NPTEL : Nonlinear Dynamical Systems (Electrical Engineering)

Co-ordinators : Prof. Harish K. Pillai, Prof. Madhu N. Belur

Lecture 1 - Introduction

Lecture 2 - First Order systems

Lecture 3 - Classification of Equilibrium points

Lecture 4 - Lipschitz Functions

Lecture 5 - Existence/uniqueness theorems

Lecture 6 - Existence/uniqueness of solutions to differential equations

Lecture 7 - Lyapunov theorem on stability

Lecture 8 - Extension of Lyapunov's Theorem in different contexts

Lecture 9 - LaSalle's Invariance principle, Barbashin and Krasovski theorems, periodic orbits

Lecture 10 - Bendixson criterion and Poincare-Bendixson criterion. Example: Lotka Volterra predator prey model

Lecture 11 - Bendixson and Poincare-Bendixson criteria van-der-Pol Oscillator

Lecture 12 - Scilab simulation of Lotka Volterra predator prey model, van-der-Pol Oscillator Review of linearization, operating point/operating trajectory

Lecture 13 - Signals, operators

Lecture 14 - Norms of signals, systems (operators), Finite gain L2 stable

Lecture 15 - Nyquist plots and Nyquist criterion for stability

Lecture 16 - Interconnection between linear system & non-linearity, passive filters

Lecture 17 - Passive filters, Dissipation equality, positive real lemma

Lecture 18 - Positive real lemma proof

Lecture 19 - Definition for positive realness and Kalman Yakubovich-Popov Theorem

Lecture 20 - Kalman-Yakubovich-Popov Lemma/theorem and memoryless nonlinearities

Lecture 21 - Loop tranformations and circle criterion

Lecture 22 - Nonlinearities based on circle criterion

Lecture 23 - Limit cycles

Lecture 24 - Popov criterion continuous, frequency-domain theorem

Lecture 25 - Popov criterion continuous, frequency-domain theorem

Lecture 26 - Describing function method

Lecture 27 - Describing Function : 2

Lecture 28 - Describing : optimal gain

Lecture 29 - Describing : optimal gain

Lecture 30 - Describing functions : Jump Hysteresis

Lecture 31 - Describing functions : sufficient conditions for existence of periodic orbits non existence of periodic orbits

Lecture 32 - Describing functions for nonlinearities

Lecture 33 - Ideal relay with Hysteresis and dead zone

Lecture 34 - Dynamical systems on manifolds-1

Lecture 35 - Dynamical systems on manifolds-2

NPTEL : Power System Dynamics and Control (Electrical Engineering)

Co-ordinators : Dr. A.M. Kulkarni

Lecture 1 - Introduction

Lecture 2 - Introduction

Lecture 3 - Analysis of Dynamical Systems

Lecture 4 - Analysis of Dynamical Systems (Continued.)

Lecture 5 - Analysis of LINEAR Time Invariant Dynamical Systems

Lecture 6 - Analysis of LINEAR Time Invariant Dynamical Systems (Continued.)

Lecture 7 - Stiff Systems, Multi Time Scale Modeling

Lecture 8 - Numerical Integration

Lecture 9 - Numerical Integration (Continued.)

Lecture 10 - Numerical Integration (Continued.)

Lecture 11 - Modeling of Synchronous Machines

Lecture 12 - Modeling of Synchronous Machines (Continued.)

Lecture 13 - Modeling of Synchronous Machines (Continued.)

Lecture 14 - Modeling of Synchronous Machines. dq0 transformation (Continued.)

Lecture 15 - Modeling of Synchronous Machines. Standard Parameters

Lecture 16 - Modeling of Synchronous Machines. Standard Parameters

Lecture 17 - Synchronous Generator Models using Standard Parameters

Lecture 18 - Synchronous Generator Models using Standard Parameters. PER UNIT REPRESENTATION

Lecture 19 - Open Circuit Response of a Synchronous Generator

Lecture 20 - Synchronous Machine Modeling. Short Circuit Analysis (Continued.)

Lecture 21 - Synchronous Machine Modeling. Short Circuit Analysis (Continued.) Synchronization of a Synchronous Machine

Lecture 22 - Synchronization of a Synchronous Machine (Continued.)

Lecture 23 - Simplified Synchronous Machine Models

Lecture 24 - Excitation Systems

Lecture 25 - Excitation System Modeling

Lecture 26 - Excitation System Modeling. Automatic Voltage Regulator

Lecture 27 - Excitation System Modeling. Automatic Voltage Regulator (Continued.)

Lecture 28 - Excitation System Modeling. Automatic Voltage Regulator (Simulation)

Lecture 29 - Excitation System Modeling. Automatic Voltage Regulator (Simulation) â€“ (Continued.)

Lecture 30 - Excitation System Modeling. Automatic Voltage Regulator. Linearized Analysis

Lecture 31 - Load Modeling

Lecture 32 - Induction Machines, Transmission Lines

Lecture 33 - Transmission Lines. Prime Mover Systems

Lecture 34 - Transmission Lines (Continued.) Prime Mover Systems

Lecture 35 - Prime Mover Systems. Stability in Integrated Power System

Lecture 36 - Stability in Integrated Power System: Two Machine Example

Lecture 37 - Two Machine System (Continued.)

Lecture 38 - Stability in Integrated Power System: Large Systems

Lecture 39 - Frequency/Angular Stability Programs. Stability Phenomena: Voltage Stability Example

Lecture 40 - Voltage Stability Example (Continued.). Fast Transients: Tools and Phenomena

Lecture 41 - Torsional Transients: Phenomena of Sub-Synchronous Resonance

Lecture 42 - Sub-Synchronous Resonance. Stability Improvement

Lecture 43 - Stability Improvement

Lecture 44 - Stability Improvement. Power System Stabilizers

Lecture 45 - Stability Improvement (Large Disturbance Stability)

NPTEL : Control Engineering (Prof. S.D. Agashe) (Electrical Engineering)

Co-ordinators : Prof. S.D. Agashe

Lecture 1 - The Control Problem

Lecture 2 - Some More Examples

Lecture 3 - Different Kinds of Control Systems

Lecture 4 - History of Feedback

Lecture 5 - Modern Control Problems

Lecture 6 - DC Motor Speed Control

Lecture 7 - System Modelling, Analogy

Lecture 8 - Causes of System Error

Lecture 9 - Calculation of Error

Lecture 10 - Control System Sensitivity

Lecture 11 - Automatic Control of DC Motor

Lecture 12 - Proportional Control

Lecture 13 - Non-Unity Feedback

Lecture 14 - Signal-Flow Graph

Lecture 15 - Mason's Gain Formula

Lecture 16 - Signal-Flow Graph for DC Motor Control

Lecture 17 - Steady-State Calculations

Lecture 18 - Differential Equation Model and Laplace Transformation Model

Lecture 19 - D-Operator Method

Lecture 20 - Second-Order System Response

Lecture 21 - Frequency Response

Lecture 22 - Laplace Transformation Theorems

Lecture 23 - Final Value Theorem

Lecture 24 - Transfer Function and Pole-Zero Diagram

Lecture 25 - 'Good' Poles and 'Bad' Poles

Lecture 26 - Signal Flow Graph with Transfer Functions

Lecture 27 - s-Domain and t-Domain

Lecture 28 - Second-Order System Response in s-Domain

Lecture 29 - Integral Feedback

Lecture 30 - Root-Locus Method

Lecture 31 - Root-Locus Rules

Lecture 32 - Asymptotes of Root Locus

Lecture 33 - Routh Array

Lecture 34 - Singular Cases

Lecture 35 - Closed Loop Poles

Lecture 36 - Controller in the Forwarded Path

Lecture 37 - Mapping of Control in the Complex-Plane

Lecture 38 - Encirclement by a Curve

Lecture 39 - Nyquist Criterion

Lecture 40 - Application of the Nyquist Criterion

Lecture 41 - Polar Plot and Bode Plots

Lecture 42 - Logarithmic Scale for Frequency

Lecture 43 - 'Asymptotic' DB Gain

Lecture 44 - Compensating Network

Lecture 45 - Nichols' Chart

Lecture 46 - Time Domain Methods of Analysis and Design

Lecture 47 - State-Variable Equations

NPTEL : Power Electronics (Electrical Engineering)

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

Lecture 1 - Power Electronics

Lecture 2 - Power Electronics

Lecture 3 - Power Electronics

Lecture 4 - Power Electronics

Lecture 5 - Power Electronics

Lecture 6 - Power Electronics

Lecture 7 - Power Electronics

Lecture 8 - Power Electronics

Lecture 9 - Power Electronics

Lecture 10 - Power Electronics

Lecture 11 - Power Electronics

Lecture 12 - Power Electronics

Lecture 13 - Power Electronics

Lecture 14 - Power Electronics

Lecture 15 - Power Electronics

Lecture 16 - Power Electronics

Lecture 17 - Power Electronics

Lecture 18 - Power Electronics

Lecture 19 - Power Electronics

Lecture 20 - Power Electronics

Lecture 21 - Power Electronics

Lecture 22 - Power Electronics

Lecture 23 - Power Electronics

Lecture 24 - Power Electronics

Lecture 25 - Power Electronics

Lecture 26 - Power Electronics

Lecture 27 - Power Electronics

Lecture 28 - Power Electronics

Lecture 29 - Power Electronics

Lecture 30 - Power Electronics

Lecture 31 - Power Electronics

Lecture 32 - Power Electronics

Lecture 33 - Power Electronics

Lecture 34 - Power Electronics

Lecture 35 - Power Electronics

Lecture 36 - Power Electronics

Lecture 37 - Power Electronics

Lecture 38 - Power Electronics

Lecture 39 - Power Electronics

Lecture 40 - Power Electronics

Lecture 41 - Power Electronics

Lecture 42 - Power Electronics

Lecture 43 - Power Electronics

NPTEL : Fabrication of Silicon VLSI Circuits using the MOS technology (Electrical Engineering)

Co-ordinators : Prof. A.N. Chandorkar

Lecture 1 - Introduction Micro to Nano A Journey into Intergrated Circuit Technology

Lecture 2 - Introduction Micro to Nano A Journey into Intergrated Circuit Technology

Lecture 3 - Crystal Properties and Silico Growth

Lecture 4 - Crystal Properties and Silico Growth (Continued...)

Lecture 5 - IC Fab Labs and Fabrication of IC

Lecture 6 - Diffusion

Lecture 7 - Diffusion (Continued...)

Lecture 8 - Solid State Diffusion

Lecture 9 - Solid State Diffusion (Continued...)

Lecture 10 - Solid State Diffusion (Continued...)

Lecture 11 - Thermal Oxidation of Silicons

Lecture 12 - Thermal Oxidation of Silicons

Lecture 13 - Thermal Oxidation of Silicons

Lecture 14 - Thermal Oxidation of Silicons (Continued...)

Lecture 15 - Thermal Oxidation of Silicons (Continued...)

Lecture 16 - Lithography

Lecture 17 - Lithography

Lecture 18 - Lithography

Lecture 19 - ION Implantation

Lecture 20 - ION Implantation

Lecture 21 - ION Implantation and Silicon IC Processing Flow for CMOS Technology

Lecture 22 - ION Implantation and Silicon IC Processing Flow for CMOS Technology

Lecture 23 - Silicon IC Processing Flow for CMOS Technology

Lecture 24 - Thin Film Deposition

Lecture 25 - Thin Film Deposition

Lecture 26 - Thin Film Deposition

Lecture 27 - Thin Film Deposition and Etching in VLSI Processing

Lecture 28 - Etching in VLSI Processing and Back -End Technology

NPTEL : NOC:Computational Electromagnetics and Applications (Electrical Engineering)

Co-ordinators : Prof.Krish Sankaran

Lecture 1 - Lecture 1

Lecture 2 - Lecture 2

Lecture 3 - Lecture 3

Lecture 4 - Exercise 1

Lecture 5 - Exercise 2

Lecture 6 - Exercise 3

Lecture 7 - Lab Tour 1

Lecture 8 - Summary week 1

Lecture 9 - Lecture 4

Lecture 10 - Lecture 5

Lecture 11 - Exercise 4

Lecture 12 - Exercise 5

Lecture 13 - Exercise 6

Lecture 14 - Summary Week 2

Lecture 15 - Lecture 6

Lecture 16 - Lecture 7

Lecture 17 - Lecture 8

Lecture 18 - Exercise 7

Lecture 19 - Exercise 8

Lecture 20 - Summary Week 3

Lecture 21 - Lecture 9

Lecture 22 - Lecture 10

Lecture 23 - Lecture 11

Lecture 24 - Lecture 12

Lecture 25 - Lecture 13

Lecture 26 - Lecture 14

Lecture 27 - Exercise 9

Lecture 28 - Lab Tour - 2

Lecture 29 - Summary Week 4

Lecture 30 - Lecture 15

Lecture 31 - Lecture 16

Lecture 32 - Lecture 17

Lecture 33 - Lecture 18

Lecture 34 - Exercise 10

Lecture 35 - Summary week 5

Lecture 36 - Lecture 19

Lecture 37 - Lecture 20

Lecture 38 - Lecture 21

Lecture 39 - Lecture 22

Lecture 40 - Exercise 11

Lecture 41 - Summary week 6

Lecture 42 - Exercise 12

Lecture 43 - Exercise 13

Lecture 44 - Exercise 14

Lecture 45 - Exercise 15

Lecture 46 - Exercise 16

Lecture 47 - Exercise 17

Lecture 48 - Summary week 7

Lecture 49 - Lecture 23

Lecture 50 - Lecture 24

Lecture 51 - Lecture 25

Lecture 52 - Exercise 18

Lecture 53 - Exercise 19

Lecture 54 - Lab tour 3

Lecture 55 - Summary week 8

Lecture 56 - Lecture 26

Lecture 57 - Lecture 27

Lecture 58 - Lecture 28

Lecture 59 - Lecture 29

Lecture 60 - Lecture 30

Lecture 61 - Lecture 31

Lecture 62 - Lab tour 4

Lecture 63 - Summary week 9

Lecture 64 - Lecture 32

Lecture 65 - Lecture 33

Lecture 66 - Lecture 34

Lecture 67 - Lecture 35

Lecture 68 - Exercise 20

Lecture 69 - Lab tour 5

Lecture 70 - Summary week 10

Lecture 71 - Lecture 36

Lecture 72 - Lecture 37

Lecture 73 - Lecture 38

Lecture 74 - Lecture 39

Lecture 75 - Lecture 40

Lecture 76 - Summary week 11

Lecture 77 - Lecture 41

Lecture 78 - Lecture 42

Lecture 79 - Lecture 43

Lecture 80 - Lecture 44

Lecture 81 - Exercise 21

Lecture 82 - Exercise 22

Lecture 83 - Summary week 12

NPTEL : NOC:Basic Electronics (Electrical Engineering)

Co-ordinators : Prof. Mahesh B. Patil

Lecture 1 - A brief history of electronics

Lecture 2 - Superposition

Lecture 3 - Useful circuit techniques - 1

Lecture 4 - Useful circuit techniques - 2

Lecture 5 - Phasors - 1

Lecture 6 - Phasors - 2

Lecture 7 - RC/RL circuits in time domain - 1

Lecture 8 - RC/RL circuits in time domain - 2

Lecture 9 - RC/RL circuits in time domain - 3

Lecture 10 - RC/RL circuits in time domain - 4

Lecture 11 - RC/RL circuits in time domain - 5

Lecture 12 - Simulation of RC circuit

Lecture 13 - Diode circuits - 1

Lecture 14 - Diode circuits - 2

Lecture 15 - Diode circuits - 3

Lecture 16 - Diode circuits - 4

Lecture 17 - Diode circuits - 5

Lecture 18 - Diode circuits - 6

Lecture 19 - Diode rectifiers - 1

Lecture 20 - Diode rectifiers - 2

Lecture 21 - Diode rectifiers - 3

Lecture 22 - Bipolar Junction Transistor - 1

Lecture 23 - Bipolar Junction Transistor - 2

Lecture 24 - Bipolar Junction Transistor - 3

Lecture 25 - BJT amplifier - 1

Lecture 26 - BJT amplifier - 2

Lecture 27 - BJT amplifier - 3

Lecture 28 - BJT amplifier - 4

Lecture 29 - BJT amplifier - 5

Lecture 30 - BJT amplifier - 6

Lecture 31 - BJT amplifier - 7

Lecture 32 - Introduction to op-amps

Lecture 33 - Op-amp circuits - 1

Lecture 34 - Op-amp circuits - 2

Lecture 35 - Op-amp circuits - 3

Lecture 36 - Difference amplifier

Lecture 37 - Instrumentation amplifier - 1

Lecture 38 - Instrumentation amplifier - 2

Lecture 39 - Op-amp nonidealities - 1

Lecture 40 - Op-amp nonidealities - 2

Lecture 41 - Bode plots - 1

Lecture 42 - Bode plots - 2

Lecture 43 - Bode plots - 3

Lecture 44 - Op-amp filters

Lecture 45 - Simulation of op-amp filter

Lecture 46 - Precision rectifiers - 1

Lecture 47 - Precision rectifiers - 2

Lecture 48 - Precision rectifiers - 3

Lecture 49 - Simulation of triangle-to-sine converter

Lecture 50 - Schmitt triggers - 1

Lecture 51 - Schmitt triggers - 2

Lecture 52 - Schmitt triggers - 3

Lecture 53 - Sinusoidal oscillators - 1

Lecture 54 - Sinusoidal oscillators - 2

Lecture 55 - Introduction to digital circuits

Lecture 56 - Boolean algebra

Lecture 57 - Karnaugh maps

Lecture 58 - Combinatorial circuits - 1

Lecture 59 - Combinatorial circuits - 2

Lecture 60 - Combinatorial circuits - 3

Lecture 61 - Introduction to sequential circuits

Lecture 62 - Latch and flip-flop

Lecture 63 - JK flip-flop

Lecture 64 - D flip-flop

Lecture 65 - Shift registers

Lecture 66 - Counters - 1

Lecture 67 - Counters - 2

Lecture 68 - Simulation of a synchronous counter

Lecture 69 - 555 timer

Lecture 70 - Digital-to-analog conversion - 1

Lecture 71 - Digital-to-analog conversion - 2

Lecture 72 - Analog-to-digital conversion

NPTEL : NOC:Antennas (Electrical Engineering)

Co-ordinators : Prof. Girish Kumar

Lecture 1 - Antenna Introduction - I

Lecture 2 - Antenna Introduction - II

Lecture 3 - Antenna Introduction - III

Lecture 4 - Antenna Fundamentals - I

Lecture 5 - Antenna Fundamentals - II

Lecture 6 - Antenna Radiation Hazards - I

Lecture 7 - Antenna Radiation Hazards - II

Lecture 8 - Dipole Antennas - I

Lecture 9 - Dipole Antennas - II

Lecture 10 - Dipole Antennas - III

Lecture 11 - Monopole Antennas - I

Lecture 12 - Monopole Antennas - II

Lecture 13 - Loop Antennas

Lecture 14 - Slot Antennas

Lecture 15 - Linear Arrays - I

Lecture 16 - Linear Arrays - II

Lecture 17 - Linear Arrays - III

Lecture 18 - Planar Arrays

Lecture 19 - Microstrip Antennas (MSA)

