducting Medium,Reflection at a Perfect Conductor (Oblique Inc.)

Lecture 19 - Reflection and Refraction of waves (Continued...)

Lecture 20 - Reflection and Refraction of waves (Continued...) - 1

Lecture 21 - Reflection and Refraction of waves (Continued...); The Plane slab

Lecture 22 - Reflection and Refraction of waves (Continued...); Transmission Line Analogy for Planes Waves

Lecture 23 - Wave Guides

Lecture 24 - Wave Guides (Continued...) Parallel plane Guide,Transverse Electric Waves,Field Distribution,Superposition of Plane Waves

Lecture 25 - Wave Guides (Continued...)

Lecture 26 - Wave Guides (Continued...) Parallel plane Guide,Characteristics of TE and Tm Waves,TEM Waves,Wave Impedances

Lecture 27 - Wave Guides (Continued...) - 1

Lecture 28 - Wave Guides (Continued...) - 2

Lecture 29 - Wave Guides (Continued...) Rectangular Wave Guides

[Lecture 30 - Wave Guides \(Continued...\)](#)

[Lecture 31 - Wave Guides \(Continued...\) Rectangular Wave Guides - 1](#)

[Lecture 32 - Resonators General Properties](#)

[Lecture 33 - Resonators \(Continued...\) Transmission Line Resonators](#)

[Lecture 34 - Resonators \(Continued...\) Wave Guide Resonators](#)

[Lecture 35 - Radiation](#)

[Lecture 36 - Radiation \(Continued...\)](#)

[Lecture 37 - Radiation \(Continued...\) - 1](#)

[Lecture 38 - Radiation \(Continued...\) - 2](#)

[Lecture 39 - Radiation \(Continued...\) Monopole Antennas half Wave Dipole Antenna](#)

[Lecture 40 - Radiation \(Continued...\)](#)

[Lecture 41 - Radiation \(Continued...\) 2 - Element Arrays, Yagi-Uda Array](#)

Lecture 1 - Introduction

Lecture 2 - Signal Spaces : Waveforms and Vector Spaces

Lecture 3 - Inner Product and Orthogonal Expansion

Lecture 4 - Signal Spaces : Gram Schmidt Orthogonalization and Receiver Structures

Lecture 5 - Signal Spaces : Fourier Series and Related expansions

Lecture 6 - Signal Spaces : Bandwidth and Degree of Freedom

Lecture 7 - Random Variables and Random Processes : Discrete Random Variable

Lecture 8 - Random Variables and Random Processes : Continuous Random Variable

Lecture 9 - Random Variables and Random Processes : Multiple Random Variable

Lecture 10 - Random Variables and Random Processes : Random Vectors

Lecture 11 - Random Variables and Random Processes : Introduction to Random Process

Lecture 12 - Random Variables and Random Processes : Properties of Random Process

Lecture 13 - Random Variables and Random Processes : Gaussian Random Process - Part 1

Lecture 14 - Random Variables and Random Processes : Gaussian Random Process - Part 2

Lecture 15 - Random Variables and Random Processes : Types of Random Process

Lecture 16 - Random Variables and Random Processes : Random Process through an LTI system

Lecture 17 - Random Variables and Random Processes : Spectral description of Random Process

Lecture 18 - Waveform Coding

Lecture 19 - Modulation : Complex Baseband Representation of Passband Signals - Part 1

Lecture 20 - Modulation : Complex Baseband Representation of Passband Signals - Part 2

Lecture 21 - Modulation : Complex Baseband Representation of Passband Signals - Part 3

Lecture 22 - Modulation : Spectral Description of Sources - Part 1

Lecture 23 - Modulation : Spectral Description of Sources - Part 2

Lecture 24 - Modulation : Spectral Description of Sources using Markov Chains and Cyclostationary Random Processes

Lecture 25 - Modulation : Nyquist Pulses

Lecture 26 - Modulation : Pulse Amplitude Modulation and Quadrature Amplitude Modulation - Part 1

Lecture 27 - Modulation : Pulse Amplitude Modulation and Quadrature Amplitude Modulation - Part 2

Lecture 28 - Modulation : Orthogonal Modulation Schemes

Lecture 29 - Modulation : Differential Modulation Schemes

Lecture 30 - Detection : Maximum A posteriori Probability (MAP) Detector and Maximum Likelihood (ML) Detector

Lecture 31 - Detection : Vector Detection

[Lecture 32 - Detection : Theorem of Irrelevance and Waveform Detection](#)

[Lecture 33 - Detection : Sequence Detection](#)

[Lecture 34 - Detection : Performance of Binary Signalling Schemes](#)

[Lecture 35 - Detection : Performance of M-ary Signaling Schemes](#)

[Lecture 36 - Detection : Performance of Orthogonal Modulation Schemes and Bit-Level Demodulation](#)

[Lecture 37 - Detection : Performance of Non-Coherent Systems Systems](#)

[Lecture 38 - Detection : Fading Channel](#)

- Lecture 1 - Intro EV Historical Background
- Lecture 2 - Intro EV Benefits of Using EVs
- Lecture 3 - Intro EV Overview of types of EVs and its Challenges
- Lecture 4 - Intro EV Motor Drive Technologies
- Lecture 5 - Intro EV Energy Source Technologies
- Lecture 6 - Intro EV Battery Charging Technologies
- Lecture 7 - Intro EV Vehicle to Grid
- Lecture 8 - Intro EV Subsystems and Configurations
- Lecture 9 - Intro HEV Subsystems and Configurations
- Lecture 10 - Intro HEV Subsystems and Modes of Operation
- Lecture 11 - Vehicle Dynamics intro and tractive effort
- Lecture 12 - Vehicle Dynamics Simulation and dynamic equation
- Lecture 13 - Vehicle Dynamics Simulation dynamic equation constant Fte
- Lecture 14 - Vehicle Dynamics dynamic equation variable Fte
- Lecture 15 - Vehicle Dynamics simulation dynamic equation variable Fte
- Lecture 16 - Vehicle Dynamics Modelling and simulation in Simulink
- Lecture 17 - Summary Electric Vehicles - Part 1 Course
- Lecture 18 - Basics of DC Motor Drive
- Lecture 19 - Realization of DC Chopper
- Lecture 20 - Open Loop Operation of Chopper Fed DC Motor Drive
- Lecture 21 - Review of Control Theory
- Lecture 22 - Modeling and Current Controller Design for Separately Excited DC Motor Drive
- Lecture 23 - Speed Controller Design and Performance Evaluation of DC Motor Drive
- Lecture 24 - Fundamentals of Three Phase Induction Motor
- Lecture 25 - Equivalent Circuit and Torque-Speed Characteristics of Induction Motor
- Lecture 26 - Starting and Speed Control of Induction Motor
- Lecture 27 - Realisation of DC to AC Power Converter
- Lecture 28 - Impact of Non-Sinusoidal Voltage on Induction Motor
- Lecture 29 - Selective Harmonic Elimination and Optimal Pulse Width Modulation Techniques
- Lecture 30 - Switching Energy Losses and Sine-Triangle PWM
- Lecture 31 - Analysis of Sine-Triangle PWM

[Lecture 32 - Simulation Studies on Open Loop Induction Motor Drive](#)

[Lecture 33 - Modeling of Crylindrical Rotor Machine](#)

[Lecture 34 - Modeling of Surface Mounted PMSM Drive](#)

[Lecture 35 - Sensored Vector Control of PMSM Drive](#)

[Lecture 36 - Dynamic Modeling of Squirrel Cage Induction Machine - Part 1](#)

[Lecture 37 - Dynamic Modeling of Squirrel Cage Induction Machine - Part 2](#)

[Lecture 38 - Controller Design for RFO Vector Controlled IM Drive](#)

[Lecture 39 - Estimation of Rotor Flux Vector and Mechanical Speed](#)

[Lecture 40 - Case Study - Indian Railway Propulsion System](#)

[Lecture 41 - Simulation Exercise - PMSM and IM Drives](#)

[Lecture 42 - Basics of Electromagnetic Circuit](#)

[Lecture 43 - SRM and BLDC Motor Drives - Part 1](#)

[Lecture 44 - SRM and BLDC Motor Drives - Part 2](#)



- Lecture 1 - Introduction to Power Electronics
- Lecture 2 - Power Devices: Diodes and SCR
- Lecture 3 - Power Devices: SCR, Triac, GTO and BJT
- Lecture 4 - Power Devices: BJT, MOSFET and IGBT
- Lecture 5 - Single-phase Uncontrolled Rectifiers
- Lecture 6 - Single-phase Controlled Rectifiers - I
- Lecture 7 - Single-phase Controlled Rectifiers - II
- Lecture 8 - Three Phase Rectifiers - I
- Lecture 9 - Numericals on devices and Single-phase Rectifiers
- Lecture 10 - Three Phase Rectifiers - II
- Lecture 11 - Dual Converter and Communication Overlap
- Lecture 12 - Communication Overlap - II and AC-AC Converter-Introduction
- Lecture 13 - Single-Phase and Three-Phase AC Voltage Controllers
- Lecture 14 - Three-Phase AC Voltage Controllers and Cycloconverters
- Lecture 15 - Non-Isolated DC-DC Converters - I
- Lecture 16 - Non-Isolated DC-DC Converters - II
- Lecture 17 - Isolated DC-DC Converters - I
- Lecture 18 - Isolated DC-DC Converters - II and Cuk Converters
- Lecture 19 - Voltage Source Inverters
- Lecture 20 - VSI PWM Techniques - I
- Lecture 21 - VSI PWM Techniques - II
- Lecture 22 - SPWM and SVM Technique
- Lecture 23 - Current Source Inverter
- Lecture 24 - Power Electronics Applications

Lecture 1 - Introduction to Electrical Machines - I

Lecture 2 - Single-phase and Three-phase AC Circuits, Magnetic circuits

Lecture 3 - Magnetic Circuit - II

Lecture 4 - Magnetic Circuit - III

Lecture 5 - Transformers - Introduction

Lecture 6 - Transformers - Amp-Turn Balance, Ideal and practical transformers

Lecture 7 - Transformer Equivalent circuit and Reducing leakage

Lecture 8 - Transformer equivalent circuit parameter determination

Lecture 9 - Transformers - Voltage regulation and efficiency

Lecture 10 - Auto-transformers

Lecture 11 - PU notation and Introduction to Instrument transformers

Lecture 12 - Instrument Transformers and All Day Efficiency

Lecture 13 - Three Phase Transformers - I

Lecture 14 - Three Phase Transformers - II

Lecture 15 - Electromechanical Energy Conversion - I

Lecture 16 - Electromechanical Energy Conversion - II

Lecture 17 - Electromechanical Energy Conversion - III

Lecture 18 - DC Machines-Introduction, Constructional Features

Lecture 19 - DC Machines - EMF and Torque Equations and Generator Operation

Lecture 20 - DC Machines - OCC and Load Characteristics Classification

Lecture 21 - DC Machines - Armature Reaction

Lecture 22 - DC Machines - Voltage Build-up and Load Characteristics

Lecture 23 - DC Generator Characteristics and Introduction to DC Motors

Lecture 24 - DC Motors: Basics and Speed-Torque Relationship

Lecture 25 - DC Motor: Speed Control (Shunt and Separately Excited Motor)

Lecture 26 - DC Motor: Speed Control (Series and Compound Motor)

Lecture 27 - DC Machine: Starting and Braking

Lecture 28 - DC Machine: Commutation

Lecture 29 - 3 Phase Induction Machine: Constructional Features and Principle of Operation

Lecture 30 - 3 Phase Induction Machine: Equivalent Circuit

Lecture 31 - 3 Phase Induction Machine: Speed Torque Characteristics

[Lecture 32 - Testing of Induction Motor: OC and SC Test](#)

[Lecture 33 - 3 Phase Induction Machine: Starting Methods](#)

[Lecture 34 - Synchronous Machines: Introduction](#)

[Lecture 35 - Synchronous Machines: Constructional Features](#)

[Lecture 36 - Numerical Session](#)

[Lecture 37 - Synchronization of Alternators](#)

[Lecture 38 - Synchronous Machines: Equivalent Circuit and Phasor Diagram](#)

[Lecture 39 - Synchronous Machines: OC and SC Test](#)

[Lecture 40 - Synchronous Machines: Power Angle Relationship, V and Inverted V Curves](#)

[Lecture 41 - Single Phase Induction Motors](#)

[Lecture 1 - Special Electromechanical Systems \(Introduction\)](#)

[Lecture 2 - Classification of Machines](#)

[Lecture 3 - Single and Two-Phase Motors](#)

[Lecture 4 - Single-Phase Induction Motors-Analysis](#)

[Lecture 5 - Starting of Single-Phase Induction Motors](#)

[Lecture 6 - Single-Phase Induction Motors Analysis](#)

[Lecture 7 - Induction Motors Analysis by Symmetrical Components](#)

[Lecture 8 - Modelling of 1-Phase Induction Motor \(One and Two Windings\)](#)

[Lecture 9 - Asymmetrical Induction Motor Generalized Rotating Field Theory](#)

[Lecture 10 - Generalized Rotating Field Theory \(Continued...\)](#)

[Lecture 11 - Generalized Rotating Field Theory \(Continued...\)](#)

[Lecture 12 - Generalized Rotating Field Theory \(Continued...\)](#)

[Lecture 13 - Analysis of Asymmetrical Machine by Generalized Rotating Field Theory](#)

[Lecture 14 - Analysis of Asymmetrical Machine](#)

[Lecture 15 - Analysis of Asymmetrical Induction Machine](#)

[Lecture 16 - Generalised Rotating-Field Theory of Wound Rotor Ind. Machine Having Asymmetry in Stator and Rotor Windings](#)

[Lecture 17 - Generalised Rotating-Field Theory of Wound Rotor Ind. Machine Having Asymmetry in Stator and Rotor Windings \(Continued...\)](#)

[Lecture 18 - Testing of Small Electrical Machines](#)

[Lecture 19 - Testing of 1-Phase Induction Motors](#)

[Lecture 20 - Variable Reluctance \(VR\) Motors](#)

[Lecture 21 - Switched Reluctance Motor \(Continued...\)](#)

[Lecture 22 - Switched Reluctance Motor \(Continued...\)](#)

[Lecture 23 - Switched Reluctance Motor \(Continued...\)](#)

[Lecture 24 - Stepper Motors](#)

[Lecture 25 - Stepper Motors \(Continued...\)](#)

[Lecture 26 - Induction Generators](#)

[Lecture 27 - Induction Generators \(Continued...\)](#)

[Lecture 28 - Doubly Fed Induction Generators](#)

[Lecture 29 - Self Excited Induction Generators](#)

[Lecture 30 - Self Excited Induction Generators \(Continued...\)](#)

[Lecture 31 - Permanent Magnet Machines](#)

[Lecture 32 - Squarewave Permanent Magnet Brushless Motor Drive](#)

[Lecture 33 - Sine Wave Permanent Magnet Brushless Motor Drives](#)

[Lecture 34 - Permanent Magnet Synchronous Motors](#)

- Lecture 1 - Basic Understanding of Converter (Introduction to Power Converters)
- Lecture 2 - Basic Understanding of Converter (Half Bridge and Full Bridge Circuit Operation)
- Lecture 3 - Basic Understanding of Converter (Sinusoidal Pulse width Modulation and Three Phase Circuit)
- Lecture 4 - Basic Understanding of Converter (Harmonics in Sinusoidal PWM)
- Lecture 5 - Third harmonic addition in Sine PWM
- Lecture 6 - Introduction to Space Vectors
- Lecture 7 - Space Vector PWM - Timing Calculation
- Lecture 8 - Space Vector PWM - Switching Sequence
- Lecture 9 - Space Vector PWM - Using Carriers
- Lecture 10 - Basic Introduction to Power Devices
- Lecture 11 - Introduction to Multilevel Converters
- Lecture 12 - Cascaded H-bridge Multilevel Converters
- Lecture 13 - Output Voltage Waveform Synthesis in CHB Converter and Basic of Asymmetrical CHB Converters
- Lecture 14 - Cascaded H-Bridge Converters: Phase-Shifted PWM
- Lecture 15 - Cascaded H-Bridge Converters: Level-Shifted PWM
- Lecture 16 - Fault Tolerant Operation of Cascaded H-Bridge Converter - Part I
- Lecture 17 - Fault Tolerant Operation of Cascaded H-Bridge Converter - Part II
- Lecture 18 - Modular Multilevel Converter - Topology and Operation
- Lecture 19 - Modular Multilevel Converter - Arm and Cell Voltage Ratings
- Lecture 20 - Modular Multilevel Converter - Arm Currents
- Lecture 21 - Modular Multilevel Converter - Arm Energy Balancing
- Lecture 22 - Modular Multilevel Converter - Different Circuit Topologies
- Lecture 23 - Modular Multilevel Converter - PWM Technique and Capacitor Voltage Balancing
- Lecture 24 - Modular Multilevel Converter - Fault Tolerant Operation and Commercial Production
- Lecture 25 - Design of Components in MMC
- Lecture 26 - Neutral Point Clamped Converter - Circuit Topology - Part I
- Lecture 27 - Neutral Point Clamped Converter - Circuit Topology - Part II
- Lecture 28 - Neutral Point Clamped Converter - Space Vector Diagram
- Lecture 29 - Neutral Point Clamped Converter - Space Vector PWM
- Lecture 30 - NPC - Sinusoidal PWM and Space Vector PWM using Single Carrier Strategy
- Lecture 31 - Neutral Point Clamped Converter - Mid-point Voltage Fluctuations