Lecture 20 - Rectangular MSA

Lecture 21 - MSA Parametric Analysis - I

Lecture 22 - MSA Parametric Analysis - II

Lecture 23 - Circular MSA

Lecture 24 - Broadband MSA - I

Lecture 25 - Broadband MSA - II

Lecture 26 - Broadband MSA - III

Lecture 27 - Broadband MSA - IV

Lecture 28 - Broadband MSA - V

Lecture 29 - Compact MSA - I

Lecture 30 - Compact MSA - II

Lecture 31 - Compact MSA - III

Lecture 32 - Tunable MSA - I

Lecture 33 - Tunable MSA - II

Lecture 34 - Circularly Polarized MSA - I

Lecture 35 - Circularly Polarized MSA - II

Lecture 36 - Circularly Polarized MSA - III

Lecture 37 - MSA Arrays - I

Lecture 38 - MSA Arrays - II

Lecture 39 - MSA Arrays - III

Lecture 40 - Helical Antennas - I

Lecture 41 - Helical Antennas - II

Lecture 42 - Helical Antennas - III

Lecture 43 - Helical Antennas - IV

Lecture 44 - Helical Antennas - V

Lecture 45 - Horn Antennas - I

Lecture 46 - Horn Antennas - II

Lecture 47 - Horn Antennas - III

Lecture 48 - Horn Antennas - IV

Lecture 49 - Horn Antennas - V

Lecture 50 - Yagi-Uda and Log-Periodic Antennas - I

Lecture 51 - Yagi-Uda and Log-Periodic Antennas - II

Lecture 52 - Yagi-Uda and Log-Periodic Antennas - III

Lecture 53 - IE3D Session TA - I

Lecture 54 - IE3D Session TA - II

Lecture 55 - IE3D Session TA - III

Lecture 56 - Reflector Antennas - I

Lecture 57 - Reflector Antennas - II

Lecture 58 - Reflector Antennas - III

Lecture 59 - Reflector Antennas - IV

Lecture 60 - Lab Session

NPTEL : NOC:Fundamentals of Wavelets, Filter Banks and Time Frequency Analysis (Electrical Engineering)

Co-ordinators : Prof. V.M. Gadre

Lecture 1 - Module 1 - Lecture 1 - Introduction

Lecture 2 - Module 1 - Lecture 2 - Origin of Wavelets

Lecture 3 - Module 1 - Lecture 3 - Haar Wavelet

Lecture 4 - Module 2 - Lecture 1 - Dyadic Wavelet

Lecture 5 - Module 2 - Lecture 2 - Dilates and Translates of Haar Wavelets

Lecture 6 - Module 2 - Lecture 3 - L2 Norm of a Function

Lecture 7 - Module 3 - Lecture 1 - Piecewise Constant Representation of a Function

Lecture 8 - Module 3 - Lecture 2 - Ladder of Subspaces

Lecture 9 - Module 3 - Lecture 3 - Scaling Function for Haar Wavelet Demo

Lecture 10 - Demonstration 1: Piecewise constant approximation of functions

Lecture 11 - Module 4 - Lecture 1 - Vector Representation of Sequences

Lecture 12 - Module 4 - Lecture 2 - Properties of Norm

Lecture 13 - Module 4 - Lecture 3 - Parseval's Theorem

Lecture 14 - Module 5 - Lecture 1 - Equivalence of sequences and functions

Lecture 15 - Module 5 - Lecture 2 - Angle between Functions and their Decomposition

Lecture 16 - Demonstration 2: Additional Information on Direct-Sum

Lecture 17 - Module 6 - Lecture 1 - Introduction to filter banks

Lecture 18 - Module 6 - Lecture 2 - Haar Analysis Filter Bank in Z-domain

Lecture 19 - Module 6 - Lecture 3 - Haar Synthesis Filter Bank in Z-domain

Lecture 20 - Module 7 - Lecture 1 - Moving from Z-domain to frequency domain

Lecture 21 - Module 7 - Lecture 2 - Frequency Response of Haar Analysis Low pass Filter bank

Lecture 22 - Module 7 - Lecture 3 - Frequency Response of Haar Analysis High pass Filter bank

Lecture 23 - Module 8 - Lecture 1 - Ideal two-band filter bank

Lecture 24 - Module 8 - Lecture 2 - Disqualification of Ideal filter bank

Lecture 25 - Module 8 - Lecture 3 - Realizable two-band filter bank

Lecture 26 - Demonstration 3: Demonstration: DWT of images

Lecture 27 - Module 9 - Lecture 1 - Relating Fourier transform of scaling function to filter bank

Lecture 28 - Module 9 - Lecture 2 - Fourier transform of scaling function

Lecture 29 - Module 9 - Lecture 3 - Construction of scaling and wavelet functions from filter bank

Lecture 30 - Demonstration 4: Demonstration: Constructing scaling and wavelet functions

Lecture 31 - Module 10 - Lecture 1 - Introduction to upsampling and down sampling as Multirate operations

Lecture 32 - Module 10 - Lecture 2 - Up sampling by a general factor M- a Z-domain analysis.

Lecture 33 - Module 10 - Lecture 3 - Down sampling by a general factor M- a Z-domain analysis

Lecture 34 - Module 11 - Lecture 1 - Z domain analysis of 2 channel filter bank.

Lecture 35 - Module 11 - Lecture 2 - Effect of X (-Z) in time domain and aliasing

Lecture 36 - Module 11 - Lecture 3 - Consequences of aliasing and simple approach to avoid it

Lecture 37 - Module 12 - Lecture 1 - Revisiting aliasing and the Idea of perfect reconstruction

Lecture 38 - Module 12 - Lecture 2 - Applying perfect reconstruction and alias cancellation on Haar MRA

Lecture 39 - Module 12 - Lecture 3 - Introduction to Daubechies family of MRA

Lecture 40 - Module 13 - Lecture 1 - Power Complementarity of low pass filter

Lecture 41 - Module 13 - Lecture 2 - Applying perfect reconstruction condition to obtain filter coefficient

Lecture 42 - Module 14 - Lecture 1 - Effect of minimum phase requirement on filter coefficients

Lecture 43 - Module 14 - Lecture 2 - Building compactly supported scaling functions

Lecture 44 - Module 14 - Lecture 3 - Second member of Daubechies family

Lecture 45 - Module 15 - Lecture 1 - Fourier transform analysis of Haar scaling and Wavelet functions

Lecture 46 - Module 15 - Lecture 2 - Revisiting Fourier Transform and Parseval's theorem

Lecture 47 - Module 15 - Lecture 3 - Transform Analysis of Haar Wavelet function

Lecture 48 - Module 16 - Lecture 1 - Nature of Haar scaling and Wavelet functions in frequency domain

Lecture 49 - Module 16 - Lecture 2 - The Idea of Time-Frequency Resolution

Lecture 50 - Module 16 - Lecture 3 - Some thoughts on Ideal time- frequency domain behavior

Lecture 51 - Module 17 - Lecture 1 - Defining Probability Density function

Lecture 52 - Module 17 - Lecture 2 - Defining Mean, Variance and Â“containment in a given domainÂ”

Lecture 53 - Module 17 - Lecture 3 - Example: Haar Scaling function

Lecture 54 - Module 17 - Lecture 4 - Variance from a slightly different perspective

Lecture 55 - Module 18 - Lecture 1 - Signal transformations: effect on mean and variance

Lecture 56 - Module 18 - Lecture 2 - Time-Bandwidth product and its properties

Lecture 57 - Module 18 - Lecture 3 - Simplification of Time-Bandwidth formulae

Lecture 58 - Module 19 - Lecture 1 - Introduction

Lecture 59 - Module 19 - Lecture 2 - Evaluation of Time-Bandwidth product

Lecture 60 - Module 19 - Lecture 3 - Optimal function in the sense of Time-Bandwidth product

Lecture 61 - Module 20 - Lecture 1 - Discontent with the Â“Optimal functionÂ”.

Lecture 62 - Module 20 - Lecture 2 - Journey from infinite to finite Time-Bandwidth product of Haar scaling function

Lecture 63 - Module 20 - Lecture 3 - More insights about Time-Bandwidth product

Lecture 64 - Module 20 - Lecture 4 - Time-frequency plane

Lecture 65 - Module 20 - Lecture 5 - Tiling the Time-frequency plane

Lecture 66 - Module 21 - Lecture 1 - STFT: Conditions for valid windows

Lecture 67 - Module 21 - Lecture 2 - STFT: Time domain and frequency domain formulations

Lecture 68 - Module 21 - Lecture 3 - STFT: Duality in the interpretations

Lecture 69 - Module 21 - Lecture 4 - Continuous Wavelet Transform (CWT)

Lecture 70 - Demonstration 5

Lecture 71 - StudentÂ’s Presentation

NPTEL : NOC:Analog Circuits (2017) (Electrical Engineering)

Co-ordinators : Prof. Jayanta Mukherjee

Lecture 1 - Module 1 - Introduction

Lecture 2 - Module 2 - Poles and zeros

Lecture 3 - Module 3 - OP-AMPs

Lecture 4 - Module 4 - Application of Op-Amps

Lecture 5 - Module 5 - Inverting amplifier and Non Inverting amplifier

Lecture 6 - Module 1 - Non Idealities in Op-AMP (Finite Gain, Finite Bandwidth and Slew Rate)

Lecture 7 - Module 2 - Non Idealities in Op-AMP (Offset Voltage and Bias Current)

Lecture 8 - Module 3 - Bode Plot

Lecture 9 - Module 4 - Frequency Response

Lecture 10 - Module 1 - Frequency Response (High Frequency Response)

Lecture 11 - Module 2 - Frequency Response example

Lecture 12 - Module 3 - Feedback

Lecture 13 - Module 4 - Effects of Feedback

Lecture 14 - Tutorial 1 and 2

Lecture 15 - Module 1 - Effect of feedback and stability

Lecture 16 - Module 2 - Stability

Lecture 17 - Module 3 - Stability and pole location

Lecture 18 - Module 4 - Stability and Pole location continuation

Lecture 19 - Tutorial 3

Lecture 20 - Module 1 - Gain Margin Â– An example

Lecture 21 - Module 2 - Frequency Compensation

Lecture 22 - Module 3 - Filters

Lecture 23 - Module 4 - Filter prototypes

Lecture 24 - Tutorial 4

Lecture 25 - Tutorial 5

Lecture 26 - Tutorial 6

Lecture 27 - Module 1 - Chebyshev Prototype, Filter transformation

Lecture 28 - Module 2 - Filter Transformations (Continued....)

Lecture 29 - Module 3 - Active Filters

Lecture 30 - Module 4 - Non Linear Applications of OPAMPS

Lecture 31 - Module 5 - Limiter, Diodes

Lecture 32 - Module 1 - Oscillators

Lecture 33 - Module 2 - Oscillator Amplitude Control , Quadrature Oscillator

Lecture 34 - Module 3 - Multivibrators

Lecture 35 - Module 4 - Multivibrators (Continued...)

Lecture 36 - Module 5 - Monostable Multivibrator

Lecture 37 - Module 1 - Zener Effect, Rectifiers

Lecture 38 - Module 2 - Rectifiers

Lecture 39 - Module 3 - Clamper, Peak Rectifier, Super diodes

Lecture 40 - Module 4 - BJT DC Circuits

Lecture 41 - Module 5 - Current Mirror

NPTEL : NOC:Microwave Theory and Techniques (Electrical Engineering)

Co-ordinators : Prof. Girish Kumar

Lecture 1 - Microwave Theory and Techniques Introduction - I

Lecture 2 - Microwave Theory and Techniques Introduction - II

Lecture 3 - Microwave Theory and Techniques Introduction - III

Lecture 4 - Effects of Microwaves on Human Body - I

Lecture 5 - Effects of Microwaves on Human Body - II

Lecture 6 - Waveguides - I: Parallel Plane Waveguides

Lecture 7 - Waveguides - II: Parallel Plane Waveguides

Lecture 8 - Waveguides - III: Rectangular Waveguides

Lecture 9 - Transmission Lines - I: Coaxial Cables, Strip Lines and Microstrip Lines

Lecture 10 - Transmission Lines - II: Transmission Line Model, Open and Short Circuited Lossless Transmission Lines

Lecture 11 - Smith Chart and Impedance Matching - I: using Quarter Wave Transformer

Lecture 12 - Smith Chart and Impedance Matching - II: using Lumped Components

Lecture 13 - Smith Chart and Impedance Matching - III: using Short and Open Circuited Stubs

Lecture 14 - ABCD - Parameters

Lecture 15 - S - Parameters

Lecture 16 - Power Dividers - I: Two-way, Three-way and Four-way Equal Power Dividers

Lecture 17 - Power Dividers - II: Unequal, Broadband and Compact Power Dividers

Lecture 18 - Microwave Couplers - I: Coupled Line Directional Couplers

Lecture 19 - Microwave Couplers - II: Branch Line Couplers

Lecture 20 - Microwave Couplers - III: Rat race Coupler and Applications

Lecture 21 - Microwave Filters - I: Filters and Low Pass Butterworth Filter

Lecture 22 - Microwave Filters - II: Low Pass Chebyshev Filters

Lecture 23 - Microwave Filters - III: Microstrip Realization, Transformation from LPF to other Filters

Lecture 24 - Microwave Filters - IV: Band Pass Filters

Lecture 25 - Microwave Filters - V: Coupled Line and Tunable Band Pass Filters

Lecture 26 - Microwave Diodes: PN Junction , Varactor, Schottky, PIN, Tunnel, and GUNN Diodes

Lecture 27 - Microwave Attenuators: Fixed and Variable Attenuators

Lecture 28 - Microwave RF Switches: Series and Shunt SPST

Lecture 29 - Series and Shunt SPDT Switches and Introduction to Phase Shifters

Lecture 30 - Microwave Phase Shifters: Switched and Loaded Line

Lecture 31 - Microwave Transistors: BJT, HBT, JFET, MOSFET, MESFET and HEMT

Lecture 32 - Microwave Amplifiers - I: Basics and Power Gain Expressions

Lecture 33 - Microwave Amplifiers - II: Stability and Constant Gain Circles

Lecture 34 - Microwave Amplifiers - III: Design Example

Lecture 35 - Low Noise Amplifiers - I: Noise Sources and Noise Figure

Lecture 36 - Low Noise Amplifiers - II: NF Circles and LNA Design

Lecture 37 - Power Amplifiers

Lecture 38 - Microwave Tubes - I : Linear Beam Tubes- Two Cavity Klystron

Lecture 39 - Microwave Tubes - II: Linear Beam Tubes- Reflex Klystron and TWT

Lecture 40 - Microwave Tubes - III: Crossed Field Tubes- Magnetron

Lecture 41 - Microwave Oscillators - I

Lecture 42 - Microwave Oscillators - II

Lecture 43 - Microwave Mixers - I: Fundamentals

Lecture 44 - Microwave Mixers - II: Circuits

Lecture 45 - Microwave Mixers - III: Design

Lecture 46 - Fundamentals of Antennas

Lecture 47 - Dipole, Monopole, loop and Slot Antennas

Lecture 48 - Linear and Planar Arrays

Lecture 49 - Microstrip Antennas

Lecture 50 - Horn and Helical Antennas

Lecture 51 - Yagi - Uda, Log-Periodic and Reflector Antennas

Lecture 52 - RF MEMS and Microwave Imaging

Lecture 53 - Microwave Systems

Lecture 54 - Microwave Measurements and Lab Demonstration

Lecture 55 - CST Software Introduction with Filter Design

Lecture 56 - Power Divider and Combiner Design in CST

Lecture 57 - Hybrid Coupler Design

Lecture 58 - Antenna Design and Amplifier Simulation in CST

Lecture 59 - Mixer Design in NI AWR Software - I

Lecture 60 - Mixer Design in NI AWR Software - II

NPTEL : NOC:Principles of Digital Communications (Electrical Engineering)

Co-ordinators : Prof. S.N. Merchant

Lecture 1 - Course Overview

Lecture 2 - Introduction to Information Theory

Lecture 3 - Entropy and its properties

Lecture 4 - Lossless Source Coding Theorem

Lecture 5 - Prefix Codes and Kraftâ€™s Inequality

Lecture 6 - Huffman Coding

Lecture 7 - Discrete Memory-less Channels : Mutual Information

Lecture 8 - Channel Capacity - I

Lecture 9 - Channel Capacity - II

Lecture 10 - Channel Coding Theorem

Lecture 11 - Differential Entropy - I

Lecture 12 - Differential Entropy - II

Lecture 13 - Channel Capacity - III

Lecture 14 - Channel Capacity - IV

Lecture 15 - Summary of Information Theory

Lecture 16 - Signal Space Representations - I

Lecture 17 - Signal Space Representations - II

Lecture 18 - Vector Representation of a Random Process

Lecture 19 - AWGN Vector Channel

Lecture 20 - Basics of Signal Detection: ML,MAP Detection

Lecture 21 - ML,MAP Detectors for AWGN Channel

Lecture 22 - Optimal Receiver: Matched Filter

Lecture 23 - Probability of error for Optimal Receiver

Lecture 24 - Probability of Error for M-ary Scheme

Lecture 25 - Pulse Code Modulation: Quantization

Lecture 26 - Uniform Quantizer

Lecture 27 - Step Size and Quantization Noise

Lecture 28 - Non-uniform Quantizer (Lloyd-Max Quantizer)

Lecture 29 - Companded Quantization - I

Lecture 30 - Companded Quantization - II

Lecture 31 - Differential Pulse Code Modulation DPCM - I

Lecture 32 - DPCM-II (Linear Prediction)

Lecture 33 - Delta Modulation

Lecture 34 - M-ary PCM/PAM - I

Lecture 35 - M-ary PCM/PAM - II

Lecture 36 - Line Coding - I

Lecture 37 - Line Coding - II

Lecture 38 - Line Coding - III

Lecture 39 - Pulse Shaping for Zero ISI - I

Lecture 40 - Pulse Shaping for Zero ISI - II

Lecture 41 - Pulse Shaping for Zero ISI - III

Lecture 42 - Partial Response Signaling - I

Lecture 43 - Partial Response Signaling - II

Lecture 44 - Principle of Invariance of Probability of Error

Lecture 45 - Binary ASK and PSK

Lecture 46 - Binary Frequency Shift Keying - I

Lecture 47 - Binary Frequency Shift Keying - II

Lecture 48 - Quadrature Phase Shift Keying - I

Lecture 49 - Quadrature Phase Shift Keying - II

Lecture 50 - Quadrature Phase Shift Keying - III

Lecture 51 - Continuous Phase Frequency Shift Keying

Lecture 52 - Minimum Shift Keying - I

Lecture 53 - Minimum Shift Keying - II

Lecture 54 - M-ary Coherent ASK (M-ASK)

Lecture 55 - M-ary PSK

Lecture 56 - M-ary Quadrature Amplitude Modulation (M-QAM)

Lecture 57 - M-ary FSK

Lecture 58 - Comparison of M-ary Schemes

Lecture 59 - Non-coherent BFSK

Lecture 60 - Differential Phase Shift Keying

Lecture 61 - Channel Coding - I

Lecture 62 - Channel Coding - II

Lecture 63 - Channel Coding - III

Lecture 64 - Channel Coding: Hamming Codes

Lecture 65 - Channel Coding: Decoding using Standard Arrays

NPTEL : NOC:Fundamental of Power Electronics (Electrical Engineering)

Co-ordinators : Prof. Vivek Agarwal

Lecture 1 - Familiarization with Power Electronic Systems

Lecture 2 - Overview of Basic Power Electronic Circuits from Laymans Point of View