[Lecture 32 - Neutral Point Clamped Converter - Capacitor Voltage Balancing](#)

[Lecture 33 - Neutral Point Clamped Converter - Another Strategy of Capacitor Voltage Balancing](#)

[Lecture 34 - Other Topologies of NPC Converters - Higher Level NPC, TNPC and Active NPC](#)

[Lecture 35 - Multipulse Transformer - Part I](#)

[Lecture 36 - Multipulse Transformer - Part II](#)

[Lecture 37 - A Case Study on MMC and CHB](#)

[Lecture 38 - Basics of Gate Driver Circuits](#)

[Lecture 39 - Gate Driver Circuits - Turn-on and Turn-off Process](#)

[Lecture 40 - Gate Driver Circuits - Features of Gate Drivers and Basics of Bootstrap Functionality](#)

[Lecture 41 - Condition Monitoring of Converters](#)

[Lecture 42 - Other Converter Topologies](#)

[Lecture 43 - Summary of the Course](#)

Lecture 1 - Introduction

Lecture 2 - Introduction continued with Project demos

Lecture 3 - Modular Approach to ESD

Lecture 4 - Modular Approach to ESD (Continued...)

Lecture 5 - Salient Features of Modern Microcontrollers

Lecture 6 - Salient Features of Modern Microcontrollers (Continued...)

Lecture 7 - Elements of Microcontroller Ecosystem

Lecture 8 - Elements of Microcontroller Ecosystem (Continued...)

Lecture 9 - Power Supply for Embedded Systems

Lecture 10 - Power Supply for Embedded Systems (Continued...)

Lecture 11 - Introduction to MSP430

Lecture 12 - MSP430 Architecture

Lecture 13 - MSP430 Architecture- (Continued...) And Introduction to Lunchbox

Lecture 14 - Programming Methods for MSP430

Lecture 15 - Physical Interfacing - 1

Lecture 16 - Physical Interfacing - 2

Lecture 17 - Physical Interfacing - 3

Lecture 18 - Physical Interfacing - 4

Lecture 19 - Physical Interfacing - 5

Lecture 20 - Physical Interfacing - 6

Lecture 21 - GIT, CCS Installation and Embedded C

Lecture 22 - MSP430 Digital I/O

Lecture 23 - MSP430 Digital I/O: Switch Interfacing

Lecture 24 - MSP430 Clock System and Reset

Lecture 25 - Interrupts in MSP430

Lecture 26 - Interrupts in MSP430 (Continued...)

Lecture 27 - Interfacing Seven Segment Displays with MSP430; Low Power Modes in MSP430

Lecture 28 - Interfacing Liquid Crystal Displays (LCD)

Lecture 29 - MSP430 Timer Module: Introduction and Timer Capture

Lecture 30 - Pulse Width Modulation, PWM using Timer Capture

Lecture 31 - Analog to Digital Converter in the MSP430



[Lecture 32 - ADC and DAC using R2R Ladder and Random number generation using LFSR](#)

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**Co-ordinators : Prof. Bhim Singh**

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**Co-ordinators : Dr. S.P. Das**

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- Lecture 11 - Some Simple Linear Block Codes - I
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- Lecture 15 - Introduction to Convolutional Codes - I: Encoding
- Lecture 16 - Introduction to Convolutional Codes - II: State Diagram, Trellis Diagram
- Lecture 17 - Convolutional Codes: Classification, Realization
- Lecture 18 - Convolutional Codes:Distance Properties
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- Lecture 30 - Distance Properties of Turbo Codes
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# DIGIMAT - The No.1 Learning Management Platform for Creative Learning

## NPTEL : NOC:Principles of Communication Systems - Part II (Electrical Engineering)

**Co-ordinators : Prof. Aditya K. Jagannatham**

Lecture 1 - Introduction to Digital Communication Systems

Lecture 2 - Spectrum of Transmitted Digital Communication Signal and Wide Sense Stationarity

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Lecture 5 - Additive White Gaussian Noise (AWGN) Properties, Gaussian Noise and White Noise

Lecture 6 - Structure of Digital Communication Receiver, Receiver Filter and Signal-to-Noise Power Ratio (SNR)

Lecture 7 - Digital Communication Receiver, Noise Properties and Output Noise Power

Lecture 8 - Digital Communication Receiver, Optimal SNR and Matched Filter

Lecture 9 - Probability of Error in Digital Communication and Probability Density Functions of Output

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Lecture 11 - Introduction to Binary Phase Shift Keying (BPSK) Modulation, Optimal Decision Rule and Probability of Bit-Error or Bit-Error Rate (BER)

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Lecture 15 - Introduction to Frequency Shift Keying (FSK)

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Lecture 17 - Introduction to Quadrature Phase Shift Keying (QPSK)

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Lecture 23 - M-ary QAM (Quadrature Amplitude Modulation) - Part-II, Optimal Decision Rule, Probability of Error and Constellation Diagram

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Lecture 25 - M-ary PSK (Phase Shift Keying) - Part-II, Optimal Decision Rule, Nearest Neighbor Criterion and Approximate Probability of Error

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Lecture 27 - Definition of Entropy, Average of Information / Uncertainty of source and Properties of Entropy

Lecture 28 - Entropy Example- Binary Source Maximum and Minimum Entropy of Binary Source

**HTML Links for 1,24,600+ NPTEL Video Lectures, Created by LinuXpert Systems, Chennai**



Lecture 29 - Maximum Entropy of Source with M-ary Alphabet, Concave/Convex Functions and Jensens Inequality

Lecture 30 - Joint Entropy , Definition of Joint Entropy of Two Sources and Simple Examples for Joint Entropy Computation

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Lecture 32 - Conditional Entropy, Example of Conditional Entropy and Properties of Conditional Entropy

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Lecture 35 - Channel Capacity, Implications of Channel Capacity, Claude E. Shannon- Father of Information Theory and Example of Capacity of Binary Symmetric Channel

Lecture 36 - Differential Entropy and Example for Uniform Probability Density function

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Lecture 39 - Capacity of Gaussian channel - Part I

Lecture 40 - Capacity of Gaussian Channel - Part-II, Practical Implications and Maximum rate in bits/sec

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Lecture 42 - Uniquely Decodable Codes, Prefix-free code, Instantaneous Code and Average Code length

Lecture 43 - Binary Tree Representation of Code, Example and Kraft Inequality

Lecture 44 - Lower Bound on Average Code Length and Kullback-Leibler Divergence

Lecture 45 - Optimal Code length, Constrained Optimization and Morse Code Example

Lecture 46 - Approaching Lower Bound on Average code length and Block Coding

Lecture 47 - Huffman Code, Algorithm, Example and Average Code Length

Lecture 48 - Introduction to channel coding, Rate of Code, Repetition Code and Hamming Distance

Lecture 49 - Introduction to Convolutional Codes, Binary Field Arithmetic and Linear Codes

Lecture 50 - Example of Convolutional Code Output and Convolution Operation for Code generation

Lecture 51 - Matrix Representation of Convolutional Codes, Generator Matrix, Transform Domain Representation and Shift Register Architecture

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Lecture 54 - Decoding of the Convolutional Code, Minimum Hamming distance and Maximum Likelihood Codeword Estimate

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Lecture 56 - Viterbi Decoder for Maximum Likelihood Decoding of Convolutional Code Using Trellis Representation, Branch Metric Calculation, State Metric Calculation and Example

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- Lecture 2 - Introduction to Transmission lines
- Lecture 3 - Sinusoidal waves on Transmission lines
- Lecture 4 - Terminating T-lines: Reflection and Transmission coefficient
- Lecture 5 - Circuit parameters of a T-line
- Lecture 6 - Lossy Transmission lines and primary constants
- Lecture 7 - When to apply T-line Theory?
- Lecture 8 - Standing Waves on T-lines
- Lecture 9 - Lumped equivalent circuits of T-lines
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- Lecture 11 - Graphical aid: Smith Chart Derivation
- Lecture 12 - Smith chart applications
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- Lecture 15 - Impedance matching techniques - Part 1
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- Lecture 19 - Further examples of use of lattice diagrams
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- Lecture 25 - Cylindrical coordinate systems
- Lecture 26 - Review of vector fields and Gradient
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- Lecture 30 - Faradays law
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Lecture 41 - Plane wave propagation in lossless dielectric media

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Lecture 51 - Application: Matrix analysis of reflection from multiple boundaries

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Lecture 55 - Attenuation and Dispersion in rectangular waveguides

Lecture 56 - Planar optical waveguides

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Lecture 58 - Application: WDM Optical Components

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[Lecture 65 - Antenna Parameters and Long wire Antenna](#)

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Lecture 1 - Principles of Signals and Systems- Introduction to Signals and Systems, Signal Classification - Continuous and Discrete Time Signals

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Lecture 4 - Real Exponential Signals

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[Lecture 61 - Discrete Fourier Transform: Properties - Conjugation, Frequency Shift, Duality, Circular Convolution, Multiplication, Parseval's Relation, Example Problems for Fourier Analysis of Discrete Time Signals](#)

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- Lecture 2 - Eigenvectors and Eigenvalues of Matrices and their Properties
- Lecture 3 - Positive Semidefinite (PSD) and Positive Definite (PD) Matrices and their Properties
- Lecture 4 - Inner Product Space and its Properties: Linearity, Symmetry and Positive Semi-definite
- Lecture 5 - Inner Product Space and its Properties: Cauchy Schwarz Inequality
- Lecture 6 - Properties of Norm, Gaussian Elimination and Echelon form of matrix
- Lecture 7 - Gram Schmidt Orthogonalization Procedure
- Lecture 8 - Null Space and Trace of Matrices
- Lecture 9 - Eigenvalue Decomposition of Hermitian Matrices and Properties
- Lecture 10 - Matrix Inversion Lemma (Woodbury identity)
- Lecture 11 - Introduction to Convex Sets and Properties
- Lecture 12 - Affine Set Examples and Application
- Lecture 13 - Norm Ball and its Practical Applications
- Lecture 14 - Ellipsoid and its Practical Applications
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- Lecture 28 - Jensen's Inequality application
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Lecture 33 - Examples on Convex Functions

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Lecture 46 - Regularization: Least Squares + Least Norm

Lecture 47 - Convex Optimization Problem representation: Canonical form, Epigraph form

Lecture 48 - Linear Program Practical Application: Base Station Co-operation

Lecture 49 - Stochastic Linear Program, Gaussian Uncertainty

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Lecture 51 - Practical Application: Multiple Input Multiple Output (MIMO) Beamformer Design

Lecture 52 - Practical Application: Co-operative Communication, Overview and various Protocols used

Lecture 53 - Practical Application: Probability of Error Computation for Co-operative Communication

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Lecture 56 - Practical Application

Lecture 57 - Practical Application- Orthogonal Matching Pursuit (OMP) algorithm for Compressive Sensing

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Lecture 3 - Uniform plane waves (UWPs) in free-space

Lecture 4 - Properties of UWPs (propagation constant, polarization, and Poynting vector)

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Lecture 6 - Obliquely incident waves-I (TE and TM waves, Snell's laws)

Lecture 7 - Obliquely incident waves-II (Reflection and transmission coefficients, Brewster angle)

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Lecture 10 - Transverse resonance condition for slab waveguides

Lecture 11 - Introduction to optical fibers

Lecture 12 - Ray theory of light propagation in optical fibers

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Lecture 14 - Systematic procedure to obtain modes of a waveguide

Lecture 15 - Systematic analysis of parallel plate metallic waveguide

Lecture 16 - Systematic analysis of dielectric slab waveguides

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Lecture 23 - Introduction to dispersion in fibers

Lecture 24 - Mathematical modelling of dispersion: Transfer function approach

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Lecture 28 - Polarization Effects on Pulse Propagation

Lecture 29 - Modes in Optical Fibres and Pulse Propagation in Optical Fibres

Lecture 30 - Graded Index Fibers

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- Lecture 32 - Basics of Lasers-I (Structure of Lasers, Process of Photon Emission)
- Lecture 33 - Basics of Lasers-II (Einstein's Theory of Radiation)
- Lecture 34 - Basics of Lasers-III (Population Inversion and Rate Equation for Lasers)
- Lecture 35 - Basic Properties of Semiconductor Laser-I (Energy Gap, Intrinsic and Extrinsic Semiconductors)
- Lecture 36 - Basic Properties of Semiconductor Laser-II (Fermi Level)
- Lecture 37 - Optical Properties of Semiconductors-I (Direct Bandgap and Indirect Bandgap, Density of States)
- Lecture 38 - Optical Properties of Semiconductors-II (Gain, Absorption, Recombination rate) Homojunction Lasers
- Lecture 39 - Double Heterostructure Lasers, Introduction to Quantum Well Lasers
- Lecture 40 - Semiconductor Optical Amplifier
- Lecture 41 - Erbium-doped fiber amplifier
- Lecture 42 - Photodetectors
- Lecture 43 - Noise in Photodetectors
- Lecture 44 - Introduction to WDM components
- Lecture 45 - Couplers, Circulators, FRM and Filters
- Lecture 46 - Filter, MUX/DEMUX, Diffraction grating (FBG and Long period grating)
- Lecture 47 - Optical Modulators-I (Current modulation)
- Lecture 48 - Optical Modulators-II (Electro-optic modulators)
- Lecture 49 - Review of Communication Concepts-I (Deterministic and Random Signals, Baseband and Passband Signals)
- Lecture 50 - Review of Communication Concepts-II (Signal and vectors, Signal energy, Orthonormal basis functions)
- Lecture 51 - Intensity modulation/ Direct Detection
- Lecture 52 - BER discussion for OOK systems
- Lecture 53 - Higher order modulation and Coherent Receiver
- Lecture 54 - Coherent receiver for BPSK systems and BER calculation
- Lecture 55 - Recovering Polarization
- Lecture 56 - DSP algorithms for Chromatic dispersion mitigation
- Lecture 57 - DSP algorithms for Carrier phase estimation - I
- Lecture 58 - DSP algorithms for Carrier phase estimation - II
- Lecture 59 - Nonlinear effects in fiber
- Lecture 60 - Four wave mixing, Loss measurement, Dispersion measurement
- Lecture 61 - Lab Demonstration (Laser diode characteristics, Loss measurement, Optical Intensity Modulation)

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Lecture 2 - Distributed Circuit Model of Uniform Transmission Line

Lecture 3 - Voltage and Current Equation of the Transmission line

Lecture 4 - Sinusoidal Excitation of Transmission Line (Propagation constant, Characteristic Impedance)

Lecture 5 - Properties of Transmission Line (Reflection Coefficient, Input Impedance, Standing Wave Ratio)

Lecture 6 - Power Calculations and Introduction to Smith Chart

Lecture 7 - Smith Chart

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Lecture 9 - Time domain Analysis of Transmission Line - I

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Lecture 11 - Usage of Lattice Diagrams

Lecture 12 - TDR analysis of Transmission Lines

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Lecture 20 - Oblique Incidence of Plane Waves - II

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Lecture 30 - Near field and Far-field Antenna and Properties of Antennas

Lecture 31 - Linear antenna - I

[Lecture 32 - Linear antenna - II and Properties of Transmitting and Receiving Antenna](#)

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Lecture 7 - Topology

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Lecture 10 - Nodal Analysis

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Lecture 18 - Maximum Power Transfer Theorem - 1

Lecture 19 - Maximum Power Transfer Theorem - 2

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Lecture 21 - First Order RC Circuits

Lecture 22 - First Order RL Circuits

Lecture 23 - Singularity Functions

Lecture 24 - Step Response of RC and RL Circuits

Lecture 25 - Second Order Response

Lecture 26 - Step Response of Second Order Circuits-First Order and Second Order Circuits (Continued...)