Lecture 3 - Applications, Definitions, and Nature of Power Electronic Circuits

Lecture 4 - Components of a Power Electronic System

Lecture 5 - Analysis of Switched Networks

Lecture 6 - Review of engineering maths for power electronic circuit analysis

Lecture 7 - Review of semiconductor physics

Lecture 8 - P-N Junction

Lecture 9 - Power Diodes

Lecture 10 - Thyristors

Lecture 11 - Motivation for rectifier capacitor filter

Lecture 12 - Circuit Operation

Lecture 13 - Designing the circuit

Lecture 14 - Simulation setup for NgSpice and gEDA schematic capture

Lecture 15 - Simulating the circuit

Lecture 16 - Practicals

Lecture 17 - Inrush current limiting - Intro

Lecture 18 - Inrush current limiting - Resistor solution

Lecture 19 - Inrush current limiting - Thermistor solution

Lecture 20 - Inrush current limiting - Transformer solution

Lecture 21 - Inrush current limiting - MOSFET solution

Lecture 22 - Inrush current limiting - Relay, contactor

Lecture 23 - Three phase rectifier capacitor filter

Lecture 24 - Simulation - 3 phase rectifier capacitor filter

Lecture 25 - Power factor - Motivation

Lecture 26 - Power factor - Discussion

Lecture 27 - Power factor - Sinusoidal

Lecture 28 - Power factor for rectifier cap filter

Lecture 29 - Passive power improvement circuit

Lecture 30 - Simulation - power factor improvement

Lecture 31 - Linear regulators - Intro

Lecture 32 - Shunt regulator

Lecture 33 - Example on shunt regulator

Lecture 34 - Non-ideality and solution

Lecture 35 - Applications of shunt regulator

Lecture 36 - Series regulator

Lecture 37 - Efficiency of series

Lecture 38 - Negative and dual voltage regulators

Lecture 39 - Over current limiting circuits

Lecture 40 - Improvements to series regulator

Lecture 41 - Regulator performance parameters

Lecture 42 - Datasheet of few IC regulators

Lecture 43 - Common IC regulator circuits

Lecture 44 - Practicals 1

Lecture 45 - Switched mode DC-DC converter intro

Lecture 46 - Volt-sec and Amp-sec balance

Lecture 47 - Input-output relationship

Lecture 48 - Buck converter - operation and waveforms

Lecture 49 - Buck converter - component selection

Lecture 50 - Primary configurations

Lecture 51 - Boost converter

Lecture 52 - Buck-Boost converter

Lecture 53 - Simulating the primary converters

Lecture 54 - Forward converter

Lecture 55 - Core reset in forward converter

Lecture 56 - Simulating with lossy core reset

Lecture 57 - Simulating with lossless core reset

Lecture 58 - Flyback converter

Lecture 59 - Simulating the flyback converter

Lecture 60 - Octave mfile for design

Lecture 61 - Magnetics design intro

Lecture 62 - Magnetics review

Lecture 63 - Permeance

Lecture 64 - Inductor value and energy storage

Lecture 65 - Inductor area product

Lecture 66 - Inductor design

Lecture 67 - Inductor example

Lecture 68 - Transformer design

Lecture 69 - Transformer example

Lecture 70 - Forward converter design mfile

Lecture 71 - Pushpull converter

Lecture 72 - Flux walking in pushpull

Lecture 73 - PWM generation

Lecture 74 - Simulation of pushpull converter

Lecture 75 - Half bridge converter

Lecture 76 - Simulation of halfbridge converter

Lecture 77 - Full bridge converter

Lecture 78 - Simulation of fullbridge converter

Lecture 79 - Area products and mfiles

Lecture 80 - Intro for drive circuits

Lecture 81 - BJT base drive

Lecture 82 - BJT base drive example

Lecture 83 - Multi-stage base drive

Lecture 84 - Base drive with speed-up circuit

Lecture 85 - Base drive with isolation

Lecture 86 - MOSFET gate drive

Lecture 87 - MOSFET drive with isolation

Lecture 88 - Over-current protection

Lecture 89 - Snubber circuits

Lecture 90 - Intro for close loop control

Lecture 91 - Close looping dc-dc converters

Lecture 92 - Simulation of close loop control

Lecture 93 - Current control for battery charger application

Lecture 94 - Instability in current control and slope compensation

Lecture 95 - Slope compensated current control

Lecture 96 - Simulation of current control

Lecture 97 - Single phase inverter with sinusoidal pwm

Lecture 98 - Simulation of sinusoidal PWM

NPTEL : NOC:Electrical Equipment and Machines: Finite Element Analysis (Electrical Engineering)

Co-ordinators : Prof. Shrikrishna V. Kulkarni

Lecture 1 - Course Outline and Introduction

Lecture 2 - Analytical and Numerical Methods

Lecture 3 - Revisiting EM Concepts: Vector Algebra and Coordinate Systems

Lecture 4 - Revisiting EM Concepts: Vector Calculus and Electrostatics

Lecture 5 - Revisiting EM Concepts: Current Densities and Electric Fields in Materials

Lecture 6 - Revisiting EM Concepts: Electrostatic Boundary Conditions and Shielding

Lecture 7 - Revisiting EM Concepts: Magnetostatics

Lecture 8 - Revisiting EM Concepts: Magnetic Forces and Materials

Lecture 9 - Revisiting EM Concepts: Time Varying Fields

Lecture 10 - Revisiting EM Concepts: Theory of Eddy Currents

Lecture 11 - FEM: Variational Approach

Lecture 12 - Finding Functional for PDEs

Lecture 13 - Whole Domain Approximation

Lecture 14 - 1D FEM: Problem Definition and Shape Function

Lecture 15 - 1D FEM: Procedure

Lecture 16 - 1D FEM: Scilab Code

Lecture 17 - 2D FEM: Problem Definition and Shape Functions

Lecture 18 - 2D FEM: Procedure

Lecture 19 - 2D FEM Scilab Code: Manual Meshing

Lecture 20 - 2D FEM Code: Gmsh and Scilab

Lecture 21 - Computation of B and H Field and Method of Weighted Residuals

Lecture 22 - Galerkin Method

Lecture 23 - Calculation of Leakage Inductance of a Transformer

Lecture 24 - Calculation of Inductance of an Induction Motor and a Gapped-Core Shunt Reactor

Lecture 25 - Insulation Design Using FE Analysis

Lecture 26 - Quadratic Finite Elements

Lecture 27 - Time Harmonic FE Analysis

Lecture 28 - Calculation of Eddy Current Losses

Lecture 29 - Eddy Losses in Transformer Windings

Lecture 30 - Torque Speed Characteristics of an Induction Motor and FE Analysis of Axisymmetric Problem

Lecture 31 - Permanent Magnets: Theory

Lecture 32 - Permanent Magnets: FEM Implementation

Lecture 33 - Periodic and Antiperiodic Boundary Conditions in Rotating Machines

Lecture 34 - FE Analysis of Rotating Machines

Lecture 35 - Voltage Fed Coupled Circuit Field Analysis

Lecture 36 - Current Fed Coupled Circuit Field Analysis

Lecture 37 - Transient FE Analysis

Lecture 38 - Nonlinear FE Analysis

Lecture 39 - Computation of Forces using Maxwell Stress Tensor

Lecture 40 - Computation of force using virtual work method

NPTEL : NOC:Digital Signal Processing and its Applications (Electrical Engineering)

Co-ordinators : Prof. V. M. Gadre

Lecture 1 - Introduction: Digital signal processing and its objectives

Lecture 2 - Introduction to sampling and Fourier Transform

Lecture 3 - Sampling of sine wave and associate complication

Lecture 4 - Review of Sampling Theorem

Lecture 5 - Idealized Sampling, Reconstruction

Lecture 6 - Filters And Discrete System

Lecture 7 - Answering questions from previous lectures

Lecture 8 - Desired requirements for discrete system

Lecture 9 - Introduction to phasors

Lecture 10 - Advantages of phasors in discrete systems

Lecture 11 - What do we want from a discrete system?

Lecture 12 - Linearity - Homogeneity and Additivity

Lecture 13 - Shift Invariance and Characterization of LTI systems

Lecture 14 - Characterization of LSI system using itâ€™s impulse response

Lecture 15 - Introduction to convolution

Lecture 16 - Convolution: Deeper ideas and understanding

Lecture 17 - Characterisation of LSI systems, Convolution-properties

Lecture 18 - Response of LSI Systems to Complex Sinusoids

Lecture 19 - Convergence of Convolution and Bibo Stability

Lecture 20 - Commutativity and Associativity

Lecture 21 - BIBO Stability of an LSI system

Lecture 22 - Causality and memory of an LSI system

Lecture 23 - Frequency response of an LSI system

Lecture 24 - Introduction and conditions of Stability

Lecture 25 - Vectors and Inner Product

Lecture 26 - Interpretation of Frequency Response as Dot Product

Lecture 27 - Interpretation of Frequency Response as Eigenvalues

Lecture 28 - Discrete time fourier transform

Lecture 29 - DTFT in LSI System and Convolution Theorem.

Lecture 30 - Definitions of sequences and Properties of DTFT

Lecture 31 - Introduction to DTFT, IDTFT

Lecture 32 - Dual to convolution property

Lecture 33 - Multiplication Property, Introduction to Parsevalâ€™s theorem

Lecture 34 - Introduction and Property of DTFT

Lecture 35 - Review of Inverse DTFT

Lecture 36 - Parsevalâ€™s Theorem and energy and time spectral density

Lecture 37 - Discussion on Unit Step

Lecture 38 - Introduction to Z transform

Lecture 39 - Example of Z transform

Lecture 40 - Region of Convergence

Lecture 41 - Properties of Z transform

Lecture 42 - Z- Transform

Lecture 43 - Rational System

Lecture 44 - Introduction and Examples of Rational Z Transform and their Inverses

Lecture 45 - Double Pole Examples and their Inverse Z Transform

Lecture 46 - Partial Fraction Decomposition

Lecture 47 - LSI System Examples

Lecture 48 - Why are Rational Systems so important?

Lecture 49 - Solving Linear constant coefficient difference equations which are valid over a finite range of time

Lecture 50 - Introduction to Resonance in Rational Systems

Lecture 51 - Characterization of Rational LSI system

Lecture 52 - Causality and stability of the ROC of the system function

Lecture 53 - Recap of Rational Systems and Discrete Time Filters

Lecture 54 - Specifications for Filter Design

Lecture 55 - Four Ideal Piecewise Constant Filters

Lecture 56 - Important Characteristics Of Ideal Filters

Lecture 57 - Synthesis of Discrete Time Filters, Realizable specifications

Lecture 58 - Realistic Specifications for low pass filter. Filter Design Process

Lecture 59 - Introduction to Filter Design. Analog IIR Filter,FIR discrete-time filter, IIR discrete-time filter

Lecture 60 - Analog to discrete transform

Lecture 61 - Intuitive transforms, Bilinear Transformation

Lecture 62 - Steps for IIR filter design

Lecture 63 - Analog filter design using Butterworth Approximation

Lecture 64 - Butterworth filter Derivation And Analysis of butterworth system function

Lecture 65 - Chebychev filter Derivation

Lecture 66 - Midsem paper review discussion

Lecture 67 - The Chebyschev Approximation

Lecture 68 - Next step in design: Obtain poles

Lecture 69 - Introduction to Frequency Transformations in the Analog Domain

Lecture 70 - High pass transformation

Lecture 71 - Band pass transformation

Lecture 72 - Frequency Transformation

Lecture 73 - Different types of filters

Lecture 74 - Impulse invariant method and ideal impulse response

Lecture 75 - Design of FIR of length (2N+1) by the truncation method,Plotting the function V(w)

Lecture 76 - IIR filter using rectangular window, IIR filter using triangular window

Lecture 77 - Proof that frequency response of an fir filter using rectangular window function centred at 0 is real

Lecture 78 - Introduction to window functions

Lecture 79 - Examples of window functions

Lecture 80 - Explanation of Gibbâ€™s Phenomenon and itâ€™s application

Lecture 81 - Comparison of FIR And IIR Filterâ€™s

Lecture 82 - Comparison of FIR And IIR Filterâ€™s

Lecture 83 - Comparison of FIR And IIR Filterâ€™s

Lecture 84 - Introduction and approach to realization (causal rational system)

Lecture 85 - Comprehension of Signal Flow Graphs and Achievement of Pseudo Assembly Language Code

Lecture 86 - Introduction to IIR Filter Realization and Cascade Structure

Lecture 87 - Cascade Parallel Structure

Lecture 88 - Lattice Structure

Lecture 89 - Recap And Review of Lattice Structure, Realization of FIR Function

Lecture 90 - Backward recursion, Change in the recursive equation of lattice

Lecture 91 - Lattice structure for an arbitrary rational system

Lecture 92 - Example realization of lattice structure for rational system

Lecture 93 - Introductory Remarks of Discrete Fourier Transform and Frequency Domain Sampling

Lecture 94 - Principle of Duality, The Circular Convolution

NPTEL : NOC:Stochastic Control and Communication (Electrical Engineering)

Co-ordinators : Prof. Ankur A. Kulkarni

Lecture 1 - Decision Making under Uncertainty

Lecture 2 - Expected Utility Theory - I

Lecture 3 - Expected Utility Theory - II

Lecture 4 - Expected Utility Theory - III

Lecture 5 - Role of Information in Decision Making

Lecture 6 - State Space Modelling of Sequential Decision Making, Example of Inventory Control

Lecture 7 - Inventory Control Problem (Continued...)

Lecture 8 - Policy-A Closed Loop Solution to Stochastic Control Problem

Lecture 9 - Introduction to Markov Decision Processes (MDP)

Lecture 10 - Types of Policy in MDP

Lecture 11 - Interpreting randomised decision rules

Lecture 12 - Stationary Transition Probability: State Diagram Representation and example of Markov policies

Lecture 13 - Example of History Dependent Policies

Lecture 14 - Complexity of the problem using brute force approach

Lecture 15 - Principle of Optimality

Lecture 16 - Dynamic Programming Algorithm

Lecture 17 - DP Algo applied to Inventory Control Problem

Lecture 18 - DP Algo applied to Inventory Control Problem (Continued...)

Lecture 19 - DP Algo applied to Inventory Control Problem (Continued...)

Lecture 20 - Optimal Stopping Problem

Lecture 21 - Optimal Stopping Example: Secretary Problem

Lecture 22 - Optimal Stopping Example: Secretary Problem (Continued...)

Lecture 23 - Optimal Stopping Example: Secretary Problem (Continued...)

Lecture 24 - Linear System Quadratic Cost Problem

Lecture 25 - Linear System Quadratic Cost Problem (Continued...)

Lecture 26 - Solving it via DP algorithm (Continued...)

Lecture 27 - Equivalence between Optimal HR Policyand optimal Markov Deterministic Policy

Lecture 28 - Stochastic Control under incomplete state information

Lecture 29 - Stochastic Control under incomplete state information (Continued...)

Lecture 30 - Stochastic Control under incomplete state information: Example

Lecture 31 - Stochastic Control under incomplete state information: Example (Continued...)

Lecture 32 - Stochastic Control under incomplete state information: Example (Continued...)

Lecture 33 - Stochastic Control under incomplete state information: Example (Continued...)

Lecture 34 - LQ systems with Imperfect Information - I

Lecture 35 - LQ systems with Imperfect Information - II

Lecture 36 - LQ systems with Imperfect Information - III

Lecture 37 - LQ systems with Imperfect Information - IV

Lecture 38 - Filtering - I

Lecture 39 - Filtering - II

Lecture 40 - Kalman Filtering - I

Lecture 41 - Kalman Filtering - II

Lecture 42 - Kalman Filtering - III

Lecture 43 - Belief State Formulation - I

Lecture 44 - Belief State Formulation - II

Lecture 45 - Information Structures - I

Lecture 46 - Information Structures - II

Lecture 47 - Witsenhausen Problem - I

Lecture 48 - Witsenhausen Problem - II

Lecture 49 - Witsenhausen Problem - III

Lecture 50 - Witsenhausen Problem - IV

Lecture 51 - Witsenhausen Problem - V

Lecture 52 - Witsenhausen Problem - VI

Lecture 53 - Witsenhausen Problem - VII

Lecture 54 - Team Decision Theory - I

Lecture 55 - Team Decision Theory - II

Lecture 56 - Team Decision Theory - III

Lecture 57 - Team Decision Theory - IV

Lecture 58 - Team Decision Theory - V

Lecture 59 - Team Decision Theory - VI

Lecture 60 - Team Decision Theory - VII

Lecture 61 - Communication Theory - I

Lecture 62 - Communication Theory - II

Lecture 63 - Communication Theory - III

Lecture 64 - Communication Theory - IV

Lecture 65 - Communication Theory - V

NPTEL : NOC:Applied Linear Algebra (2024) (Electrical Engineering)

Co-ordinators : Prof. Dwaipayan Mukherjee

Lecture 1 - Introduction - Part A

Lecture 2 - Introduction - Part B

Lecture 3 - Introduction - Part C

Lecture 4 - Equivalent Systems - Part A

Lecture 5 - Equivalent Systems - Part B

Lecture 6 - Equivalent Systems - Part C

Lecture 7 - Solution of Ax = b - Part A

Lecture 8 - Solution of Ax = b - Part B

Lecture 9 - Solution of Ax = b - Part C

Lecture 10 - Rings, Integral Domains and Fields - Part A

Lecture 11 - Rings, Integral Domains and Fields - Part B

Lecture 12 - Rings, Integral Domains and Fields - Part C

Lecture 13 - Vector Spaces and Subspaces - Part A

Lecture 14 - Vector Spaces and Subspaces - Part B

Lecture 15 - Vector Spaces and Subspaces - Part C

Lecture 16 - Unions, Intersection, Sums of Subspaces - Part A

Lecture 17 - Unions, Intersection, Sums of Subspaces - Part B

Lecture 18 - Generating sets, Linear independence and basis - Part A

Lecture 19 - Generating sets, Linear independence and basis - Part B

Lecture 20 - Generating sets, Linear independence and basis - Part C

Lecture 21 - Ordered basis and co-ordinates - Part A

Lecture 22 - Ordered basis and co-ordinates - Part B

Lecture 23 - Ordered basis and co-ordinates - Part C

Lecture 24 - Rank-Nullity Theorem (Matrices) - Part A

Lecture 25 - Rank-Nullity Theorem (Matrices) - Part B

Lecture 26 - Rank-Nullity Theorem (Matrices) - Part C

Lecture 27 - Rank-Nullity Theorem (Linear Transformation) - Part A

Lecture 28 - Rank-Nullity Theorem (Linear Transformation) - Part B

Lecture 29 - Rank-Nullity Theorem (Linear Transformation) - Part C

Lecture 30 - Isomorphism and Inverses - Part A

Lecture 31 - Isomorphism and Inverses - Part B

Lecture 32 - Isomorphism and Inverses - Part C

Lecture 33 - Dual Basis and Annihilator - Part A

Lecture 34 - Dual Basis and Annihilator - Part B

Lecture 35 - Dual Basis and Annihilator - Part C

Lecture 36 - Dual maps and double dual - Part A

Lecture 37 - Dual maps and double dual - Part B

Lecture 38 - Dual maps and double dual - Part C

Lecture 39 - Quotient spaces and quotient map - Part A

Lecture 40 - Quotient spaces and quotient map - Part B

Lecture 41 - Quotient spaces and quotient map - Part C

Lecture 42 - Inner Product Spaces - Part A

Lecture 43 - Inner Product Spaces - Part B

Lecture 44 - Inner Product Spaces - Part C

Lecture 45 - Gram Schmidt Procedure - Part A

Lecture 46 - Gram Schmidt Procedure - Part B

Lecture 47 - Gram Schmidt Procedure - Part C

Lecture 48 - Best Approximation of a Vector - Part A

Lecture 49 - Best Approximation of a Vector - Part B

Lecture 50 - Best Approximation of a Vector - Part C

Lecture 51 - Projection map and summary of Ax = b - Part A

Lecture 52 - Projection map and summary of Ax = b - Part B

Lecture 53 - Projection map and summary of Ax = b - Part C

Lecture 54 - Linear Differential Equations - Part A

Lecture 55 - Linear Differential Equations - Part B

Lecture 56 - Introduction to Eigen values and Eigen vectors - Part A

Lecture 57 - Introduction to Eigen values and Eigen vectors - Part B

Lecture 58 - Introduction to Eigen values and Eigen vectors - Part C

Lecture 59 - Singular Value Decomposition - Part A

Lecture 60 - Singular Value Decomposition - Part B

Lecture 61 - Singular Value Decomposition - Part C

Lecture 62 - Algebraic and geometric multiplicities - Part A

Lecture 63 - Algebraic and geometric multiplicities - Part B

Lecture 64 - A-Invariant Subspaces - Part A

Lecture 65 - A-Invariant Subspaces - Part B

Lecture 66 - A-Invariant Subspaces - Part C

Lecture 67 - Minimal Polynomial-I - Part A

Lecture 68 - Minimal Polynomial-I - Part B

Lecture 69 - Minimal Polynomial-I - Part C

Lecture 70 - Minimal Polynomial-I - Part D

Lecture 71 - Minimal Polynomial-II - Part A

Lecture 72 - Minimal Polynomial-II - Part B

Lecture 73 - Minimal Polynomial-II - Part C

Lecture 74 - Minimal Polynomial-II - Part D

Lecture 75 - Cayley Hamilton Theorem - Part A

Lecture 76 - Cayley Hamilton Theorem - Part B

Lecture 77 - Cayley Hamilton Theorem - Part C

Lecture 78 - Jordan Canonical Form - Part A

Lecture 79 - Jordan Canonical Form - Part B

Lecture 80 - Jordan Canonical Form - Part C

Lecture 81 - Algebraic Graph Theory and Consensus - Part A

Lecture 82 - Algebraic Graph Theory and Consensus - Part B

Lecture 83 - Algebraic Graph Theory and Consensus - Part C

Lecture 84 - Positive Matrices and Leontieff's Model - Part A

Lecture 85 - Positive Matrices and Leontieff's Model - Part B

NPTEL : NOC:Digital Communication using GNU Radio (Electrical Engineering)

Co-ordinators : Prof. Kumar Appaiah

Lecture 1 - Introduction to Digital Communication

Lecture 2 - Understanding GNU Radio features for Digital Communication: Basic blocks, input and output

Lecture 3 - Understanding GNU Radio features for Digital Communication: Advanced blocks, hardware interfacing

Lecture 4 - Fundamentals of Digital Communication: Signal Processing methods, vectors, and relevant GNU Radio Examples - Part 1

Lecture 5 - Fundamentals of Digital Communication: Signal Processing methods, vectors, and relevant GNU Radio Examples - Part 2

Lecture 6 - Complex Baseband Signal Representation

Lecture 7 - Real Passband Signal Representation, Up and Down Conversion of Complex Baseband Signals

Lecture 8 - Random Variables and Random Processes

Lecture 9 - Fundamentals of Digital Modulation

Lecture 10 - Linear Modulation Methods: Amplitude Shift Keying (ASK)

Lecture 11 - Linear Modulation Methods: Phase Shift Keying (PSK)

Lecture 12 - Linear Modulation Methods: Quadrature Amplitude Modulation (QAM) and Frequency Shift Keying (FSK)

Lecture 13 - Pulse Shaping for ISI Free Signaling

Lecture 14 - ASK using Raised Cosine (RC) and Root-Raised Cosine (RRC) Pulse Shaping

Lecture 15 - Basics of Detection: Properties of Gaussian Random Variables

Lecture 16 - Basics of Detection: Gaussian Random Vectors and Hypothesis Testing

Lecture 17 - Optimal Receivers for M-ary Signaling

Lecture 18 - Gram-Schmidt Orthogonalisation

Lecture 19 - Optimal Reception of M-ary Signals in AWGN

Lecture 20 - Detection and Optimal Decision for On-Off Signaling in AWGN Channel

Lecture 21 - Detection and Optimal Decision for M-ary Signaling

Lecture 22 - Python for GNU Radio

Lecture 23 - Extending GNU Radio Features using Python

Lecture 24 - Constructing and Visualising Constellations using GNU Radio

Lecture 25 - Understanding matched filtering using GNU Radio

Lecture 26 - Histograms in GNU Radio

Lecture 27 - Visualising Symbol Error Rate in GNU Radio

Lecture 28 - Signal-to-Noise Ratio and Symbol Error Probability - Part 1

Lecture 29 - Signal-to-Noise Ratio and Symbol Error Probability - Part 2

Lecture 30 - Symbol error rate and Bit error rate

Lecture 31 - Computing bit error rates in GNU Radio

Lecture 32 - End-to-end Digital Communication System Simulation in GNU Radio

Lecture 33 - Parameter Estimation for Practical Receivers - Part 1

Lecture 34 - Parameter Estimation for Practical Receivers - Part 2

Lecture 35 - Phase Locked Loop and Differential Modulation

Lecture 36 - Maximum Likelihood delay estimate for a single symbol in GNU Radio

Lecture 37 - Maximum Likelihood delay estimate for multiple symbols in GNU Radio

Lecture 38 - Phase offse estimation in GNU Radio

Lecture 39 - Phase Locked Loop in GNU Radio

Lecture 40 - Costas Loop and Differential PSK in GNU Radio

Lecture 41 - Channel Equalisation

Lecture 42 - Detection Strategy for Dispersive Channels

Lecture 43 - Maximum Likelihood sequence estimation: Viterbi Algorithm

Lecture 44 - Suboptimal Channel Equalisation: Zero-forcing Receiver

Lecture 45 - Zero forcing Receiver in GNU Radio

Lecture 46 - Suboptimal Channel Equalisation: Linear Minimum mean-square error receiver

Lecture 47 - LMMSE Receiver in GNU Radio

Lecture 48 - Parallelising Frequency Selective Channels

Lecture 49 - Orthogonal Frequency Division Multiplexing (OFDM)

Lecture 50 - OFDM in the prescence of dispersive channels

Lecture 51 - Equalisation using OFDM in GNU Radio

Lecture 52 - Error Control Coding: Parity Check Codes

Lecture 53 - Error Control Coding: Repetition Codes

Lecture 54 - Error Control Coding: Linear Block Codes

Lecture 55 - Repetition Codes in GNU Radio

Lecture 56 - Error Control Coding: Perfect Codes

Lecture 57 - Error Control Coding: Hamming Codes

Lecture 58 - (7,4) Hamming Code in GNU Radio

Lecture 59 - Rate and error-free Communication

Lecture 60 - Quantisation

Lecture 61 - Visualising Quantisation in GNU Radio

Lecture 62 - Course Summary

NPTEL : Circuit Theory (Electrical Engineering)

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

Lecture 1 - Review of Signals and Systems

Lecture 2 - Review of Signals and Systems

Lecture 3 - Network Equations; Initial and Final Conditions

Lecture 4 - Problem Session 1

Lecture 5 - Step, Impulse and Complete Responses

Lecture 6 - 2nd Order Circuits:Magnetically Coupled Circuits

Lecture 7 - Transformer Transform Domain Analysis

Lecture 8 - Problem Session 2 : Step,Impulse

Lecture 9 - Network Theorems and Network Functions

Lecture 10 - Network Functions (Continued.)

Lecture 11 - Amplitude and Phase of Network Functions

Lecture 12 - Problem Session 3 : Network Theorems Transform

Lecture 13 - Poles, Zeros and Network Response

Lecture 14 - Single Tuned Circuits

Lecture 15 - Single Tuned Circuits (Continued.)

Lecture 16 - Double Tuned Circuits

Lecture 17 - Double Tuned Circuits (Continued.)

Lecture 18 - Problem Session 4 : Network Functions, Analysis

Lecture 19 - Double Tuned Circuits (Continued.)

Lecture 20 - Concept of Delay and Introduction

Lecture 21 - Two-port Networks (Continued.)

Lecture 22 - Problem Session 5

Lecture 23 - Minor - 1

Lecture 24 - The Hybrid & Transmission Parameters of 2 ports

Lecture 25 - Problem Session 6 : Two - port networks

Lecture 26 - Two - port Network parameters

Lecture 27 - Two-port Interconnections

Lecture 28 - Interconnection of Two-port Networks (Continued.)

Lecture 29 - Problem Session 7 : Two-port Networks (Continued.)

Lecture 30 - Scattering Matrix

Lecture 31 - Scattering Parameters of a Two-port

Lecture 32 - Problem Session 8 : Two- port Parameters

Lecture 33 - Solutions of Minor - 2 Problems

Lecture 34 - Insertion Loss

Lecture 35 - Example of Insertion Loss and Elements

Lecture 36 - Elements of Realizability Theory (Continued.)

Lecture 37 - Positive Real Functions

Lecture 38 - Testing of Positive Real Functions

Lecture 39 - Problem Session 9

Lecture 40 - More on PRF's and their Synthesis

Lecture 41 - LC Driving Point Functions

Lecture 42 - LC Driving Point Synthesis (Continued.)

Lecture 43 - RC and RL Driving Point Synthesis

Lecture 44 - Problem Session 10 : LC Driving Point Synthesis

Lecture 45 - RC & RL One-port Synthesis (Continued.)

Lecture 46 - Elementary RLC One-port Synthesis

Lecture 47 - Properties and Synthesis of Transfer Parameters

Lecture 48 - Resistance Terminated LC Ladder

Lecture 49 - Resistance Terminated LC Ladder (Continued.)

Lecture 50 - Problem session 11: Two-port Synthesis

Lecture 51 - Network Transmission Criteria

NPTEL : Control Engineering (Prof. M. Gopal) (Electrical Engineering)

Co-ordinators : Prof. M. Gopal

Lecture 1 - Introduction to control problem

Lecture 2 - Basic Feedback Structure

Lecture 3 - Introduction to Control Problem (Continued.)

Lecture 4 - Dynamic Systems and Dynamic Response

Lecture 5 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 6 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 7 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 8 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 9 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 10 - Models of Industrial Control Devices and Systems

Lecture 11 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 12 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 13 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 14 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 15 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 16 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 17 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 18 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 19 - Basic Principles of Feedback Control

Lecture 20 - Basic Principles of Feedback Control (Continued.)

Lecture 21 - Basic Principles of Feedback Control (Continued.)

Lecture 22 - Basic Principles of Feedback Control (Continued.)

Lecture 23 - Concepts of stability and Routh Stability Criterion

Lecture 24 - Concepts of stability and Routh Stability Criterion (Continued.)

Lecture 25 - Concepts of stability and Routh Stability Criterion (Continued.)

Lecture 26 - The Performance of Feedback Systems

Lecture 27 - The Performance of Feedback Systems (Continued.)

Lecture 28 - The Performance of Feedback Systems (Continued.)

Lecture 29 - The Performance of Feedback Systems (Continued.)

Lecture 30 - Compensator Design Using Root Locus Plots

Lecture 31 - Compensator Design Using Root Locus Plots (Continued.)

Lecture 32 - Compensator Design Using Root Locus Plots (Continued.)

Lecture 33 - Compensator Design Using Root Locus Plots (Continued.)

Lecture 34 - Compensator Design Using Root Locus Plots (Continued.)

Lecture 35 - The Nyquist Stability Criterion and Stability Margins

Lecture 36 - The Nyquist Stability Criterion and Stability Margins (Continued.)

Lecture 37 - The Nyquist Stability Criterion and Stability Margins (Continued.)

Lecture 38 - The Nyquist Stability Criterion and Stability Margins (Continued.)

Lecture 39 - Feedback System Performance Based on the Frequency Response

Lecture 40 - Feedback System Performance Based on the Frequency Response (Continued.)

Lecture 41 - Compensator Design Using Frequency Response Plots

NPTEL : Embedded Systems (Electrical Engineering)

Co-ordinators : Prof. Santanu Chaudhary

Lecture 1 - Embedded Systems: Introduction

Lecture 2 - Embedded Hardware

Lecture 3 - PIC: Instruction Set

Lecture 4 - PIC Peripherals On Chip

Lecture 5 - ARM Processor

Lecture 6 - More ARM Instructions

Lecture 7 - ARM: Interrupt Processing

Lecture 8 - Digital Signal Processors

Lecture 9 - More on DSP Processors

Lecture 10 - System On Chip (SOC)

Lecture 11 - Memory

Lecture 12 - Memory Organization

Lecture 13 - Virtual Memory and Memory Management Unit

Lecture 14 - Bus Structure

Lecture 15 - Bus Structure - 2

Lecture 16 - Bus Structure - 3 Serial Interfaces

Lecture 17 - Serial Interfaces

Lecture 18 - Power Aware Architecture

Lecture 19 - Software for Embedded Systems

Lecture 20 - Fundamentals of Embedded Operating Systems

Lecture 21 - Scheduling Policies

Lecture 22 - Resource Management

Lecture 23 - Embedded - OS

Lecture 24 - Networked Embedded Systems - I

Lecture 25 - Networked Embedded Systems - II

Lecture 26 - Networked Embedded Systems - III

Lecture 27 - Networked Embedded Systems - IV

Lecture 28 - Designing Embedded Systems - I

Lecture 29 - Designing Embedded Systems - II

Lecture 30 - Designing Embedded Systems- III

Lecture 31 - Embedded System Design - IV

Lecture 32 - Designing Embedded Systems - V

Lecture 33 - Platform Based Design

Lecture 34 - Compilers for Embedded Systems

Lecture 35 - Developing Embedded Systems

Lecture 36 - Building Dependable Embedded Systems

Lecture 37 - Pervasive and Ubiquitous Computing

NPTEL : Power System Generation, Transmission and Distribution (Encapsulated from earlier Video) (Electrical Engineering)

Co-ordinators : Prof. D.P. Kothari

Lecture 1 - Electric Energy Systems A Perspective

Lecture 2 - Structure of Power Systems

Lecture 3 - Conventional Sources of Electric Energy

Lecture 4 - Hydroelectric Power Generation

Lecture 5 - Non Conventional Energy Sources

Lecture 6 - Renewable Energy (Continued.)

Lecture 7 - Energy Storage

Lecture 8 - Deregulation

Lecture 9 - Air Pollutants

Lecture 10 - Transmission Line Parameters

Lecture 11 - Capacitance of Transmission Lines

Lecture 12 - Characteristics and Performance of Transmission Lines

Lecture 13 - Voltage Regulation (VR)

Lecture 14 - Power Flow through a Line

Lecture 15 - Methods of Voltage Control

Lecture 16 - Compensation of Transmission Lines

Lecture 17 - Compensation of Transmission Lines (Continued.)

Lecture 18 - Underground Cables

Lecture 19 - Cables (Continued.)

Lecture 20 - Insulators for Overhead Lines

Lecture 21 - HVDC

Lecture 22 - HVDC (Continued.)

Lecture 23 - Distribution Systems

Lecture 24 - Automatic Generation Control

Lecture 25 - Automatic Generation Control (Continued.)

Lecture 26 - Load Flow Studies

Lecture 27 - Load Flow Problem

Lecture 28 - Load Flow Analysis (Continued.), Gauss Siedel Method

Lecture 29 - Newton Raphson (NR), Load Flow Method

Lecture 30 - Fast Decoupled Load Flow

Lecture 31 - Control of Voltage Profile

Lecture 32 - Optimal System Operation (Economic Operation)

Lecture 33 - Optimal Unit Commitment

Lecture 34 - Optimal Generation Scheduling

Lecture 35 - Optimal Load Flow (Continued.) and Hydro Thermal Scheduling

NPTEL : Power System Dynamics (Electrical Engineering)

Co-ordinators : Dr. M.L. Kothari

Lecture 1 - Introduction to Power System Stability Problem - Part-1

Lecture 2 - Introduction to Power System Stability Problem - Part-2

Lecture 3 - Introduction to Power System Stability Problem - Part-3

Lecture 4 - Solution of Switching Equation

Lecture 5 - The Equal Area Criterion for Stability - Part-1

Lecture 6 - The Equal Area Criterion for Stability - Part-2

Lecture 7 - Transient Stability Analysis of a Multi Machine System

Lecture 8 - Modeling of Synchronous Machine - Part-1

Lecture 9 - Modeling of Synchronous Machine - Part-2

Lecture 10 - Modeling of Synchronous Machine - Part-3

Lecture 11 - Modeling of Synchronous Machine - Part-4

Lecture 12 - Synchronous Machine Representation for Stability Studies - Part-1

Lecture 13 - Synchronous Machine Representation for Stability Studies - Part-2

Lecture 14 - Excitation Systems - Part-1

Lecture 15 - Excitation Systems - Part-2

Lecture 16 - Modeling of Excitation Systems - Part-1

Lecture 17 - Modeling of Excitation Systems - Part-2

Lecture 18 - Small Signal Stability of a Single Machine Infinite Bus System - Part-1

Lecture 19 - Small Signal Stability of a Single Machine Infinite Bus System - Part-2

Lecture 20 - Small Signal Stability of a Single Machine Infinite Bus System - Part-3

Lecture 21 - Small Signal Stability of a Single Machine Infinite Bus System - Part-4

Lecture 22 - Small Signal Stability of a Single Machine Infinite Bus System - Part-5

Lecture 23 - Dynamic Modeling of Steam turbines and Governors

Lecture 24 - Dynamic modeling of Hydro Turbines and Governors

Lecture 25 - Load modeling for Stability Studies

Lecture 26 - Numerical Integration Methods for Solving a Set of Ordinary Nonlinear Differential Equation

Lecture 27 - Simulation of Power System Dynamic Response

Lecture 28 - Dynamic Equivalents for Large Scale Systems - Part-1

Lecture 29 - Dynamic Equivalents for Large Scale Systems - Part-2

Lecture 30 - Dynamic Equivalents for Large Scale Systems - Part-3

Lecture 31 - Direct Method of Transient Stability Analysis - Part-1

Lecture 32 - Direct Method of Transient Stability Analysis - Part-2

Lecture 33 - Sub Synchronous Oscillations - Part-1

Lecture 34 - Sub Synchronous Oscillations - Part-2

Lecture 35 - Voltage Stability - Part-1

Lecture 36 - Voltage Stability - Part-2

Lecture 37 - Voltage Stability - Part-3

Lecture 38 - Voltage Stability - Part-4

Lecture 39 - Methods of Improving Stability - Part-1

Lecture 40 - Methods of Improving Stability - Part-2

NPTEL : Analog Electronic Circuits (Electrical Engineering)

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

Lecture 1 - Review of DC Models of Diodes & BJT's

Lecture 2 - Review of DC Models of BJT (Continued...) and FET

Lecture 3 - FET Characteristics and Models

Lecture 4 - Problem Session-1 on DC Analysis of BJT Circuits

Lecture 5 - BJT Biasing and Bias Stability

Lecture 6 - BJT Bias Stability (Continued...)

Lecture 7 - FET Biasing, Current Sources

Lecture 8 - Problem Session-2 on FET and BJT Characteristics and Biasing

Lecture 9 - Current Mirrors; BJT Small Signal Models

Lecture 10 - Small Signal Amplifiers: Mid Frequency Analysis

Lecture 11 - Mid Frequency Analysis of the CE and CB Amplifier

Lecture 12 - Problem Session-3 on Mid- Frequency Analysis of CE Amplifiers

Lecture 13 - Midband Analysis of CB and CC Amplifiers

Lecture 14 - Midband Analysis of FET Amplifiers

Lecture 15 - Problem Session-4 on Midband Analysis of Amplifiers

Lecture 16 - High Frequency Response of Small Signal Amplifiers

Lecture 17 - High Frequency Response of Small Signal Amplifiers (Continued...)

Lecture 18 - Low Frequency Response of Small Signal Amplifiers

Lecture 19 - Problem Session-5 on Frequency Response of Small Signal Amplifiers

Lecture 20 - Differential Amplifiers

Lecture 21 - Differential Amplifiers (Continued...)

Lecture 22 - Discussion on Minor-1 Problems and Differential Amplifiers (Continued...)

Lecture 23 - Problem Session-6 on Frequency Response of Small Signal Amplifiers (Continued...) and Differential Amplifiers

Lecture 24 - Use of Current Mirrors in Differential Amplifiers

Lecture 25 - FET Differential Amplifiers and Introduction to Power Amplifiers

Lecture 26 - Class B, Class AB and Class A Power Amplifiers

Lecture 27 - Class A Power Amplifiers; Efficiency Considerations

Lecture 28 - Problem Session-7 on Deferential and Power Amplifiers

Lecture 29 - Introduction to Feedback Amplifiers

Lecture 30 - Advantages of Negative Feedback Amplifiers

Lecture 31 - Analysis of Feedback Amplifiers

Lecture 32 - Analysis of the Series - Series and Other Feedback Configurations

Lecture 33 - Problem Session-8 on Feedback Amplifiers

Lecture 34 - Sinusoidal Oscillators : An Example of Positive Feedback

Lecture 35 - More on Oscillators

Lecture 36 - Solutions to Minor-2 Exam and Concluding Discussions on Oscillators

Lecture 37 - Problem Session-9 on Oscillators

Lecture 38 - Tuned (or Narrowband) Amplifiers

Lecture 39 - Widebanding Techniques : Introduction & Use of Inductors

Lecture 40 - Widebanding By Using an Inductance

Lecture 41 - Problem Session-10 on Tuned Amplifiers

Lecture 42 - Widebanding by Using Compound Devices

Lecture 43 - Cascode Configuration as Wideband Amplifier

Lecture 44 - Widebanding by Local Feedback

Lecture 45 - Problem Session-11 on Minor-3 Problems & Widebanding by Compound Devices

Lecture 46 - Widebanding by Local Feedback and Feedback Cascades

Lecture 47 - Widebanding by Overall Feedback and Dual Loop Feedback

Lecture 48 - The Differential Pair and the Gilbert Cell as Wideband Amplifiers

Lecture 49 - Correction to Gilbert Cell Analysis and Operational Amplifier Imperfections

Lecture 50 - Op-Amp offsets, Compensation and Slew Rate

Lecture 51 - Op-Amp Compensation, Slew Rate and Some Problems

NPTEL : Digital Communication (Electrical Engineering)

Co-ordinators : Prof. Surendra Prasad

Lecture 1 - Introduction to the Course

Lecture 2 - Digital Representation of Analog Signals, Delta Modulation

Lecture 3 - Digital Representation of Analog Signals, Pulse Code Modulation

Lecture 4 - Digital Representation of Analog Signals

Lecture 5 - Quantization Noise in Delta Modulation (Continued...) and Time Division Multiplexing

Lecture 6 - Introduction to Line Coding

Lecture 7 - Spectral Properties of Line Codes: General Relations

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 - Mâ€™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 Mâ€™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...)