Lecture 27 - Step Response of Parallel RLC Circuit-First Order and Second Order Circuits (Continued...)

Lecture 28 - Definition of the Laplace Transform

Lecture 29 - Properties of the Laplace Transform

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**Co-ordinators : Prof. N.K. Kishore**

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**Co-ordinators : Prof. A.K. Sinha**

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**NPTEL : Phase-locked loops (Electrical Engineering)**

**Co-ordinators : Dr. Saurabh Saxena**

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- Lecture 15 - Protection of Transmission Lines using Distance Relays - II
- Lecture 16 - Protection of Transmission Lines using Distance Relays - III
- Lecture 17 - Protection of Transmission Lines using Distance Relays - IV
- Lecture 18 - Protection of Transmission Lines using Distance Relays - V
- Lecture 19 - Carrier Aided Schemes for Transmission Lines - I
- Lecture 20 - Carrier Aided Schemes for Transmission Lines - II
- Lecture 21 - Carrier Aided Schemes for Transmission Lines - III
- Lecture 22 - Carrier Aided Schemes for Transmission Lines - IV
- Lecture 23 - Auto-reclosing and Synchronizing - I
- Lecture 24 - Auto-reclosing and Synchronizing - II
- Lecture 25 - Auto-reclosing and Synchronizing - III
- Lecture 26 - Protection of Transformers - I
- Lecture 27 - Protection of Transformers - II
- Lecture 28 - Protection of Generators - I
- Lecture 29 - Protection of Generators - II
- Lecture 30 - Protection of Induction Motors
- Lecture 31 - Protection of Busbars

[Lecture 32 - Protection against Transients and Surges along with System Response to Severe Upsets - I](#)

[Lecture 33 - Protection against Transients and Surges along with System Response to Severe Upsets - II](#)

[Lecture 34 - Arc Interruption Theory in Circuit Breaker - I](#)

[Lecture 35 - Arc Interruption Theory in Circuit Breaker - II](#)

[Lecture 36 - Arc Interruption Theory in Circuit Breaker - III](#)

[Lecture 37 - Arc Interruption Theory in Circuit Breaker - IV](#)

[Lecture 38 - Types of Circuit Breakers](#)

[Lecture 39 - Testing, Commissioning and Maintenance of Relays - I](#)

[Lecture 40 - Testing, Commissioning and Maintenance of Relays - II](#)

[Lecture 1 - Basic of Wireless Communication - I](#)

[Lecture 2 - Basic of Wireless Communication - II](#)

[Lecture 3 - Basic of Wireless Communication - III](#)

[Lecture 4 - Basic of Wireless Communication - IV](#)

[Lecture 5 - Basic of Wireless Communication - V](#)

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[Lecture 7 - Noise in RF Systems - I](#)

[Lecture 8 - Noise in RF Systems - II](#)

[Lecture 9 - Noise in RF Systems - III](#)

[Lecture 10 - Noise in RF Systems - IV](#)

[Lecture 11 - Non-Linearity in RF Systems - I](#)

[Lecture 12 - Non-Linearity in RF Systems - II](#)

[Lecture 13 - Non-Linearity in RF Systems - III](#)

[Lecture 14 - Transceiver Architecture - I](#)

[Lecture 15 - Transceiver Architecture - II](#)

[Lecture 16 - Transceiver Architecture - III](#)

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[Lecture 18 - Transceiver Architecture - V](#)

[Lecture 19 - Transceiver Architecture - VI](#)

[Lecture 20 - Transceiver Architecture - VII](#)

[Lecture 21 - Active Devices - I](#)

[Lecture 22 - Active Devices - II](#)

[Lecture 23 - Active Devices - III](#)

[Lecture 24 - Active Devices - IV](#)

[Lecture 25 - Passive Components and Impedance Matching - I](#)

[Lecture 26 - Passive Components and Impedance Matching - II](#)

[Lecture 27 - Passive Components and Impedance Matching - III](#)

[Lecture 28 - Passive Components and Impedance Matching - IV](#)

[Lecture 29 - Passive Components and Impedance Matching - V](#)

[Lecture 30 - Passive Components and Impedance Matching - VI](#)

[Lecture 31 - Passive Components and Impedance Matching - VII](#)

[Lecture 32 - Stability and Amplifier Design - I](#)

[Lecture 33 - Stability and Amplifier Design - II](#)

[Lecture 34 - Stability and Amplifier Design - III](#)

[Lecture 35 - Stability and Amplifier Design - IV](#)

[Lecture 36 - Low Noise Amplifier Design - I](#)

[Lecture 37 - Low Noise Amplifier Design - II](#)

[Lecture 38 - Low Noise Amplifier Design - III](#)

[Lecture 39 - Low Noise Amplifier Design - IV](#)

[Lecture 40 - Low Noise Amplifier Design - V](#)

[Lecture 41 - Low Noise Amplifier Design - VI](#)

[Lecture 42 - Mixer Design - I](#)

[Lecture 43 - Mixer Design - II](#)

[Lecture 44 - Mixer Design - III](#)

[Lecture 45 - Mixer Design - IV](#)

[Lecture 46 - Mixer Design - V](#)

[Lecture 47 - Mixer Design - VI](#)

[Lecture 48 - Mixer Design - VII](#)

[Lecture 49 - Mixer Design - VIII](#)

[Lecture 50 - Mixer Design - IX](#)

[Lecture 51 - Oscillator Design - I](#)

[Lecture 52 - Oscillator Design - II](#)

[Lecture 53 - Oscillator Design - III](#)

[Lecture 54 - Oscillator Design - IV](#)

[Lecture 55 - Power Amplifier Design - I](#)

[Lecture 56 - Power Amplifier Design - II](#)

[Lecture 57 - Power Amplifier Design - III](#)

[Lecture 58 - Basics of Phase Locked Loop - I](#)

[Lecture 59 - Basics of Phase Locked Loop - II](#)

[Lecture 60 - System Level Considerations](#)

[Lecture 61 - RF Testing and Measurement Techniques](#)

Lecture 1 - Introduction to VLSI Design

Lecture 2 - Introduction to VLSI Physical Design

Lecture 3 - Complexity Analysis for Algorithms

Lecture 4 - Graphs for Physical Design

Lecture 5 - Graph searching Algorithms

Lecture 6 - Spanning Tree and Shortest Path Algorithms

Lecture 7 - Overview of Timing Analysis

Lecture 8 - Timing Arcs and Unateness

Lecture 9 - Delay Parameters of a Combinational Circuit

Lecture 10 - Delay Parameters of a Sequential Circuit

Lecture 11 - Timing Analysis in a Sequential Circuit

Lecture 12 - STA in Sequential Circuit with Clock Skew - I

Lecture 13 - STA in Sequential Circuit with Clock Skew - II

Lecture 14 - STA in Sequential Circuit with Clock Jitter

Lecture 15 - STA considering OCV and CRPR (Setup check)

Lecture 16 - STA considering OCV and CRPR (Hold check)

Lecture 17 - STA for Combinational Circuits - I

Lecture 18 - STA for Combinational Circuits - II

Lecture 19 - Introduction to Partitioning - I

Lecture 20 - Introduction to Partitioning - II

Lecture 21 - Partitioning Algorithms

Lecture 22 - Kernighan-Lin (KL) Algorithm

Lecture 23 - Fiduccia-Mattheyses (FM) Algorithm

Lecture 24 - Introduction to Floorplanning

Lecture 25 - Floorplanning Representations

Lecture 26 - Floorplanning Algorithms - 1

Lecture 27 - Floorplanning Algorithms - 2

Lecture 28 - Pin Assignment and Power - Ground Routing

Lecture 29 - Introduction to Placement

Lecture 30 - Wirelength estimation techniques

Lecture 31 - Min-cut placement

[Lecture 32 - Placement Algorithms](#)

[Lecture 33 - Placement algorithms and legalization](#)

[Lecture 34 - Introduction to Clock Tree Synthesis](#)

[Lecture 35 - Clock Routing Algorithms - I](#)

[Lecture 36 - Clock Routing Algorithms - II](#)

[Lecture 37 - Clock Routing Algorithms - III](#)

[Lecture 38 - Introduction and Optimization Goals - Global Routing](#)

[Lecture 39 - Single net routing \(Rectilinear routing\)](#)

[Lecture 40 - Global Routing in the connectivity graph](#)

[Lecture 41 - Finding Shortest Paths with Dijkstra's Algorithm](#)

[Lecture 42 - Full-Netlist Routing](#)

[Lecture 43 - Introduction: Detailed Routing](#)

[Lecture 44 - Channel Routing Algorithms - I](#)

[Lecture 45 - Channel Routing Algorithms - II](#)

[Lecture 46 - Switchbox and Over the cell routing](#)

[Lecture 47 - Timing Constraints in latch based system](#)

[Lecture 48 - Timing Constraints in Pulsed Latch-based System](#)

[Lecture 49 - Time Borrowing in Latch](#)

[Lecture 50 - Crosstalk Analysis](#)

[Lecture 51 - Standard Cell Library](#)

[Lecture 52 - Low Power Cells in Standard Cell Library](#)

[Lecture 53 - Sub-threshold Standard Cell Library](#)

[Lecture 54 - Timing Library for Standard Cells](#)

[Lecture 55 - PDK and Other files](#)

[Lecture 56 - Open-Source Tool Installation and Qflow](#)

[Lecture 57 - Open-Source tool - YOSYS](#)

[Lecture 58 - OpenSTA Static Timing Analyzer](#)

[Lecture 59 - OpenROAD Physical Synthesis Flow - I](#)

[Lecture 60 - OpenROAD Physical Synthesis Flow - II](#)



[Lecture 1 - Introduction](#)

[Lecture 2 - Carson's Line](#)

[Lecture 3 - Carson's Line \(Continued...\)](#)

[Lecture 4 - Three-phase Transmission Line - 1](#)

[Lecture 5 - Three-phase Transmission Line - 2](#)

[Lecture 6 - Three-phase Transmission Line \(Continued...\)](#)

[Lecture 7 - Three-phase Transmission Line \(Continued...\)](#)

[Lecture 8 - Three-phase Transmission Line \(Continued...\)](#)

[Lecture 9 - Transposition of Transmission Line](#)

[Lecture 10 - Transposition of Transmission Line \(Continued...\)](#)

[Lecture 11 - Sequence impedance of Transmission Line](#)

[Lecture 12 - Sequence impedance of Transmission Line \(Continued...\)](#)

[Lecture 13 - Impedance of Transmission Line](#)

[Lecture 14 - Impedance of Transmission Line \(Continued...\)](#)

[Lecture 15 - Impedance of Transmission Line \(Continued...\)](#)

[Lecture 16 - Impedance of Transmission Line \(Continued...\)](#)

[Lecture 17 - Impedance of Transmission Line \(Continued...\)](#)

[Lecture 18 - Impedance of Transmission Line \(Continued...\)](#)

[Lecture 19 - Impedance of Transmission Line \(Continued...\)](#)

[Lecture 20 - Impedance of Transmission Line \(Continued...\)](#)

[Lecture 21 - Capacitance of Transmission Line](#)

[Lecture 22 - Capacitance of Transmission Line \(Continued...\)](#)

[Lecture 23 - Capacitance of Transmission Line \(Continued...\)](#)

[Lecture 24 - Capacitance of Transmission Line \(Continued...\)](#)

[Lecture 25 - Transformer Modeling \(Introduction,  \$Y\_g Y\_{g0}\$ \)](#)

[Lecture 26 - Transformer Modeling \( \$Y\_g Y\_{g0}\$ ,  \$Y\_g Y\_{g4}\$ \)](#)

[Lecture 27 - Transformer Modeling \( \$Y\_g D1\$ \)](#)

[Lecture 28 - Transformer Modeling \( \$Y\_g D1\$ ,  \$Y\_{D1}\$ \)](#)

[Lecture 29 - Transformer Modeling \( \$Y\_{D1}\$ \) \(Continued...\)](#)

[Lecture 30 - Transformer Modeling \( \$Y\_{D1}\$ \) \(Continued...\)](#)

[Lecture 31 - Transformer Modeling \( \$Y Y\_{g0}\$ ,  \$D\_{d0}\$ \)](#)

[Lecture 32 - Transformer Modeling \(Dd0, Overall Summary\)](#)

[Lecture 33 - Three-Phase Load Flow \(Network Modelling\)](#)

[Lecture 34 - Three-Phase Load Flow \(Formation of bus admittance matrix\)](#)

[Lecture 35 - Three-Phase Load Flow \(Formation of bus admittance matrix\) \(Continued...\)](#)

[Lecture 36 - Three-Phase Load Flow \(Formation of bus admittance matrix\) \(Continued...\)](#)

[Lecture 37 - Three-Phase Load Flow \(General expression of bus admittance matrix\)](#)

[Lecture 38 - Three-Phase Load Flow \(General expression of bus injected current\)](#)

[Lecture 39 - Three-Phase Load Flow \(Derivation of power flow equations\)](#)

[Lecture 40 - Three-Phase Load Flow \(Concept of Generator Internal Bus\)](#)

[Lecture 41 - Three-Phase Load Flow \(Unknown Quantities\)](#)

[Lecture 42 - Three-Phase Load Flow \(Classification of Unknown Quantities\)](#)

[Lecture 43 - Three-Phase Load Flow \(Classification of Known Quantities\)](#)

[Lecture 44 - Three-Phase Load Flow \(Equations Relating Known and Unknown Quantities\)](#)

[Lecture 45 - Three-Phase Load Flow \(NRLF Polar Method\)](#)

[Lecture 46 - Three-Phase Load Flow \(General Definitions and Dimensions of Jacobian Submatrices\)](#)

[Lecture 47 - Three-Phase Load Flow \(Derivation of J1\)](#)

[Lecture 48 - Three-Phase Load Flow \(Derivation of J1\) \(Continued...\)](#)

[Lecture 49 - Three-Phase Load Flow \(Derivation of J2\)](#)

[Lecture 50 - Three-Phase Load Flow \(Derivation of J3\)](#)

[Lecture 51 - Three-Phase Load Flow \(Derivation of J3\) \(Continued...\)](#)

[Lecture 52 - Three-Phase Load Flow \(Derivation of J4, J5, J6, J7, J8\)](#)

[Lecture 53 - Three-Phase Load Flow \(Derivation of J9\)](#)

[Lecture 54 - Three-Phase Load Flow \(Derivation of J9, J10\)](#)

[Lecture 55 - Three-Phase Load Flow \(Derivation of J11, J12\)](#)

[Lecture 56 - Three-Phase Load Flow \(Derivation of J13, J14, J15 and J16, Algorithm and Example\)](#)

[Lecture 57 - Three-Phase State Estimation \(Revision of WLS State Estimation Method for Balanced Systems\)](#)

[Lecture 58 - Three-Phase State Estimation \(Derivation of Measurement Functions for Unbalanced Systems\)](#)

[Lecture 59 - Three-Phase State Estimation \(Derivation of Measurement Functions for Unbalanced Systems\)](#)

[Lecture 60 - Three-Phase State Estimation \(General Structure of Jacobian Matrix, Example\)](#)

**NPTEL : NOC:Semiconductor Devices for Next Generation Field Effect Transistors (More than Moore): A Physics Perspective  
(Electrical Engineering)**

**Co-ordinators : Prof. Sudeb Dasgupta**

Lecture 1 - Introduction to Subject

Lecture 2 - Introduction of MOS and Energy Band Diagram - I

Lecture 3 - Introduction of MOS and Energy Band Diagram - II

Lecture 4 - Introduction of MOS

Lecture 5 - Introduction of MOS (3 Terminal)