NPTEL : NOC:Analog Electronic Circuit (Electrical Engineering)

Co-ordinators : Dr. Shouribrata Chatterjee

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

NPTEL : NOC:Nonlinear and Adaptive Control (Electrical Engineering)

Co-ordinators : Prof. Shubhendu Bhasin

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

NPTEL : NOC:Information Theory, Coding and Cryptography (Electrical Engineering)

Co-ordinators : Prof. Ranjan Bose

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 - Vitrebi Decoding and Known good Convolutional Codes

Lecture 29 - Introduction to Turbo Codes

Lecture 30 - Introduction to Trellis Coded Modulation (TCM)

Lecture 31 - Ungerboek'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

NPTEL : Engineering Electromagnetics (Electrical Engineering)

Co-ordinators : Prof. Sheel Aditya

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

NPTEL : NOC:Principles of Digital Communications (2018) (Electrical Engineering)

Co-ordinators : Prof. Abhishek Dixit

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 Aposteriori 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

NPTEL : NOC:Electric Vehicles - Part 1 (Electrical Engineering)

Co-ordinators : Prof. Amit Jain

Lecture 1 - Introduction - EV Historical Background

Lecture 2 - Introduction - EV Benefits of Using EVs

Lecture 3 - Introduction - EV Overview of types of EVs and its Challenges

Lecture 4 - Introduction - EV Motor Drive Technologies

Lecture 5 - Introduction - EV Energy Source Technologies

Lecture 6 - Introduction - EV Battery Charging Technologies

Lecture 7 - Introduction - EV Vehicle to Grid

Lecture 8 - Introduction - EV Subsystems and Configurations

Lecture 9 - Introduction - HEV Subsystems and Configurations

Lecture 10 - Introduction - HEV Subsystems and Modes of Operation

Lecture 11 - Vehicle Dynamics Introduction and tractive effort

Lecture 12 - Vehicle Dynamics 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

NPTEL : NOC:Power Electronics (Electrical Engineering)

Co-ordinators : Prof. G.Bhuvaneshwari

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

NPTEL : NOC:Electrical Machines (Electrical Engineering)

Co-ordinators : Prof. G.Bhuvaneshwari

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 Intoduction 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 Charactristics 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 Exicited Motor)

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

Lecture 27 - DC Machine: Starting and Braking

Lecture 28 - DC Machine: Comutation

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

NPTEL : Special Electromechanical Systems (Electrical Engineering)

Co-ordinators : Prof. S.S. Murthy

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 - Squareware Permanent Magnet Brushless Motor Drive

Lecture 33 - Sine Wave Permanent Magnet Brushless Motor Drives

Lecture 34 - Permanent Magnet Synchronous Motors

NPTEL : NOC:High Power Multilevel Converters - Analysis, Design and Operational Issues (Electrical Engineering)

Co-ordinators : Prof. Anand Rup

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

NPTEL : NOC:Introduction to Embedded System Design (Electrical Engineering)

Co-ordinators : Prof. Badri N Subudhi, Prof.Dhananjay V. Gadre

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

Lecture 33 - Serial Communication Protocols, USCI Module in MSP430

Lecture 34 - MSP430 Timer in Capture Mode

Lecture 35 - Coding Ninja

Lecture 36 - Building an Electronics Project

Lecture 37 - Circuit Prototyping Techniques

Lecture 38 - Single Purpose Computers

Lecture 39 - Single Purpose Computers (Continued...)

Lecture 40 - Recap of Course Coverage and Project Demonstration from Concept to Final

NPTEL : NOC:Power Quality (Electrical Engineering)

Co-ordinators : Prof. Bhim Singh

Lecture 1 - Power Quality - An Introduction

Lecture 2 - Power Quality Standards and Monitoring

Lecture 3 - Power Quality Standards and Monitoring (Continued...)

Lecture 4 - Passive Shunt and Series Compensations

Lecture 5 - Passive Shunt and Series Compensations (Continued...)

Lecture 6 - Passive Shunt and Series Compensations (Continued...)

Lecture 7 - Active Shunt Compensation

Lecture 8 - Active Shunt Compensation (Continued...)

Lecture 9 - Active Shunt Compensation (Continued...)

Lecture 10 - Active Series Compensation

Lecture 11 - Active Series Compensation (Continued...)

Lecture 12 - Unified Power Quality Compensators

Lecture 13 - Unified Power Quality Compensators (Continued...)

Lecture 14 - Unified Power Quality Compensators (Continued...)

Lecture 15 - Loads Which Cause Power Quality Problems

Lecture 16 - Loads Which Cause Power Quality Problems (Continued...)

Lecture 17 - Passive Power Filters

Lecture 18 - Passive Power Filters (Continued...)

Lecture 19 - Passive Power Filters (Continued...)

Lecture 20 - Shunt Active Power Filters

Lecture 21 - Shunt Active Power Filters (Continued...)

Lecture 22 - Shunt Active Power Filters (Continued...)

Lecture 23 - Active Series Power Filters

Lecture 24 - Active Series Power Filters (Continued...)

Lecture 25 - Active Series Power Filters (Continued...)

Lecture 26 - Hybrid Power Filters

Lecture 27 - Hybrid Power Filters (Continued...)

Lecture 28 - Hybrid Power Filters (Continued...)

Lecture 29 - AC-DC Converters That Cause Power Quality

Lecture 30 - Improved Power Quality Converters - AC-DC Boost Converters

Lecture 31 - Improved Power Quality Converters - AC-DC Boost Converters (Continued...)

Lecture 32 - Improved Power Quality Converters - AC-DC Buck Converters

Lecture 33 - Improved Power Quality Converters - AC-DC Buck-Boost Converters

Lecture 34 - Improved Power Quality Converters - AC-DC Buck-Boost Converters (Continued...)

Lecture 35 - Improved Power Quality Converters - AC-DC Buck-Boost Converters (Continued...)

Lecture 36 - Three Phase AC-DC Improved Power Quality Converters

Lecture 37 - Multipulse Converters

Lecture 38 - Multipulse Converters (Continued...)

Lecture 39 - Multipulse Converters (Continued...)

Lecture 40 - Power Quality Improvement in Solar Energy Conversion System

Lecture 41 - Power Quality Improvement in Solar Energy Conversion System (Continued...)

Lecture 42 - Power Quality Improvement in Wind Energy Conversion System

Lecture 43 - Power Quality Improvement in Diesel Generator Set Based Power Supply System

Lecture 44 - Power Quality Improvement in Diesel Generator Set Based Power Supply System (Continued...)

Lecture 45 - Power Quality Improvement in Distributed Generation Sources Based Microgrids

NPTEL : NOC:Introduction to Electrical Engineering (Electrical Engineering)

Co-ordinators : Prof. Bhim Singh

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

Lecture 37

Lecture 38

Lecture 39

Lecture 40

Lecture 41

Lecture 42

NPTEL : NOC:Transducers for Instrumentation (Electrical Engineering)

Co-ordinators : Ankur Gupta

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

NPTEL : NOC:Computer-Aided Design of Electrical Machines (Electrical Engineering)

Co-ordinators : Prof. Bhim Singh

Lecture 1 - Course Outline and Introduction

Lecture 2 - Fundamental - I

Lecture 3 - Equivalent Circuit Approach to Design

Lecture 4 - Transformer Design - I

Lecture 5 - Transformer Design - II

Lecture 6 - Transformer Design - III

Lecture 7 - Transformer Design - IV

Lecture 8 - Windings in Electrical Machines

Lecture 9 - Design of DC Machine - I

Lecture 10 - Design of DC Machine - II

Lecture 11 - Design of DC Machine - III

Lecture 12 - Design of Three-Phase Induction Motors - I

Lecture 13 - Design of Three-Phase Induction Motors - II

Lecture 14 - Design of Three-Phase Induction Motors - III

Lecture 15 - Design of Three-Phase Induction Motors - IV

Lecture 16 - Design of Single-Phase Induction Machine - I

Lecture 17 - Design of Single-Phase Induction Machine - II

Lecture 18 - Design of Single-Phase Induction Machine - III

Lecture 19 - Design of Three-Phase Synchronous Machines - I

Lecture 20 - Design of Three-Phase Synchronous Machines - II

Lecture 21 - Design of Three-Phase Synchronous Machines - III

Lecture 22 - Design of Three-Phase Synchronous Machines - IV

Lecture 23 - Design of Synchronous Reluctance Machines - I

Lecture 24 - Design of Synchronous Reluctance Machines - II

Lecture 25 - Design of Synchronous Reluctance Machines - III

Lecture 26 - Design of Brushless PM Machines - I

Lecture 27 - Design of Brushless PM Machines - II

Lecture 28 - Design of Brushless PM Machines - III

Lecture 29 - Design of Brushless PM Machines - IV

Lecture 30 - Design of Brushless PM Machines - V

Lecture 31 - Design of Switched Reluctance Machines - I

Lecture 32 - Design of Switched Reluctance Machines - II

Lecture 33 - Design of Switched Reluctance Machines - III

Lecture 34 - Design of Stepper Machines - I

Lecture 35 - Design of Stepper Machines - II

Lecture 36 - Design of Axial Flux Machines - I

Lecture 37 - Design of Axial Flux Machines - II

Lecture 38 - Computer Aided Design and Analysis Method - I

Lecture 39 - Computer Aided Design and Analysis Method - II

Lecture 40 - Case Studies and Tutorials - I and II

Lecture 41 - Tutorial-III : Determination of Transformer Operating Point

Lecture 42 - Tutorial-IV

NPTEL : Advanced Control Systems (Electrical Engineering)

Co-ordinators : Prof. S. Majhi

Lecture 1 - Introduction

Lecture 2 - Control structures and performance measures

Lecture 3 - Time and frequency domain performance measures

Lecture 4 - Design of controller

Lecture 5 - Design of controller for SISO system

Lecture 6 - Controller design for TITO processes

Lecture 7 - Limitations of PID controllers

Lecture 8 - PI-PD controller for SISO system

Lecture 9 - PID-P controller for Two Input Two Output system

Lecture 10 - Effects of measurement noise and load

Lecture 11 - Identification of dynamic models of plants

Lecture 12 - Relay control system for identification

Lecture 13 - Off-line identification of process dynamics

Lecture 14 - On-line identification of plant dynamics

Lecture 15 - State space based identification

Lecture 16 - State space analysis of systems

Lecture 17 - State space based identification of systems - 1

Lecture 18 - State space based identification of systems - 2

Lecture 19 - Identification of simple systems

Lecture 20 - Identification of FOPDT model

Lecture 21 - Identification of second order plus dead time model

Lecture 22 - Identification of SOPDT model

Lecture 23 - Steady state gain from asymmetrical relay test

Lecture 24 - Identification of SOPDT model with pole multiplicity

Lecture 25 - Existence of limit cycle for unstable system

Lecture 26 - Identification procedures

Lecture 27 - Identification of underdamped systems

Lecture 28 - Off-line identification of TITO systems

Lecture 29 - On-line identification of TITO systems

Lecture 30 - Review of time domain based identification

Lecture 31 - DF based analytical expressions for on-line identification

Lecture 32 - Model parameter accuracy and sensitivity

Lecture 33 - Improved identification using Fourier series and wavelet transform

Lecture 34 - Reviews of DF based identification

Lecture 35 - Advanced Smith predictor controller

Lecture 36 - Design of controllers for the advanced Smith predictor

Lecture 37 - Model-free controller design

Lecture 38 - Model Based PID controller Design - I

Lecture 39 - Model Based PI-PD controller Design - II

Lecture 40 - Tuning of reconfigurable PID controllers

NPTEL : NOC:Optimization Techniques for Digital VLSI Design (Electrical Engineering)

Co-ordinators : Dr. Santosh Biswas, Prof. Chandan Karfa

Lecture 1 - Introduction to Digital VLSI Design Flow

Lecture 2 - High-level Synthesis (HLS) flow with an example

Lecture 3 - Automation of High-level Synthesis Steps

Lecture 4 - Impact of Coding Style on HLS Results

Lecture 5 - Impact of Compiler Optimizations on HLS Results

Lecture 6 - RTL Optimizations for Timing

Lecture 7 - Retiming

Lecture 8 - RTL Optimizations for Area

Lecture 9 - RTL Optimizations for Power

Lecture 10 - High Level Synthesis: Introduction to Logic Synthesis

Lecture 11 - Overview of FPGA Technology Mapping

Lecture 12 - Introduction to Physical Synthesis

Lecture 13 - Introduction to Digital VLSI Testing - I

Lecture 14 - Introduction to Digital VLSI Testing - II

Lecture 15 - Optimization Techniques for ATPG - Part I

Lecture 16 - Optimization Techniques for ATPG - Part II

Lecture 17 - Optimization Techniques for Design for Testability

Lecture 18 - High-level fault modeling and RTL level Testing

Lecture 19 - LTL/CTL based Verification

Lecture 20 - Verification of Large Scale Systems

Lecture 21 - BDD based verification

Lecture 22 - Verification: ADD based verification, HDD based verification

Lecture 23 - Verification: Symbolic Model Checking

Lecture 24 - Verification: Bounded Model Checking

NPTEL : NOC:Advanced Topics in Probability and Random Processes (Electrical Engineering)

Co-ordinators : Prof. Prabin K Bora

Lecture 1 - Probability Basics

Lecture 2 - Random Variable - I

Lecture 3 - Random Variable - II

Lecture 4 - Random Vectors and Random Processes

Lecture 5 - Infinite Sequence of Events - I

Lecture 6 - Infinite Sequence of Events - II

Lecture 7 - Convergence of Sequence of Random Variables

Lecture 8 - Weak Convergence - I

Lecture 9 - Weak Convergence - II

Lecture 10 - Laws of Large Numbers

Lecture 11 - Central Limit Theorem

Lecture 12 - Large Deviation Theory

Lecture 13 - Crammer's Theorem for Large Deviation

Lecture 14 - Introduction to Markov Processes

Lecture 15 - Discrete Time Markov Chain - 1

Lecture 16 - Discrete Time Markov Chain - 2

Lecture 17 - Discrete Time Markov Chain - 3

Lecture 18 - Discrete Time Markov Chain - 4

Lecture 19 - Discrete Time Markov Chain - 5

Lecture 20 - Continuous Time Markov Chain - 1

Lecture 21 - Continuous Time Markov Chain - 2

Lecture 22 - Continuous Time Markov Chain - 3

Lecture 23 - Martingale Process - 1

Lecture 24 - Martingale Process - 2

NPTEL : NOC:Microwave Engineering (Electrical Engineering)

Co-ordinators : Dr. Ratnajit Bhattacharjee

Lecture 1 - Introduction to Microwave Engineering

Lecture 2 - Introduction to Transmission Line Theory

Lecture 3 - Lossy Transmission Line

Lecture 4 - Smith Chart

Lecture 5 - Introduction to Waveguides and Rectangular Waveguide

Lecture 6 - Circular Waveguide

Lecture 7 - Attenuation Waveguide

Lecture 8 - N-port microwave networks and equivalent voltages and currents

Lecture 9 - Scattering Matrix (S-Parameters) Part-1

Lecture 10 - Scattering Matrix (S-parameters) Part-2 and Transmission Matrix (ABCD-Parameters)

Lecture 11 - Impedance Matching Using L-Section and Series Stub Networks

Lecture 12 - Impedance Matching Using Shunt Stub, Double Stub and Quarter wave Transformer

Lecture 13 - Multisection Matching Networks and Tapered Lines

Lecture 14 - Series and Parallel RLC Resonators

Lecture 15 - Transmission Line Resonators

Lecture 16 - Waveguide Resonators

Lecture 17 - Introduction to power dividers

Lecture 18 - Directional couplers

Lecture 19 - Microwave Filters - Part 1

Lecture 20 - Microwave Filters - Part 2

Lecture 21 - Characteristics of Microwave BJT and FET

Lecture 22 - PIN Diodes and Control Circuits

Lecture 23 - Schottky Diodes and Detectors and Tunnel Diodes

Lecture 24 - Gunn Diodes, IMPATT Diodes and Varactor Diodes

Lecture 25 - Two-Port Power Gain and Stability

Lecture 26 - Design of single stage transistor amplifier (for maximum gain, specified gain, low noise)

Lecture 27 - RF oscillator

Lecture 28 - Limitations of Conventional Tubes at Microwave Ranges

Lecture 29 - Introduction to Klystron

Lecture 30 - Reflex Klystron, Magnetron and TWT

Lecture 31 - Ferrite Devices

Lecture 32 - Planar transmission lines for MIC

Lecture 33 - Lumped elements for MIC

Lecture 34 - Lumped inductor, HMIC and MMIC

Lecture 35 - Overview of Radar

Lecture 36 - Cellular Communication

Lecture 37 - Satellite Communication and Applications of Microwave

NPTEL : NOC:Microprocessors and Interfacing (Electrical Engineering)

Co-ordinators : Prof. Shaik Rafi Ahamed

Lecture 1 - Microprocessor Operations

Lecture 2 - 8086 Flags

Lecture 3 - Functional Diagram of 8086

Lecture 4 - 8086 Common and Minimum Mode Signals

Lecture 5 - 8086 Maximum Mode Signals

Lecture 6 - 8086 Data Transfer Instructions

Lecture 7 - 8086 Arithmetic Instructions - I

Lecture 8 - 8086 Arithmetic Instructions - II

Lecture 9 - 8086 Logical Instructions

Lecture 10 - 8086 Branch and String Instructions

Lecture 11 - 8086 Interrupt and Machine Control Instructions

Lecture 12 - Sum of Products, Multi-byte addition

Lecture 13 - Largest number, 2's complement Programs

Lecture 14 - Programs on Subroutines

Lecture 15 - ROM, RAM

Lecture 16 - Example I

Lecture 17 - Example II

Lecture 18 - Architecture, Interfacing to Simple I/O

Lecture 19 - Keyboard Interface

Lecture 20 - 7-segment Display Interface

Lecture 21 - Multiplexed 7-sgment Display Interface

Lecture 22 - Stepper motor, Liquid level control

Lecture 23 - Traffic light control, A/D converter

Lecture 24 - D/A converter

Lecture 25 - Electronic weighing machine

Lecture 26 - Programable Interval Timer (8254)

Lecture 27 - Modes of 8254

Lecture 28 - Architecture of 8259

Lecture 29 - Initialization command words of 8259

Lecture 30 - Operational command words of 8259

Lecture 31 - 8237 Architecture, interfacing and Programming

Lecture 32 - Basic Concepts of serial I/O

Lecture 33 - Basic Concepts of serial I/O (Continued...)

Lecture 34 - Architecture of 8251

NPTEL : NOC:Statistical Signal Processing (Electrical Engineering)

Co-ordinators : Prof. Prabin Kumar Bora

Lecture 1 - Overview of Statistical Signal Processing

Lecture 2 - Probability and Random Variables

Lecture 3 - Linear Algebra of Random Variables

Lecture 4 - Random Processes

Lecture 5 - Linear Shift Invariant Systems with Random Inputs

Lecture 6 - White Noise and Spectral Factorization Theorem

Lecture 7 - Linear Models of Random Signals

Lecture 8 - Estimation Theory - 1

Lecture 9 - Estimation Theory - 2: MVUE and Cramer Rao Lower Bound

Lecture 10 - Cramer Rao Lower Bound 2

Lecture 11 - MVUE through Sufficient Statistic - 1

Lecture 12 - MVUE through Sufficient Statistic - 2

Lecture 13 - Method of Moments and Maximum Likelihood Estimators

Lecture 14 - Properties of Maximum Likelihood Estimator (MLE)

Lecture 15 - Bayesian Estimators - 1

Lecture 16 - Bayesian Estimators - 2

Lecture 17 - Optimal linear filters: Wiener Filter

Lecture 18 - FIR Wiener filter

Lecture 19 - Non-Causual IIR Wiener Filter

Lecture 20 - Causal IIR Wiener Filter

Lecture 21 - Linear Prediction of Signals - 1

Lecture 22 - Linear Prediction of Signals - 2

Lecture 23 - Linear Prediction of Signals - 3

Lecture 24 - Review Assignment - 1

Lecture 25 - Adaptive Filters - 1

Lecture 26 - Adaptive Filters - 2

Lecture 27 - Adaptive Filters - 3

Lecture 28 - Review Assignment - 2

Lecture 29 - Adaptive Filters - 4

Lecture 30 - Adaptive Filters - 4 (Continued...)

Lecture 31 - Review Assignment - 3

Lecture 32 - Recursive Least Squares (RLS) Adaptive Filter - 1

Lecture 33 - Recursive Least Squares (RLS) Adaptive Filter - 2

Lecture 34 - Review Assignment - 4

Lecture 35 - Kalman Filter - 1

Lecture 36 - Vector Kalman Filter

Lecture 37 - Linear Models of Random Signals

Lecture 38 - Review - 1

Lecture 39 - Review - 2

NPTEL : NOC:Computer Vision and Image Processing - Fundamentals and Applications (Electrical Engineering)

Co-ordinators : Prof. M. K. Bhuyan

Lecture 1 - Introduction to Digital Image Processing

Lecture 2 - Introduction to Computer Vision

Lecture 3 - Introduction to Computer Vision and Basic Concepts of Image Formation

Lecture 4 - Shape From Shading

Lecture 5 - Image Formation: Geometric Camera Models - I

Lecture 6 - Image Formation: Geometric Camera Models - II

Lecture 7 - Image Formation: Geometric Camera Models - III

Lecture 8 - Image Formation in a Stereo Vision Setup

Lecture 9 - Image Reconstruction from a Series of Projections

Lecture 10 - Image Reconstruction from a Series of Projections

Lecture 11 - Image Transforms - I

Lecture 12 - Image Transforms - II

Lecture 13 - Image Transforms - III

Lecture 14 - Image Transforms - IV

Lecture 15 - Image Enhancement

Lecture 16 - Image Filtering - I

Lecture 17 - Image Filtering - II

Lecture 18 - Colour Image Processing - I

Lecture 19 - Colour Image Processing - II

Lecture 20 - Image Segmentation

Lecture 21 - Image Features and Edge Detection

Lecture 22 - Edge Detection

Lecture 23 - Hough Transform

Lecture 24 - Image Texture Analysis - I

Lecture 25 - Image Texture Analysis - II

Lecture 26 - Object Boundary and Shape Representations - I

Lecture 27 - Object Boundary and Shape Representations - II

Lecture 28 - Interest Point Detectors

Lecture 29 - Image Features - HOG and SIFT

Lecture 30 - Introduction to Machine Learning - I

Lecture 31 - Introduction to Machine Learning - II

Lecture 32 - Introduction to Machine Learning - III

Lecture 33 - Introduction to Machine Learning - IV

Lecture 34 - Introduction to Machine Learning - V

Lecture 35 - Artificial Neural Network for Pattern Classification - I

Lecture 36 - Artificial Neural Network for Pattern Classification - II

Lecture 37 - Introduction to Deep Learning

Lecture 38 - Gesture Recognition

Lecture 39 - Background Modelling and Motion Estimation

Lecture 40 - Object Tracking

Lecture 41 - Programming Examples

NPTEL : NOC:System Design through VERILOG (Electrical Engineering)

Co-ordinators : Prof. Shaik Rafi Ahamed

Lecture 1 - Verilog Operators and Modules

Lecture 2 - Verilog Ports, Data types and Assignments

Lecture 3 - Basics of gate level modeling

Lecture 4 - Half adder, full adder and ripple carry adder

Lecture 5 - Parallel adder/subtractor

Lecture 6 - Multiplier and comparator

Lecture 7 - Decoder, encoder and multiplexer

Lecture 8 - Demultiplexer, read only memory

Lecture 9 - Review of flip-flops

Lecture 10 - Verilog modeling of flip-flops

Lecture 11 - Modeling of CMOS gates and Boolean functions

Lecture 12 - Modeling using transmission gates, CMOS dalay times

Lecture 13 - Signal strengths

Lecture 14 - Basics of dataflow modeling

Lecture 15 - Examples of dataflow modeling

Lecture 16 - Basics of behavioral modeling

Lecture 17 - Examples of behavioral modeling

Lecture 18 - Verilog modeling of counters

Lecture 19 - Verilog modeling of sequence detector

Lecture 20 - Verilog modeling FSMs and shift registers

Lecture 21 - Combinational circuit examples

Lecture 22 - Sequential circuit examples

Lecture 23 - Arithmetic and Logic Unit (ALU)

Lecture 24 - Static RAM and Braun Multiplier

Lecture 25 - FIR filter implementation

Lecture 26 - Baugh-Wooley signed multiplier architecture

Lecture 27 - IIR filter implementation

NPTEL : NOC:Usability Engineering (Electrical Engineering)

Co-ordinators : Prof. Debayan Dhar

Lecture 1 - Introduction to Usability

Lecture 2 - Usability - Historical Foundations

Lecture 3 - Standard Terminologies

Lecture 4 - Elements of User Experience

Lecture 5 - Usability in software development - I

Lecture 6 - Usability in software development - II

Lecture 7 - User Centered Design Process - I

Lecture 8 - User Centered Design Process - II

Lecture 9 - User Centered Design Process - III

Lecture 10 - Requirement Analysis - I (A)

Lecture 11 - Requirement Analysis - I (B)

Lecture 12 - Requirement Analysis - I (C)

Lecture 13 - Requirement Analysis - I (D)

Lecture 14 - Requirement Analysis - I (E)

Lecture 15 - Requirement Analysis - I (F)

Lecture 16 - Requirement Analysis - II (A)

Lecture 17 - Requirement Analysis - II (B)

Lecture 18 - Requirement Analysis - II (C)

Lecture 19 - Requirement Analysis - II (D)

Lecture 20 - Requirement Analysis - III (A)

Lecture 21 - Eye Tracker

Lecture 22 - Demonstration of an Eye tracking device

Lecture 23 - Requirement Analysis - III (B)

Lecture 24 - Mapping Experiences

Lecture 25 - Cognitive Issues - I

Lecture 26 - Cognitive Issues - II

Lecture 27 - Cognitive Issues - III

Lecture 28 - Cognitive Issues - IV

Lecture 29 - Competitive analysis and preparing for design briefing - I

Lecture 30 - Competitive analysis and preparing for design briefing - II

Lecture 31 - Conceptualization and Prototyping - I (A)

Lecture 32 - Conceptualization and Prototyping - I (B)

Lecture 33 - Conceptualization and Prototyping - I (C)

Lecture 34 - Conceptualization and Prototyping - II (A)

Lecture 35 - Conceptualization and Prototyping - II (B)

Lecture 36 - Usability heuristics and testing - I

Lecture 37 - Usability heuristics and testing - II

Lecture 38 - Usability heuristics and testing - III

Lecture 39 - Usability Testing (A)

Lecture 40 - Usability Testing (B)

Lecture 41 - Usability Testing (C)

Lecture 42 - UI/UX design based on Garret model: a case study

Lecture 43 - Effective contextual enquiry

Lecture 44 - Contextual enquiry: case study

NPTEL : NOC:Probability and Random Processes (Electrical Engineering)

Co-ordinators : Prof. Ribhu, Prof. Rohit Sinha

Lecture 1 - Introduction

Lecture 2 - Algebra of Events

Lecture 3 - Axioms of Probability

Lecture 4 - Example 1

Lecture 5 - Example 2

Lecture 6 - Example 3

Lecture 7 - Example 4

Lecture 8 - Example 5

Lecture 9 - Conditional Probability

Lecture 10 - Bayes Theorem 1

Lecture 11 - Bayes Theorem 2

Lecture 12 - A Brief Review

Lecture 13 - Example 1

Lecture 14 - Example 2

Lecture 15 - Example 3

Lecture 16 - Example 4

Lecture 17 - Example 5

Lecture 18 - Independent Events

Lecture 19 - A Brief Review

Lecture 20 - Example 1

Lecture 21 - Example 2

Lecture 22 - Example 3

Lecture 23 - Example 4

Lecture 24 - Discrete Random Variables

Lecture 25 - Expectation

Lecture 26 - Moments

Lecture 27 - Variance

Lecture 28 - Binomial Random Variables

Lecture 29 - Poisson Random Variables

Lecture 30 - More on Poission Random Variables

Lecture 31 - Properties of the CDF

Lecture 32 - A Brief Review - I

Lecture 33 - A Brief Review - II

Lecture 34 - Example 1

Lecture 35 - Example 2

Lecture 36 - Example 3

Lecture 37 - Example 4

Lecture 38 - Example 5

Lecture 39 - Example 6

Lecture 40 - Example 7

Lecture 41 - Example 8

Lecture 42 - Example 9

Lecture 43 - Continuous Random Variables

Lecture 44 - Expectation of Continuous random variables

Lecture 45 - The uniform and the Gaussian Random variables

Lecture 46 - The mean and variance of a Gaussian Random Variable

Lecture 47 - The exponential random variable and other continuous distributions

Lecture 48 - A Brief Review

Lecture 49 - Example 1

Lecture 50 - Example 2

Lecture 51 - Example 3

Lecture 52 - Example 4

Lecture 53 - Example 5

Lecture 54 - Functions of a random varible

Lecture 55 - Functions of a random varible

Lecture 56 - The moment generating function

Lecture 57 - Conditional Distributions

Lecture 58 - Bivariate Distributions

Lecture 59 - Independence of Random Varibles

Lecture 60 - Jointly Gaussian Random Varibales and Circular symmetry

Lecture 61 - Jointly Discrete Random Variables

Lecture 62 - One Function of two random variables

Lecture 63 - Order Statistics

Lecture 64 - Two functions of two random variables

Lecture 65 - Joint Moments

Lecture 66 - Joint Charactristic Functions

Lecture 67 - Conditional Distributions for multiple random variables

Lecture 68 - Conditional Expectations

Lecture 69 - Examples

Lecture 70 - Random Vectors

Lecture 71 - Independence of Random Varibles

Lecture 72 - Complex Random Varibales

Lecture 73 - Covariance Matrices

Lecture 74 - Conditional Densities

Lecture 75 - Gaussianity

Lecture 76 - Chi Squared Densities

Lecture 77 - Examples

Lecture 78 - Estimation Theory

Lecture 79 - Measurements

Lecture 80 - Sequences of Random Variables

Lecture 81 - Laws of large numbers

Lecture 82 - Random processes

Lecture 83 - Stationarity, Cyclostationarity, Ergodicity

Lecture 84 - Random Processes as Signals (PSD and LTI Response)

Lecture 85 - White and Gaussian Processes Noise

NPTEL : NOC:Simulation of Communication Systems using Matlab (Electrical Engineering)

Co-ordinators : Dr. Ribhu

Lecture 1 - Introduction

Lecture 2 - Basics of MATLAB

Lecture 3 - Data Types

Lecture 4 - Floating Point Numbers

Lecture 5 - Scripts and Flow of Control

Lecture 6 - The For Loop

Lecture 7 - Arrays

Lecture 8 - Indexing

Lecture 9 - Some Reuslts from Linear Algebra

Lecture 10 - Matrix Multiplication

Lecture 11 - Eigenvalues and Eigenvectors

Lecture 12 - Complex Numbers

Lecture 13 - Hermitian Matrices

Lecture 14 - Matrix Inversion

Lecture 15 - Signals

Lecture 16 - Convolution

Lecture 17 - Probability

Lecture 18 - Bayes Theorem

Lecture 19 - Random Varibles

Lecture 20 - Clinical Trials - I

Lecture 21 - Clinical Trials - II

Lecture 22 - Random Numbers

Lecture 23 - Random Disttributions

Lecture 24 - Histograms - I

Lecture 25 - Histograms - II

Lecture 26 - Functions of Random Variables

Lecture 27 - Generating Random Disttributions

Lecture 28 - Laws of Large numbers

Lecture 29 - Random Processes

Lecture 30 - Properties of Random Processes

Lecture 31 - Power Spectra

Lecture 32 - Signals and Noise

Lecture 33 - Stochastic Models

Lecture 34 - The AR-1 Process

Lecture 35 - Stochastic Models II

Lecture 36 - Yule Walker Equations

Lecture 37 - Markov Chains - I

Lecture 38 - Markov Chains - II

Lecture 39 - Markov Chains - III

Lecture 40 - Analog to Digital Coversion

Lecture 41 - K Means

Lecture 42 - Correlation

Lecture 43 - Predictive Coding

Lecture 44 - Image Compression

Lecture 45 - Transform Domain Compression

Lecture 46 - Multi Resolution Coding

Lecture 47 - Introduction to Communications

Lecture 48 - Low Pass and BandPass Signals

Lecture 49 - Signal Spaces

Lecture 50 - PAM

Lecture 51 - Detection

Lecture 52 - Effects of AWGN

Lecture 53 - ML Detection - I

Lecture 54 - ML Detection - II

Lecture 55 - The Union Bound

Lecture 56 - Symbol Error Rates

Lecture 57 - Choosing Constellations

Lecture 58 - Orthogonal Signalling

Lecture 59 - Non-Coherent Dection - 1

Lecture 60 - Non-Coherent Dection - 2

Lecture 61 - DPSK - I

Lecture 62 - DPSK - II

Lecture 63 - Introduction to Wireless Communications

Lecture 64 - Conclusion

NPTEL : NOC:Machine Learning and Deep Learning - Fundamentals and Applications (Electrical Engineering)

Co-ordinators : Prof. M.K. Bhuyan

Lecture 1 - Introduction to Machine Learning

Lecture 2 - Performance Measures of Classification

Lecture 3 - Bias-Variance Tradeoff

Lecture 4 - Regression

Lecture 5 - Bayesian Decision Theory - 1

Lecture 6 - Bayesian Decision Theory - 2

Lecture 7 - Bayes Decision Theory - Binary Features

Lecture 8 - Bayesian Decision Theory - 3

Lecture 9 - Bayesian Decision Theory - 4

Lecture 10 - Bayesian Belief Networks

Lecture 11 - Parameter Estimation and Maximum Likelihood Estimation

Lecture 12 - Parameter Estimation and Bayesian Estimation

Lecture 13 - Concept of non-parametric techniques

Lecture 14 - Density Estimation by Parzen Window

Lecture 15 - Parzen Window and K nearest neighbor algorithm

Lecture 16 - Linear Discriminant Functions and Perceptron Criteria - Part I

Lecture 17 - Linear Discriminant Functions and Perceptron Criteria - Part II

Lecture 18 - Linear Discriminant Functions and Perceptron Criteria - Part III

Lecture 19 - Support Vector Machine - Part I

Lecture 20 - Support Vector Machine - Part II

Lecture 21 - Logistic Regression

Lecture 22 - Decision Tree

Lecture 23 - Hidden Markov Model (HMM)

Lecture 24 - Ensemble Classifiers - Part I

Lecture 25 - Ensemble Classifiers - Part II

Lecture 26 - Dimensionality Problem and Principal Component Analysis

Lecture 27 - Principal Component Analysis

Lecture 28 - Linear Discriminant Analysis (LDA) - Part I

Lecture 29 - Linear Discriminant Analysis (LDA) - Part II

Lecture 30 - Gaussian Mixture Model and EM Algorithm

Lecture 31 - K-means clustering.

Lecture 32 - Fuzzy K-means clustering

Lecture 33 - Hierarchical Agglomerative Clustering and Mean-shift Clustering

Lecture 34 - Artificial Neural Networks for Pattern Classification - Part 1

Lecture 35 - Artificial Neural Networks for Pattern Classification - Part 2

Lecture 36 - Artificial Neural Networks for Pattern Classification - Part 3

Lecture 37 - Introduction to Deep Learning and Convolutional Neural Network (CNN)

Lecture 38 - Vanishing and Exploding Gradients in Deep Neural Networks

Lecture 39 - CNN Architectures - LeNet-5 and AlexNet

Lecture 40 - CNN Architectures - VGG 16, GoogLeNet and ResNet

Lecture 41 - Generative Adversarial Networks (GAN) - Fundamentals and Applications

Lecture 42 - U-Net: Convolutional Networks for Image Segmentation

Lecture 43 - Introduction to Autoencoder and Recurrent Neural Networks (RNN)

Lecture 44 - Programming Concepts - 1

Lecture 45 - Programming Concepts - 2

Lecture 46 - Problem Solving Session - 1

Lecture 47 - Problem Solving Session - 2

Lecture 48 - Problem Solving Session - 3

NPTEL : NOC:Integrated Circuits and Applications (Electrical Engineering)

Co-ordinators : Prof. Shaik Rafi Ahamed

Lecture 1 - Introduction to Integrated Circuits

Lecture 2 - Summing and Difference Amplifiers

Lecture 3 - Instrumentation Amplifier

Lecture 4 - Integrator and Diffrentiator

Lecture 5 - Precision Half Wave and Full Wave Rectifiers

Lecture 6 - Clipper and Clamper circuits

Lecture 7 - Logarithmic and Anti-logarithmic Amplifiers

Lecture 8 - DC Characteristics (Offset Currents and Voltages)

Lecture 9 - AC Charcterstics (Frequency Response)

Lecture 10 - AC Charcterstics (Compensation Techniques and Slew Rate)

Lecture 11 - Examples on Design of Adder and Subtractor Circuits

Lecture 12 - Examples on Transfer Function Computation

Lecture 13 - Examples on Instrumentation Amplifier

Lecture 14 - Examples on CMRR Computation

Lecture 15 - First Order Low Pass Filter

Lecture 16 - Second Order Low Pass Filter

Lecture 17 - Design of Butterworth Low Pass Filter

Lecture 18 - Design of Butterworth High Pass Filter

Lecture 19 - Design of Band Pass Filter

Lecture 20 - Design of Band Stop Filter

Lecture 21 - All Pass Filter

Lecture 22 - RC Phase Shift Oscillator

Lecture 23 - Wien Bridge, Colpitt's and Hartley Oscillators

Lecture 24 - Comparator and Schmitt Trigger Circuits

Lecture 25 - Square Wave and Triangular Waveform Generators

Lecture 26 - Monostable operation

Lecture 27 - Monostable applications - I

Lecture 28 - Monostable applications - II

Lecture 29 - Astable operation

Lecture 30 - Phase detectors

Lecture 31 - Voltage Controlled oscillator

Lecture 32 - PLL IC 565 operation

Lecture 33 - PLL Applications

Lecture 34 - Fixed Voltage Regulator

Lecture 35 - Adjastable Voltage Regulator

Lecture 36 - Switching Regulators

Lecture 37 - Weighted Resistor D/A Converter

Lecture 38 - R-2R Ladder D/A Converter

Lecture 39 - Inverted R-2R Ladder D/A Converter

Lecture 40 - Analog to Digital Converters

Lecture 41 - CMOS Inverter

Lecture 42 - CMOS NAND Gate

Lecture 43 - Transient Response of CMOS NAND and NOR Gates

Lecture 44 - Boolean function Realization using CMOS and Sizing

NPTEL : Advanced Electric Drives (Electrical Engineering)

Co-ordinators : Dr. S.P. Das

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

Lecture 37

Lecture 38

Lecture 39

Lecture 40

NPTEL : High Voltage DC Transmission (Electrical Engineering)