Lecture 6 - MOS Capacitor - I

Lecture 7 - MOS Capacitor - II

Lecture 8 - Introduction to MOSFET

Lecture 9 - I-V Characteristics of MOSFETs - I

Lecture 10 - I-V Characteristics of MOSFETs - II

Lecture 11 - Capacitance Modeling for High and Low Frequency - I

Lecture 12 - Capacitance Modeling for High and Low Frequency - II

Lecture 13 - Capacitance Modeling for High and Low Frequency - III

Lecture 14 - High Frequency Modeling of MOSFET

Lecture 15 - Application of MOSFET

Lecture 16 - MOSFET Switch and Amplifier

Lecture 17 - Introduction to Spice

Lecture 18 - Spice sub Circuit Models

Lecture 19 - Spice Installation Setup

Lecture 20 - Spice Model Equations - I

Lecture 21 - Spice Model Equations - II

Lecture 22 - Spice Model Equations - III

Lecture 23 - Spice Models Some Examples

Lecture 24 - Carriers and Transportation

Lecture 25 - Introduction to Semiconductor Heterostructures - I

Lecture 26 - Introduction to Semiconductor Heterostructures - II

Lecture 27 - Introduction to Semiconductor Heterostructures - III

Lecture 28 - Band Diagram of Heterostructure

Lecture 29 - P N Heterojunction Diode

Lecture 30 - Leakage in MOSFET

# DIGIMAT - The No.1 Learning Management Platform for Creative Learning

[Lecture 31 - DIBL, GIDL, Channel Length Modulation, Source/Drain Series Resistance - I](#)

[Lecture 32 - DIBL, GIDL, Channel Length Modulation, Source/Drain Series Resistance - II](#)

[Lecture 33 - Velocity Saturation Effect, Velocity Overshoot, Ballistic Transport](#)

[Lecture 34 - Mobility Effects and Self Heating Effects](#)

[Lecture 35 - Introduction to Double Gate MOSFET](#)

[Lecture 36 - SOI MOSFET, Partially and Fully Depleted MOSFET](#)

[Lecture 37 - Subthreshold Swing and Transconductance](#)

[Lecture 38 - Small and Large Signal Modeling and Junctionless Transistors](#)

[Lecture 39 - Introduction to FinFETs Structure](#)

[Lecture 40 - Fabrication of FinFETs and HF Modeling](#)

[Lecture 41 - High-Frequency Small Signal Modeling](#)

[Lecture 42 - RLC FinFET Modeling](#)

[Lecture 43 - Gate All Around FETs, Device-Design Perspective](#)

[Lecture 44 - Gate All Around FETs](#)

[Lecture 45 - Nanosheet FET](#)

[Lecture 46 - Process Variation in Nanosheet FET](#)

[Lecture 47 - Negative Capacitance: Improved Subthreshold Swing - I](#)

[Lecture 48 - Negative Capacitance: Improved Subthreshold Swing - II](#)

[Lecture 49 - Introduction to Forksheet FET](#)

[Lecture 50 - Challenges of Forksheet FET](#)

[Lecture 51 - CFET Advancements and Industry Adoption](#)

[Lecture 52 - Design Challenges and CFET Optimization for Semiconductor Scaling](#)

[Lecture 53 - Introduction to Compound Semiconductor Materials](#)

[Lecture 54 - III-V Materials and Their Role for High-Speed Devices](#)

[Lecture 55 - III-V HEMT and its Modeling - I](#)

[Lecture 56 - III-V HEMT and its Modeling - II](#)

[Lecture 57 - III-V HEMT and its Modeling - III](#)

[Lecture 58 - Vertical High Electron Mobility Transistor](#)

[Lecture 59 - Introduction to 2D Semiconductor Materials](#)

[Lecture 60 - 2D Semiconductor Materials](#)

Lecture 1 - Robotics: Primer-Robot Anatomy and Terminology

Lecture 2 - Robotics: Primer-Kinematics and Dynamics

Lecture 3 - Back Stepping Control

Lecture 4 - Feedback Linearization

Lecture 5 - Lyapunov Stability

Lecture 6 - Introduction to Fuzzy Logic

Lecture 7 - Fuzzy Relations and Rule Base

Lecture 8 - Fuzzy Logic Control - I

Lecture 9 - Fuzzy Logic Control - II

Lecture 10 - T-S Fuzzy

Lecture 11 - Neural Network based Robot Control

Lecture 12 - Neural Adaptive Control of Robotics Systems

Lecture 13 - Neural Network based Feedback Linearization

Lecture 14 - Robust RBFN

Lecture 15 - NN based Hybrid Force/Position Control of Robot Manipulator

Lecture 16 - Introduction to Reinforcement Learning

Lecture 17 - Introduction to Search Methods

Lecture 18 - Introduction to Path Planning

Lecture 19 - Sampling based Path Planning Methods

Lecture 20 - Path Planning of Robotic Needle

Lecture 1 - Introduction and Objectives of the course

Lecture 2 - Definition of a system and history of semiconductors

Lecture 3 - Products and levels of packaging

Lecture 4 - Packaging aspects of handheld products; Case studies in applications

Lecture 5 - Case Study (continued); Definition of PWB, summary and Questions for review

Lecture 6 - Basics of Semiconductor and Process flowchart; Video on “Sand-to-Silicon”

Lecture 7 - Wafer fabrication, inspection and testing

Lecture 8 - Wafer packaging; Packaging evolution; Chip connection choices

Lecture 9 - Wire bonding, TAB and flipchip-1

Lecture 10 - Wire bonding, TAB and flipchip-2; Tutorials

Lecture 11 - Why packaging? & Single chip packages or modules (SCM)

Lecture 12 - Commonly used packages and advanced packages; Materials in packages

Lecture 13 - Advances packages (continued); Thermal mismatch in packages; Current trends in packaging

Lecture 14 - Multichip modules (MCM)-types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits; Quiz on packages

Lecture 15 - Electrical Issues “ I; Resistive Parasitic

Lecture 16 - Electrical Issues “ II; Capacitive and Inductive Parasitic

Lecture 17 - Electrical Issues “ III; Layout guidelines and the Reflection problem

Lecture 18 - Electrical Issues “ IV; Interconnection

Lecture 19 - Quick Tutorial on packages; Benefits from CAD; Introduction to DFM, DFR & DFT

Lecture 20 - Components of a CAD package and its highlights

Lecture 21 - Design Flow considerations; Beginning a circuit design with schematic work and component layout

Lecture 22 - Demo and examples of layout and routing; Technology file generation from CAD; DFM check list and design rules; Design for Reliability

Lecture 23 - Review of CAD output files for PCB fabrication; Photo plotting and mask generation

Lecture 24 - Process flow-chart; Vias; PWB substrates

Lecture 25 - Substrates continued; Video highlights; Surface preparation

Lecture 26 - Photoresist and application methods; UV exposure and developing; Printing technologies for PWBs

Lecture 27 - PWB etching; Resist stripping; Screen-printing technology

Lecture 28 - Through-hole manufacture process steps; Panel and pattern plating methods

Lecture 29 - Video highlights on manufacturing; Solder mask for PWBs; Multilayer PWBs; Introduction to microvias

Lecture 30 - Microvia technology and Sequential build-up technology process flow for high-density interconnects

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[Lecture 31 - Conventional Vs HDI technologies; Flexible circuits; Tutorial session](#)

[Lecture 32 - SMD benefits; Design issues; Introduction to soldering](#)

[Lecture 33 - Reflow and Wave Soldering methods to attach SMDs](#)

[Lecture 34 - Solders; Wetting of solders; Flux and its properties; Defects in wave soldering](#)

[Lecture 35 - Vapour phase soldering, BGA soldering and Desoldering/Repair; SMT failures](#)

[Lecture 36 - SMT failure library and Tin Whiskers](#)

[Lecture 37 - Tin-lead and lead-free solders; Phase diagrams; Thermal profiles for reflow soldering; Lead-free alloys](#)

[Lecture 38 - Lead-free solder considerations; Green electronics; RoHS compliance and e-waste recycling issues](#)

[Lecture 39 - Thermal Design considerations in systems packaging](#)

[Lecture 40 - Introduction to embedded passives; Need for embedded passives; Design Library; Embedded resistor processes](#)

[Lecture 41 - Embedded capacitors; Processes for embedding capacitors; Case study examples; Summary of materials in packaging](#)

[Lecture 42 - Chapter-wise summary](#)

Lecture 1 - Course introduction and overview

Lecture 2 - Distributed generation technologies

Lecture 3 - Distributed storage technologies

Lecture 4 - Distribution system protection

Lecture 5 - Circuit breaker coordination

Lecture 6 - Symmetrical component analysis and sequence excitation

Lecture 7 - Modeling of distribution system components

Lecture 8 - Protection components

Lecture 9 - Impact of distributed generation of distribution protection

Lecture 10 - Consumption and distribution grounding

Lecture 11 - Islanding of distribution systems

Lecture 12 - Modeling of islanded distribution systems

Lecture 13 - Distribution system problems and examples

Lecture 14 - Distribution system problems and examples continued

Lecture 15 - Anti-islanding methods

Lecture 16 - Solid state circuit switching

Lecture 17 - Relaying for distributed generation

Lecture 18 - Feeder voltage regulation

Lecture 19 - Grounding, distribution protection coordination problems and examples

Lecture 20 - Ring and network distribution

Lecture 21 - Economic evaluation of DG systems

Lecture 22 - Design for effective initial cost

Lecture 23 - Single phase inverters

Lecture 24 - DC bus design in voltage source inverter

Lecture 25 - Electrolytic capacitor reliability and lifetime

Lecture 26 - Inverter switching and average model

Lecture 27 - Common mode and differential mode model of inverters

Lecture 28 - Two leg single phase inverter

Lecture 29 - Distribution system problems, and examples

Lecture 30 - DG evaluation problems and examples

Lecture 31 - Switch selection in two level voltage source inverters and loss evaluation



[Lecture 32 - Thermal model, management and cycling failure of IGBT modules](#)

[Lecture 33 - Semiconductor switch design reliability considerations](#)

[Lecture 34 - AC filters for grid connected inverters](#)

[Lecture 35 - AC inductor design and need for LCL filter](#)

[Lecture 36 - LCL filter design](#)

[Lecture 37 - Examples in power electronic design for DG systems](#)

[Lecture 38 - Examples in power electronic design for DG systems continued](#)

[Lecture 39 - Higher order passive damping design for LCL filters](#)

[Lecture 40 - Balance of hardware component for inverters in DG systems](#)

Lecture 1 - Electronic switches

Lecture 2 - DC - DC converters

Lecture 3 - DC - AC converters

Lecture 4 - Multilevel converters - I

Lecture 5 - Multilevel converters - II

Lecture 6 - Applications of voltage source converter - I

Lecture 7 - Applications of voltage source converter - II

Lecture 8 - Applications of voltage source converter - III

Lecture 9 - Purpose of PWM - I

Lecture 10 - Purpose of PWM - II

Lecture 11 - Low switching frequency PWM - I

Lecture 12 - Low switching frequency PWM - II

Lecture 13 - Selective harmonic elimination

Lecture 14 - Off-line optimized pulsewidth modulation

Lecture 15 - Sine-triangle pulsewidth modulation

Lecture 16 - Harmonic injection pulsewidth modulation

Lecture 17 - Bus-clamping pulsewidth modulation

Lecture 18 - Triangle-comparison based PWM for three-phase inverter

Lecture 19 - Concept of space vector

Lecture 20 - Conventional space vector PWM

Lecture 21 - Space vector based bus-clamping PWM

Lecture 22 - Space vector based advanced bus-clamping PWM

Lecture 23 - Harmonic analysis of PWM techniques

Lecture 24 - Analysis of RMS line current ripple using the notion of stator flux ripple

Lecture 25 - Evaluation of RMS line current ripple using the notion of stator flux ripple

Lecture 26 - Analysis and design of PWM techniques from line current ripple perspective

Lecture 27 - Instantaneous and average dc link current in a voltage source inverter

Lecture 28 - DC link current and DC capacitor current in a voltage source inverter

Lecture 29 - Analysis of torque ripple in induction motor drives - I

Lecture 30 - Analysis of torque ripple in induction motor drives - II

Lecture 31 - Evaluation of conduction loss in three-phase inverter

[Lecture 32 - Evaluation of switching loss in three-phase inverter](#)

[Lecture 33 - Design of PWM for reduced switching loss in three-phase inverter](#)

[Lecture 34 - Effect of dead-time on inverter output voltage for continuous PWM schemes](#)

[Lecture 35 - Effect of dead-time on inverter output voltage for bus-clamping PWM schemes](#)

[Lecture 36 - Analysis of overmodulation in sine-triangle PWM from space vector perspective](#)

[Lecture 37 - Overmodulation in space vector modulated inverter](#)

[Lecture 38 - PWM for three-level neutral-point-clamped inverter - I](#)

[Lecture 39 - PWM for three-level neutral-point-clamped inverter - II](#)

[Lecture 40 - PWM for three-level neutral-point-clamped inverter - III](#)

**NPTEL : Switched Mode Power Conversion (Electrical Engineering)**

**Co-ordinators : Prof. L. Umanand, Prof. V. Ramanarayanan**

Lecture 1 - Introduction to DC-DC converter

Lecture 2 - Diode

Lecture 3 - Controlled Switches

Lecture 4 - Prior Art

Lecture 5 - Inductor

Lecture 6 - Transformer

Lecture 7 - Capacitor

Lecture 8 - Issues related to switches

Lecture 9 - Energy storage - Capacitor

Lecture 10 - Energy storage - Inductor

Lecture 11 - Primitive Converter

Lecture 12 - Non-Isolated converter - I

Lecture 13 - Non-Isolated converter - II

Lecture 14 - Isolated Converters - I

Lecture 15 - Isolated Converters - II

Lecture 16 - Conduction Mode

Lecture 17 - Problem set - I

Lecture 18 - Problem set - II

Lecture 19 - Modeling DC-DC converters

Lecture 20 - State space representation - I

Lecture 21 - State Space representation - II

Lecture 22 - Circuit Averaging - I

Lecture 23 - Circuit Averaging - II

Lecture 24 - State Space Model of Boost Converter

Lecture 25 - DC-DC converter controller

Lecture 26 - Controller Structure

Lecture 27 - PID Controller - I

Lecture 28 - PID Controller - II

Lecture 29 - PID Controller - III

Lecture 30 - Implementation of PID controller

Lecture 31 - Pulse Width Modulator

[Lecture 32 - Controller Design - I](#)

[Lecture 33 - Controller Design - II](#)

[Lecture 34 - Controllers and Sensing Circuit](#)

[Lecture 35 - Regulation of Multiple outputs - I](#)

[Lecture 36 - Regulation of Multiple outputs - II](#)

[Lecture 37 - Current Control](#)

[Lecture 38 - Unity Power Factor Converter](#)

[Lecture 39 - Magnetic Design](#)

[Lecture 40 - DC-DC Converter Design](#)

Lecture 1 - Basic Electrical Technology

Lecture 2 - Passive Components

Lecture 3 - Sources

Lecture 4 - Kirchoff's Law

Lecture 5 - Modelling of Circuit - Part 1

Lecture 6 - Modelling of Circuit - Part 2

Lecture 7 - Analysis Using MatLab

Lecture 8 - Sinusoidal steady state

Lecture 9 - Transfer Function and Pole Zero domain

Lecture 10 - Transfer function & pole zero

Lecture 11 - The Sinusoid

Lecture 12 - Phasor Analysis - Part 1

Lecture 13 - Phasor Analysis - Part 2

Lecture 14 - Power Factor

Lecture 15 - Power ports

Lecture 16 - Transformer Basics - Part 1

Lecture 17 - Transformer Basics - Part 2

Lecture 18 - Transformer Basics - Part 3

Lecture 19 - The Practical Transformer - Part 1

Lecture 20 - The Practical Transformer - Part 2

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Lecture 6 - Failure of apparatus in the field, importance of reliability and testing

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Lecture 8 - Planning of High Voltage laboratories

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Lecture 10 - Unique representation theorem

Lecture 11 - Basis and cardinality of basis

Lecture 12 - Norms and inner product spaces

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Lecture 15 - Orthonormality

Lecture 16 - Problem on sum of subspaces

Lecture 17 - Linear independence of orthogonal vectors

Lecture 18 - Hilbert space and linear transformation

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Lecture 25 - Operational Amplifier as a High Pass Filter

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