Co-ordinators : Dr. S.N. Singh

Lecture 1 - High Voltage DC Transmission

Lecture 2 - High Voltage DC Transmission

Lecture 3 - High Voltage DC Transmission

Lecture 4 - High Voltage DC Transmission

Lecture 5 - High Voltage DC Transmission

Lecture 6 - High Voltage DC Transmission

Lecture 7 - High Voltage DC Transmission

Lecture 8 - High Voltage DC Transmission

Lecture 9 - High Voltage DC Transmission

Lecture 10 - High Voltage DC Transmission

Lecture 11 - High Voltage DC Transmission

Lecture 12 - High Voltage DC Transmission

Lecture 13 - High Voltage DC Transmission

Lecture 14 - High Voltage DC Transmission

Lecture 15 - High Voltage DC Transmission

Lecture 16 - High Voltage DC Transmission

Lecture 17 - High Voltage DC Transmission

Lecture 18 - High Voltage DC Transmission

Lecture 19 - High Voltage DC Transmission

Lecture 20 - High Voltage DC Transmission

Lecture 21 - High Voltage DC Transmission

Lecture 22 - High Voltage DC Transmission

Lecture 23 - High Voltage DC Transmission

Lecture 24 - High Voltage DC Transmission

Lecture 25 - High Voltage DC Transmission

Lecture 26 - High Voltage DC Transmission

Lecture 27 - High Voltage DC Transmission

Lecture 28 - High Voltage DC Transmission

Lecture 29 - High Voltage DC Transmission

Lecture 30 - High Voltage DC Transmission

Lecture 31 - High Voltage DC Transmission

Lecture 32 - High Voltage DC Transmission

Lecture 33 - High Voltage DC Transmission

Lecture 34 - High Voltage DC Transmission

Lecture 35 - High Voltage DC Transmission

Lecture 36 - High Voltage DC Transmission

Lecture 37 - High Voltage DC Transmission

NPTEL : Intelligent Systems and Control (Electrical Engineering)

Co-ordinators : Prof. Laxmidhar Behera

Lecture 1 - Introduction to Intelligent Systems and Control

Lecture 2 - Linear Neural networks

Lecture 3 - Multi layered Neural Networks

Lecture 4 - Back Propagation Algorithm revisited

Lecture 5 - Non Linear System Analysis - Part I

Lecture 6 - Non Linear System Analysis - Part II

Lecture 7 - Radial Basis Function Networks

Lecture 8 - Adaptive Learning rate

Lecture 9 - Weight update rules

Lecture 10 - Recurrent networks Back propagation through time

Lecture 11 - Recurrent networks Real time recurrent learning

Lecture 12 - Self organizing Map - Multidimensional networks

Lecture 13 - Fuzzy sets - A Primer

Lecture 14 - Fuzzy Relations

Lecture 15 - Fuzzy Rule base and Approximate Reasoning

Lecture 16 - Introduction to Fuzzy Logic Control

Lecture 17 - Neural Control A review

Lecture 18 - Network inversion and Control

Lecture 19 - Neural Model of a Robot manipulator

Lecture 20 - Indirect Adaptive Control of a Robot manipulator

Lecture 21 - Adaptive neural control for Affine Systems SISO

Lecture 22 - Adaptive neural control for Affine systems MIMO

Lecture 23 - Visual Motor Coordination with KSOM

Lecture 24 - Visual Motor coordination - quantum clustering

Lecture 25 - Direct Adaptive control of Manipulators - Intro

Lecture 26 - NN based back stepping control

Lecture 27 - Fuzzy Control - a Review

Lecture 28 - Mamdani type flc and parameter optimization

Lecture 29 - Fuzzy Control of a pH reactor

Lecture 30 - Fuzzy Lyapunov controller - Computing with words

Lecture 31 - Controller Design for a T-S Fuzzy model

Lecture 32 - Linear controllers using T-S fuzzy model

NPTEL : Power Systems Operation and Control (Electrical Engineering)

Co-ordinators : Dr. S.N. Singh

Module 1 - Lecture 1

Module 1 - Lecture 2

Module 1 - Lecture 3

Module 2 - Lecture 1

Module 2 - Lecture 2

Module 2 - Lecture 3

Module 2 - Lecture 4

Module 2 - Lecture 5

Module 2 - Lecture 6

Module 2 - Lecture 7

Module 2 - Lecture 8

Module 2 - Lecture 9

Module 2 - Lecture 10

Module 2 - Lecture 11

Module 2 - Lecture 12

Module 2 - Lecture 13

Module 2 - Lecture 14

Module 3 - Lecture 1

Module 3 - Lecture 2

Module 3 - Lecture 3

Module 3 - Lecture 4

Module 3 - Lecture 5

Module 3 - Lecture 6

Module 3 - Lecture 7

Module 3 - Lecture 8

Module 3 - Lecture 9

Module 3 - Lecture 10

Module 4 - Lecture 1

Module 4 - Lecture 2

Module 4 - Lecture 3

Module 4 - Lecture 4

Module 5 - Lecture 1

Module 5 - Lecture 2

Module 6 - Lecture 1

Module 6 - Lecture 2

NPTEL : NOC:Electromagnetic theory (Electrical Engineering)

Co-ordinators : Dr. Pradeep Kumar K

Lecture 1 - Introduction to EMT

Lecture 2 - Coulombs law

Lecture 3 - Vector analysis-I and Introduction to coordinate system

Lecture 4 - Rectangular coordinate system

Lecture 5 - Vector analysis-II

Lecture 6 - Introduction to Electric field

Lecture 7 - Electric field-I

Lecture 8 - Cylindrical coordinate system

Lecture 9 - Transformation and Electric field-II

Lecture 10 - Electric Potential-I

Lecture 11 - Spherical co-ordinate system and Electric potential-II

Lecture 12 - Vector Analysis-III and Electric potential-III

Lecture 13 - GaussÂ’s law and its application-I

Lecture 14 - GaussÂ’s law and its application-II

Lecture 15 - Divergence and PoissonÂ’s and LaplaceÂ’s equation

Lecture 16 - GaussÂ’s law and its application -III

Lecture 17 - Vector analysis Â–III (curl and its significance)

Lecture 18 - Conductor and dielectric-I

Lecture 19 - Polarization - I

Lecture 20 - Polarization - II

Lecture 21 - Polarization - II (Continued...)

Lecture 22 - Boundary condition

Lecture 23 - Continuity equation and Conductors - III

Lecture 24 - Conductors Â– IV

Lecture 25 - Conductors Â– IV (Continued...) and Capacitor - I

Lecture 26 - Capacitor - II

Lecture 27 - Capacitor - II (Continued...) and Equipotential Surfaces

Lecture 28 - Solution of LaplaceÂ’s equation-I

Lecture 29 - Solution of LaplaceÂ’s equation-I I and method of images-I

Lecture 30 - Method of images-II

Lecture 31 - Solution of LaplaceÂ’s equation-III

Lecture 32 - Solution of LaplaceÂ's equation-IV

Lecture 33 - Introduction of magnetic field

Lecture 34 - Biot savart law and its application

Lecture 35 - Biot savart lawandits application-II

Lecture 36 - Magnetic vector potential

Lecture 37 - Magnetic force, torque and dipole

Lecture 38 - Magnetic force, torque and dipole (Continued...)

Lecture 39 - Magnetic materials-I

Lecture 40 - Magnetic materials-I (Continued...) and Magnetic moment

Lecture 41 - Magnetic materials-I (Continued...) and Boundary condition for Magnetic fields

Lecture 42 - Inductor and calculation of inductance for different shapes

Lecture 43 - Inductor and calculation of inductance for different shapes (Continued...)

Lecture 44 - Faradays law and its application-I

Lecture 45 - Faradays law and its application-II

Lecture 46 - Displacement current

Lecture 47 - MaxwellÂ's equation

Lecture 48 - Wave propagation

Lecture 49 - Solution of Helmholtz equation

Lecture 50 - Uniform plane waves

Lecture 51 - Polarization and Poynting Vector

Lecture 52 - Wave reflections (Normal incidence)

Lecture 53 - Waves in imperfect dielectrics and Good conductors

Lecture 54 - Skin depth/effect

Lecture 55 - Oblique incidence of waves

Lecture 56 - Oblique incidence of waves (Continued...)

Lecture 57 - Transmission line

Lecture 58 - Transmission line model

Lecture 59 - Steady state sinusoidal response of T-line-I

Lecture 60 - Steady state sinusoidal response of T-line-II

Lecture 61 - Steady state sinusoidal response of T-line-IIand Smith chart

Lecture 62 - Application of smith chart-I

Lecture 63 - Application of smith chart-II

Lecture 64 - Impedance matching

Lecture 65 - Transients on Transmission line-I

Lecture 66 - Transients on Transmission line-II

Lecture 67 - Pulse on Transmission line

Lecture 68 - Capacitive termination in Transmission line

Lecture 69 - Waveguide

Lecture 70 - Waveguide Analysis

Lecture 71 - TM modes in Waveguide

Lecture 72 - Rectangular waveguide: TM modes

Lecture 73 - Rectangular waveguide: TE modes

Lecture 74 - Waveguide: Wavelength, Impedance and power calculation

Lecture 75 - Waveguide losses

Lecture 76 - Dielectric Waveguide

Lecture 77 - Dielectric Waveguide (Continued...)

Lecture 78 - Radiation and Antenna

Lecture 79 - Hertzian Dipole Antenna

Lecture 80 - Hertzian Dipole Antenna (Continued...)

Lecture 81 - Quasi-statistics-I

Lecture 82 - Quasi-statistics-II

Lecture 83 - Long wire Antenna

Lecture 84 - Group velocity and Phase velocity

Lecture 85 - Numerical solution of Laplace's equation

NPTEL : NOC:Principles of Communication - Part 1 (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

Lecture 1 - Basics - Definition of Energy and Power of Signals

Lecture 2 - Frequency Domain Representation and Introduction to Discrete Fourier Series

Lecture 3 - Discrete Fourier Series Example and Parseval's Theorem for Periodic Signals

Lecture 4 - Fourier Transform (FT), Inverse Fourier Transform (IFT) of Continuous Signals, Example of FT of Pulse and Sinc Function

Lecture 5 - Modulation Property of Fourier Transform, Dirac Delta or Unit Impulse Function - Definition and Fourier Transform

Lecture 6 - Duality Property of Fourier Transform and Introduction to Linear Time Invatiant (LTI) Systems

Lecture 7 - Transmission of Signal through Linear Time Invariant (LTI) Systems and Cross- Correlation of Signals

Lecture 8 - Auto-Correlation of Signal and Energy Spectral Density (ESD)

Lecture 9 - Example for Auto-Correlation of Signal and Energy Spectral Density (ESD)

Lecture 10 - Introduction to Amplitude Modulation (AM), Modulation Index, Envelope Distortion and Over Modulation

Lecture 11 - Spectrum of Amplitude Modulated(AM) Signals and Introduction to Envelope Detection

Lecture 12 - Envelope Detection for Amplitude Modulated (AM) Signals and Time Constant for Capacitor in Envelope Detector

Lecture 13 - Power of Amplitude Modulated (AM) Signals and Power Efficiency of AM Signals

Lecture 14 - Double Sideband (DSB) Suppressed Carrier (SC) Modulation, Spectrum of DSB-SC Signals and Coherent Demodulation

Lecture 15 - Double Sideband(DSB) Suppressed Carrier (SC) Demodulation, Non-coherent demodulation, Impact of Carrier Phase Offset

Lecture 16 - Carrier Phase Offset Example for Double Sideband (DSB) Suppressed Carrier (SC) Demodulation- Wireless Cellular Communication with User Mobility

Lecture 17 - Phase Synchronization using Costas Receiver for Double Sideband (DSB) Suppressed Carrier (SC) Demodulation

Lecture 18 - Introduction to Quadrature Carrier Multiplexing (QCM) and Demodulation of QCM Signals.

Lecture 19 - Introduction to Single Sideband (SSB) Modulation

Lecture 20 - Generation of Single Sideband (SSB) Modulation Signals through Frequency Discrimination

Lecture 21 - Frequency Domain Description of Hilbert Transform Â– Fourier Spectrum of the Hilbert Transformer

Lecture 22 - Time Domain Description of Hilbert Transform Â– Impulse Response of the Hilbert Transformer

Lecture 23 - Phase Shifting Method for Generation of Single Sideband (SSB) Modulated Signals based on Hilbert Transform

Lecture 24 - Complex Pre-Envelope and Complex Envelope of Passband Signals

Lecture 25 - Complex Pre- Envelope and Complex Envelope of QCM (Quadrature Carrier Modulated) Signals

Lecture 26 - Introduction to Vestigial Side Band(VSB) Modulation and Non- Ideal Filtering, Spectral Efficiency

Lecture 27 - Properties of Vestigial Side Band Filter for Reconstruction of Message Signal without Distortion

Lecture 28 - Introduction to Angle Modulation, Description of Phase Modulation (PM) and Frequency Modulation (FM)

Lecture 29 - Frequency Modulation (FM) with Sinusoidal Modulation Signal and Pictorial Examples, Insights of PM and FM signals

Lecture 30 - Indirect Method for Generation of FM Signals - Generation of Narrowband FM Signal

Lecture 31 - Indirect Method for Generation of FM Signals - Generation of Wideband FM Signal through Frequency Multiplication

Lecture 32 - Spectrum of Frequency Modulated (FM) Signals

Lecture 33 - Bandwidth of Frequency Modulated (FM) Signals - Carson's Rule

Lecture 34 - Demodulation of Frequency Modulated (FM) Signals, Condition of Envelope Detection

Lecture 35 - Analog to Digital Conversion of Signals and Introduction to Sampling

Lecture 36 - Spectrum of Sampled Signal, Aliasing and Nyquist Sampling Theorem

Lecture 37 - Ideal Impluse Train Sampling, Reconstruction of Original Signal from Samples, Sinc Interpolation

Lecture 38 - Introduction to Pulse Amplitude Modulation (PAM), Sample and Hold, Flat Top Sampling

Lecture 39 - Pulse Amplitude Modulation (PAM), Spectrum of PAM Signal , Reconstruction of Original Signal from PAM Signal, Equalization

Lecture 40 - Introduction to Quantization, Uniform Quantizer, Mid- Tread Quantizer

Lecture 41 - Quantization, Mid- Rise Quantizer, PDF and Power of Quantization Noise, Quantization Noise Power versus Quantizer Resolution

Lecture 42 - Introduction to Lloyd- Max Quantization Algorithm, Optimal Quantizer Design

Lecture 43 - Lloyd- Max Quantization Algorithm, Iterative Computation of Optimal Quantization Levels and Intervals

Lecture 44 - Companding for Non- Uniform Quantization, Mu-law Compressor, A- Law Compressor

Lecture 45 - Introduction to Delta Modulation, One-bit Quantizer

Lecture 46 - Signal Reconstruction in Delta Modulation, Schematic Diagrams, Slope Overload Distortion and Granular Noise

Lecture 47 - Differential Pulse Coded Modulation (DPCM), DPCM Signal Reconstruction and Schematic Diagram

Lecture 48 - Frequency Mixing and Translation in Communication Systems, Heterodyne and Super Heterodyne Receivers

Lecture 49 - Frequency Translation and Super Heterodyne Receivers, Problem of Image Frequency

Lecture 50 - Frequency Division Multiplexing (FDM), Carrier Spacing in FDM

Lecture 51 - Time Division Multiplexing (TDM), Operation of TDM, Sample Spacing in TDM

Lecture 52 - Bandwidth Requirements for Time Division Multiplexing (TDM), The T1 TDM System : A Case Study

NPTEL : NOC:An Introduction to Coding Theory (Electrical Engineering)

Co-ordinators : Dr. Adrish Banerjee

Lecture 1 - Introduction to Error Control Coding - I

Lecture 2 - Introduction to Error Control Coding - II

Lecture 3 - Introduction to Error Control Coding - III

Lecture 4 - Introduction to Linear Block Codes, Generator Matrix and Parity Check Matrix

Lecture 5 - Syndrome, Error Correction and Error Detection

Lecture 6 - Problem Solving Session - I

Lecture 7 - Decoding of Linear Block Codes

Lecture 8 - Distance Properties of Linear Block Codes - I

Lecture 9 - Distance Properties of Linear Block Codes - II

Lecture 10 - Problem Solving Session - II

Lecture 11 - Some Simple Linear Block Codes - I

Lecture 12 - Some Simple Linear Block Codes - II: Reed Muller Codes

Lecture 13 - Bounds on the Size of a Code

Lecture 14 - Problem Solving Session - III

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

Lecture 19 - Decoding of Convolutional Codes - I: Viterbi Algorithm

Lecture 20 - Decoding of Convolutional Codes - II: BCJR Algorithm

Lecture 21 - Problem solving session - IV

Lecture 22 - Problem solving session - V

Lecture 23 - Performance Bounds for Convolutional Codes

Lecture 24 - Low Density Parity Check Codes

Lecture 25 - Decoding of Low Density Parity Check Codes - I

Lecture 26 - Decoding of Low Density Parity Check Codes - II: Belief Propagation Algorithm

Lecture 27 - Turbo Codes

Lecture 28 - Turbo Decoding

Lecture 29 - Problem Solving Sessions - VI

Lecture 30 - Distance Properties of Turbo Codes

Lecture 31 - Convergence of Turbo Codes

Lecture 32 - Automatic Repeat reQuest (ARQ) Schemes

Lecture 33 - Applications of Linear Codes

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

Lecture 3 - Spectrum of Transmitted Digital Communication Signal, Autocorrelation Function and Power Spectral Density

Lecture 4 - Spectrum of Transmitted Digital Communication Signal, Relation to Energy Spectral Density and Introduction to AWGN Channel

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

Lecture 10 - Probability of Error in Digital Communication, Optimal Decison Rule and Gaussian Q function

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

Lecture 12 - Introduction to Amplitude Shift Keying (ASK) Modulation

Lecture 13 - Optimal Decision Rule for Amplitude Shift Keying (ASK), Bit Error Rate (BER) and Comparison with Binary Phase Shift Keying (BPSK) Modulation

Lecture 14 - Introduction to Signal Space Concept and Orthonormal Basis Signals

Lecture 15 - Introduction to Frequency Shift Keying (FSK)

Lecture 16 - Optimal Decision Rule for FSK, Bit Error Rate (BER) and Comparison with BPSK, ASK

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

Lecture 18 - Waveforms of Quadrature Phase Shift Keying (QPSK)

Lecture 19 - Matched Filtering, Bit Error Rate and Symbol Error Rate for Quadrature Phase Shift Keying (QPSK)

Lecture 20 - Introduction to M-ary PAM (Pulse Amplitude Modulation), Average Symbol Power and Decision rules

Lecture 21 - M-ary PAM (Pulse Amplitude Modulation) -Part-II, Optimal Decision Rule and Probability of Error

Lecture 22 - M-ary QAM (Quadrature Amplitude Modulation) Part-I, Introduction, Transmitted Waveform and Average Symbol Energy

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

Lecture 24 - M-ary PSK (Phase Shift Keying) Part-I, Introduction , Transmitted Waveform and Constellation Diagram

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

Lecture 26 - Introduction to Information Theory, Relevance of Information Theory and Characterization of Information

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

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

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

Lecture 31 - Properties of Joint Entropy and Relation between Joint Entropy and Marginal Entropies

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

Lecture 33 - Mutual Information, Diagrammatic Representation and Properties of Mutual Information

Lecture 34 - Simple Example of Mutual Information and Practical Example of Mutual Information-Binary Symmetric Channel

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

Lecture 37 - Differential Entropy of Gaussian Source and Insights

Lecture 38 - Joint Conditional/ Differential Entropies and Mutual Information

Lecture 39 - Capacity of Gaussian channel - Part I

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

Lecture 41 - Introduction to Source Coding and Data Compression, Variable Length codes and Unique Decodability

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

Lecture 52 - State Diagram Representation of Convolutional Code, State transitions and Example of Code Generation using State transitions

Lecture 53 - Trellis Representation of Convolutional Code and Valid Code Words

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

Lecture 55 - Principle of Decoding of Convolutional code

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

NPTEL : NOC:Applied Engineering Electromagnetics (Electrical Engineering)

Co-ordinators : Dr. Pradeep Kumar K

Lecture 1 - Introduction to Applied Elecromagnetics

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

Lecture 10 - Impedance transformation and power flow on T-lines

Lecture 11 - Graphical aid: Smith Chart Derivation

Lecture 12 - Smith chart applications

Lecture 13 - Further applications of Smith chart - Part 1

Lecture 14 - Further applications of Smith chart - Part 2

Lecture 15 - Impedance matching techniques - Part 1

Lecture 16 - Impedance matching techniques - Part 2

Lecture 17 - Impedance matching techniques - Part 3

Lecture 18 - T-lines in time domain: Lattice diagrams

Lecture 19 - Further examples of use of lattice diagrams

Lecture 20 - High-speed digital signal propagation on T-lines

Lecture 21 - Transient analysis with reactive termination and Time-domain reflectometry

Lecture 22 - Fault detection using TDR

Lecture 23 - Why Electromagnetics?

Lecture 24 - Rectangular coordinate systems

Lecture 25 - Cylindrical coordinate systems

Lecture 26 - Review of vector fields and Gradient

Lecture 27 - Divergence, Curl, and Laplacian operations

Lecture 28 - Towards Maxwells equations - Part 1

Lecture 29 - Towards Maxwells equations - Part 2

Lecture 30 - Faradays law

Lecture 31 - Completing Maxwells equations and Boundary conditions

Lecture 32 - Boundary conditions for Electromagnetic fields

Lecture 33 - Electrostatics-I: Laplace and Poissons equations

Lecture 34 - Electrostatics-II: Solving Laplaces equation in 1D

Lecture 35 - Electrostatics-III: Solving Laplaces equation in 2D

Lecture 36 - Electrostatics-IV: Finite Difference method for solving Laplaces equation

Lecture 37 - Magnetostatic fields-I: Biot-Savart Law

Lecture 38 - Magnetostatic fields-II: Calculation of magnetic fields

Lecture 39 - Inductance calculations

Lecture 40 - From Maxwells equations to uniform plane waves

Lecture 41 - Plane wave propagation in lossless dielectric media

Lecture 42 - Polarization of plane waves

Lecture 43 - Can an Ideal capacitor exist?

Lecture 44 - Skin effect in conductors

Lecture 45 - Skin effect in round wires

Lecture 46 - Finite difference method

Lecture 47 - Reflection of uniform plane waves

Lecture 48 - Application: Reflection from multiple media and anti-reflection coating.

Lecture 49 - Oblique incidence of plane waves

Lecture 50 - Total internal reflection

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

Lecture 52 - Application: Fabry-Perot cavity and Multi-layer films

Lecture 53 - Introduction to waveguides

Lecture 54 - Rectangular waveguides

Lecture 55 - Attenuation and Dispersion in rectangular waveguides

Lecture 56 - Planar optical waveguides

Lecture 57 - Application: Optical Fibers

Lecture 58 - Application: WDM Optical Components

Lecture 59 - Mach-Zehnder Modulator

Lecture 60 - Wave Propagation in Anisotropic Medium

Lecture 61 - Wave Propagation in Ferrites

Lecture 62 - Magnetic Vector Potential - Part 1

Lecture 63 - Magnetic Vector Potential - Part 2

Lecture 64 - Fields of a Dipole Antenna

Lecture 65 - Antenna Parameters and Long wire Antenna

Lecture 66 - Friis Transmission Formula

NPTEL : NOC:Principles of Signals and Systems (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

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

Lecture 2 - Analog and Digital Signals

Lecture 3 - Energy and Power Signals

Lecture 4 - Real Exponential Signals

Lecture 5 - Memory/Memory-less and Causal/Non-Causal Systems

Lecture 6 - Properties of Linear Systems

Lecture 7 - Example Problems - 1

Lecture 8 - Example Problems - 2

Lecture 9 - Example Problems - 3

Lecture 10 - Properties and Analysis of LTI Systems - I

Lecture 11 - Properties and Analysis of LTI Systems - II

Lecture 12 - Properties and Analysis of LTI Systems - III

Lecture 13 - Properties of Discrete Time LTI Systems

Lecture 14 - Example Problems LTI Systems - I

Lecture 15 - Example Problems LTI Systems - II

Lecture 16 - Example Problems DT-LTI Systems

Lecture 17 - Laplace Transform

Lecture 18 - Laplace Transform Properties - I

Lecture 19 - Laplace Transform Properties - II

Lecture 20 - Laplace Transform of LTI Systems

Lecture 21 - Laplace Transform Example Problems - I

Lecture 22 - Laplace Transform Example Problems - II

Lecture 23 - Laplace Transform of RL, RC Circuit

Lecture 24 - Z-Transform

Lecture 25 - Z-Transform Properties - I

Lecture 26 - Z-Transform Properties - II

Lecture 27 - Z-Transform of LTI Systems

Lecture 28 - Z-Transform Examples - I

Lecture 29 - Z-Transform Examples - II

Lecture 30 - Z-Transform Examples - III

Lecture 31 - Z-Transform Examples - IV

Lecture 32 - Inverse Z-Transform

Lecture 33 - Fourier Analysis Introduction

Lecture 34 - Complex Exponential and Trigonometric FS

Lecture 35 - Conditions for Existence of FS

Lecture 36 - Fourier Transform (FT) Introduction

Lecture 37 - Properties of Fourier Transform - I

Lecture 38 - Properties of Fourier Transform - II

Lecture 39 - Fourier Transform - Parsevalâ€™s Relation

Lecture 40 - Fourier Transform of LTI Systems

Lecture 41 - FT- Ideal and Non-Ideal Filters

Lecture 42 - Fourier Analysis Examples - I

Lecture 43 - Fourier Analysis Examples - II

Lecture 44 - Fourier Analysis Examples - III

Lecture 45 - Fourier Analysis Examples - IV

Lecture 46 - Fourier Analysis Examples - V

Lecture 47 - Fourier Analysis Examples - VI

Lecture 48 - Fourier Analysis Bode Plot - I

Lecture 49 - Fourier Analysis Bode Plot - II

Lecture 50 - Fourier Transform Examples: Filtering - Ideal Low Pass Filter

Lecture 51 - Fourier Transform Problems: Unit Step Response of RC Circuit, Sampling of Continuous Signal

Lecture 52 - Sampling: Spectrum of Sampled Signal, Nyquist Criterion

Lecture 53 - Sampling: Reconstruction from Sampled Signal

Lecture 54 - Fourier Analysis of Discrete Time Signals and Systems - Introduction

Lecture 55 - Fourier Analysis of Discrete Time Signals - Duality, Parsevalâ€™s Theorem

Lecture 56 - Discrete Time Fourier Transform: Definition, Inverse DTFT, Convergence, Relation between DTFT and z-Transform, DTFT of Common Signals

Lecture 57 - Discrete Time Fourier Transform: Properties of DTFT - Linearity, Time Shifting, Frequency Shifting, Conjugation, Time-Reversal, Duality

Lecture 58 - Discrete Time Fourier Transform: Properties of DTFT - Differentiation in Frequency, Difference in Time, Convolution, Multiplication, Parsevalâ€™s Relation

Lecture 59 - DTFT: Discrete Time LTI Systems - LTI Systems Characterized by Difference Equations

Lecture 60 - Discrete Fourier Transform - Definition, Inverse DFT, Relation between DFT and DFS, Relation between DFT and DTFT, Properties - Linearity, Time Shifting

Lecture 61 - Discrete Fourier Transform: Properties - Conjugation, Frequency Shift, Duality, Circular Convolution, Multiplication, Parsevalâ€™s Relation, Example Problems for Fourier Analysis of Discrete Time Signals

Lecture 62 - Example Problems: DFS Analysis of Discrete Time Signals, Problems on DTFT

Lecture 63 - Example Problems: DTFT of Cosine, Unit Step Signals

Lecture 64 - DTFT Example Problems - III

Lecture 65 - DTFT Example Problems - IV

Lecture 66 - DTFT Example Problems - V

Lecture 67 - DFT Example Problems - I

Lecture 68 - Example Problems: DFT, IDFT in Matrix form

Lecture 69 - Group/Phase Delay - Part I

Lecture 70 - Group/Phase Delay - Part II

Lecture 71 - IIR Filter Structures: DF-I, DF-II

Lecture 72 - IIR Filter Structures: Transpose Form

Lecture 73 - IIR Filter Structures: Example

Lecture 74 - IIR Filter Structures: Cascade Form

Lecture 75 - IIR Filter: Parallel Form-I and II

NPTEL : NOC:Applied Optimization for Wireless, Machine Learning, Big Data (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

Lecture 1 - Vectors and Matrices - Linear Independence and Rank

Lecture 2 - Eigenvectors and Eigenvalues of Matrices and their Properties

Lecture 3 - Positive Semidefinite (PSD) and Postive Definite (PD) Matrices and their Properties

Lecture 4 - Inner Product Space and it's Properties: Linearity, Symmetry and Positive Semi-definite

Lecture 5 - Inner Product Space and it's Properties: Cauchy Schwarz Inequality

Lecture 6 - Properties of Norm, Gaussian Elimination and Echleon 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

Lecture 15 - Norm Cone,Polyhedron and its Applications

Lecture 16 - Applications: Cooperative Cellular Transmission

Lecture 17 - Positive Semi Definite Cone And Positive Semi Definite (PSD) Matrices

Lecture 18 - Introduction to Affine functions and examples

Lecture 19 - norm balls and Matrix properties:Trace,Determinant

Lecture 20 - Inverse of a Positive Definite Matrix

Lecture 21 - Example Problems: Property of Norms,Problems on Convex Sets

Lecture 22 - Problems on Convex Sets (Continued...)

Lecture 23 - Introduction to Convex and Concave Functions

Lecture 24 - Properties of Convex Functions with examples

Lecture 25 - Test for Convexity: Positive Semidefinite Hessian Matrix

Lecture 26 - Application: MIMO Receiver Design as a Least Squares Problem

Lecture 27 - Jensen's Inequality and Practical Application

Lecture 28 - Jensen's Inequality application

Lecture 29 - Properties of Convex Functions

Lecture 30 - Conjugate Function and Examples to prove Convexity of various Functions

Lecture 31 - Examples on Operations Preserving Convexity

Lecture 32 - Examples on Test for Convexity, Quasi-Convexity

Lecture 33 - Examples on Convex Functions

Lecture 34 - Practical Application: Beamforming in Multi-antenna Wireless Communication

Lecture 35 - Practical Application: Maximal Ratio Combiner for Wireless Systems

Lecture 36 - Practical Application: Multi-antenna Beamforming with Interfering User

Lecture 37 - Practical Application: Zero-Forcing (ZF) Beamforming with Interfering User

Lecture 38 - Practical Application: Robust Beamforming With Channel Uncertainity for Wireless Systems

Lecture 39 - Practical Application: Robust Beamformer Design for Wireless Systems

Lecture 40 - Practical Application: Detailed Solution for Robust Beamformer Computation in Wireless Systems Text

Lecture 41 - Linear modeling and Approximation Problems: Least Squares

Lecture 42 - Geometric Intuition for Least Squares

Lecture 43 - Practical Application: Multi antenna channel estimation

Lecture 44 - Practical Application:Image deblurring

Lecture 45 - Least Norm Signal Estimation

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

Lecture 50 - Practical Application: Multiple Input Multiple Output (MIMO) Beamforming

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

Lecture 54 - Practical Application:Optimal power allocation factor determination for Co-operative Communication

Lecture 55 - Practical Application: Compressive Sensing

Lecture 56 - Practical Application

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

Lecture 58 - Example Problem: Orthogonal Matching Pursuit (OMP) algorithm

Lecture 59 - Practical Application : L1 norm minimization and regularization approach for Compressive Sensing Optimization problem

Lecture 60 - Practical Application of Machine Learning and Artificial Intelligence:Linear Classification, Overview and Motivation

Lecture 61 - Practical Application: Linear Classifier (Support Vector Machine) Design

Lecture 62 - Practical Application: Approximate Classifier Design

Lecture 63 - Concept of Duality

Lecture 64 - Relation between optimal value of Primal and Dual Problems, concepts of Duality gap and Strong Duality

Lecture 65 - Example problem on Strong Duality

Lecture 66 - Karush-Kuhn-Tucker (KKT) conditions

Lecture 67 - Application of KKT condition:Optimal MIMO power allocation (Waterfilling)

Lecture 68 - Optimal MIMO Power allocation (Waterfilling)-II

Lecture 69 - Example problem on Optimal MIMO Power allocation (Waterfilling)

Lecture 70 - Linear objective with box constraints, Linear Programming

Lecture 71 - Example Problems II

Lecture 72 - Examples on Quadratic Optimization

Lecture 73 - Examples on Duality: Dual Norm, Dual of Linear Program (LP)

Lecture 74 - Examples on Duality: Min-Max problem, Analytic Centering

Lecture 75 - Semi Definite Program (SDP) and its application:MIMO symbol vector decoding

Lecture 76 - Application:SDP for MIMO Maximum Likelihood (ML) Detection

Lecture 77 - Introduction to big Data: Online Recommender System (Netflix)

Lecture 78 - Matrix Completion Problem in Big Data: Netflix-I

Lecture 79 - Matrix Completion Problem in Big Data: Netflix-II

NPTEL : NOC:Fiber-Optic Communication Systems and Techniques (Electrical Engineering)

Co-ordinators : Dr. Pradeep Kumar K

Lecture 1 - Overview of fiber-optic communication systems

Lecture 2 - Review of Maxwellâ€™s equations

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

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

Lecture 5 - Boundary conditions and reflection from a PEC

Lecture 6 - Obliquely incident waves-I (TE and TM waves, Snellâ€™s laws)

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

Lecture 8 - Total internal reflection

Lecture 9 - Ray theory of dielectric slab waveguides

Lecture 10 - Transverse resonance condition for slab waveguides

Lecture 11 - Introduction to optical fibers

Lecture 12 - Ray theory of light propagation in optical fibers

Lecture 13 - Concept of waveguide modes

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

Lecture 17 - Further discussion on slab waveguides

Lecture 18 - Modal analysis of step index optical fiber

Lecture 19 - Properties of modes of step-index optical fiber - I

Lecture 20 - Properties of modes of step-index optical fiber - II

Lecture 21 - Linearly polarized modes

Lecture 22 - Attenuation and power loss in fibers

Lecture 23 - Introduction to dispersion in fibers

Lecture 24 - Mathematical modelling of dispersion: Transfer function approach

Lecture 25 - Pulse propagation equation and its solution

Lecture 26 - Pre-chirped pulses and Inter and Intra-modal dispersion in optical fibers

Lecture 27 - Beam Propagation Method

Lecture 28 - Polarization Effects on Pulse Propagation

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

Lecture 30 - Graded Index Fibers

Lecture 31 - Light Sources, Detectors and Amplifiers

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)

NPTEL : NOC:Electromagnetic Waves in Guided and Wireless Media (Electrical Engineering)

Co-ordinators : Dr. Pradeep Kumar K

Lecture 1 - Introduction and Types of Transmission Lines

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

Lecture 8 - Additional Applications of Smith Chart

Lecture 9 - Time domain Analysis of Transmission Line - I

Lecture 10 - Time domain Analysis of Transmission Line - II

Lecture 11 - Usage of Lattice Diagrams

Lecture 12 - TDR analysis of Transmission Lines

Lecture 13 - Introduction to Propagation of Electromagnetic Waves

Lecture 14 - Uniform Plane Waves - I

Lecture 15 - Uniform Plane Waves - II

Lecture 16 - Poynting Vector, Average Power, Polarization

Lecture 17 - Uniform Plane Waves in Lossy Medium

Lecture 18 - Normal Incidence of Plane Waves

Lecture 19 - Oblique Incidence of Plane Waves - I

Lecture 20 - Oblique Incidence of Plane Waves - II

Lecture 21 - Total Internal Reflection

Lecture 22 - Slab Waveguides

Lecture 23 - Optical Fibers

Lecture 24 - Parallel Plate Waveguides

Lecture 25 - Rectangular Waveguides

Lecture 26 - Modes of Rectangular Waveguides

Lecture 27 - Waveguides summary and Introduction to Radiation

Lecture 28 - Solution to Electric Scalar Potential and Magnetic Vector Potential Equations

Lecture 29 - Further discussion on Magnetic Vector Potential and Elementary Hertzian Dipole

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

Lecture 33 - Friis Transmission Formula

Lecture 34 - Antenna Array

Lecture 35 - Wireless Channel

Lecture 36 - Further discussion on Wireless Channel Modelling

Lecture 37 - Diffraction - I

Lecture 38 - Diffraction - II

Lecture 39 - Distribution of Laser Beam

Lecture 40 - Interference (Double slit experiment, Fabry Perot Interferometer)

Lecture 41 - Summary

NPTEL : NOC:Basic Electric Circuits (Electrical Engineering)

Co-ordinators : Prof. Ankush Sharma

Lecture 1 - Basic Concepts

Lecture 2 - Sinusoids and Phasors

Lecture 3 - Circuit Elements - Part 1

Lecture 4 - Circuit Elements - Part 2

Lecture 5 - AC Power Analysis

Lecture 6 - RMS Voltage and Current

Lecture 7 - Topology

Lecture 8 - Star-Delta Transformation and Mesh Analysis

Lecture 9 - Mesh Analysis.

Lecture 10 - Nodal Analysis

Lecture 11 - Linearity Property and Superposition Theorem

Lecture 12 - Source Transformation

Lecture 13 - Duality

Lecture 14 - Thevenin's Theorem - 1

Lecture 15 - Thevenin's Theorem - 2

Lecture 16 - Norton's Theorem - 1

Lecture 17 - Norton's Theorem - 2

Lecture 18 - Maximum Power Transfer Theorem - 1

Lecture 19 - Maximum Power Transfer Theorem - 2

Lecture 20 - Reciprocity and Compensation Theorem

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

Lecture 30 - Inverse Laplace Transform

Lecture 31 - Laplace Transform of Circuit Elements

Lecture 32 - Transfer Function

Lecture 33 - Convolution Integral

Lecture 34 - Graphical Approach of Convolution Integral

Lecture 35 - Network Stability and Network Synthesis

Lecture 36 - Impedance Parameters

Lecture 37 - Admittance Parameters

Lecture 38 - Hybrid Parameters

Lecture 39 - Transmission Parameters

Lecture 40 - Interconnection of Networks

Lecture 41 - Nodal and Mesh Analysis

Lecture 42 - Superposition Theorem and Source Transformation

Lecture 43 - Thevenin's, Norton's and, Maximum Power Transfer Theorem

Lecture 44 - Magnetically Coupled Circuits

Lecture 45 - Energy in Coupled Circuits and Ideal Transformer

Lecture 46 - Ideal Transformer and Introduction to Three-Phase Circuits

Lecture 47 - Balanced Three-Phase Connections

Lecture 48 - Balanced Wye-Delta and Delta-Delta Connections

Lecture 49 - Balanced Delta-Wye Connection and Power in Balanced Three-Phase System

Lecture 50 - Unbalanced Three-Phase System and Three-Phase Power Measurement

Lecture 51 - Introduction to Graphical Models

Lecture 52 - State Equations

Lecture 53 - State Diagram

Lecture 54 - State Transition Matrix

Lecture 55 - State Variable Method to Circuit Analysis

Lecture 56 - Characteristic Equation, Eigenvalues, and Eigenvectors-State Variable Analysis (Continued...)

Lecture 57 - Modeling of Mechanical Systems

Lecture 58 - Modeling of The Rotational Motion of Mechanical Systems

Lecture 59 - Modeling of Electrical Systems

Lecture 60 - Solving Analogous Systems

NPTEL : NOC:Fundamentals of Electric Drives (Electrical Engineering)

Co-ordinators : Prof. Shyama Prasad Das

Lecture 1 - Introduction to Electric Drives

Lecture 2 - Dynamics of Electric Drives, Four Quadrant Operation, Equivalent Drive Parameters

Lecture 3 - Equivalent Drive Parameters, Friction Components, Nature of Load Torque

Lecture 4 - Steady State Stability, Load Equalization

Lecture 5 - Load Equalization, Characteristics of DC Motor

Lecture 6 - Speed Torque Characteristics of Separately Excited DC Motor and Series DC Motor

Lecture 7 - Field Control of Series Motor, Motoring and Braking of Separately Excited and Series DC motors

Lecture 8 - Speed Control of Separately Excited DC Motor Using Controlled Rectifiers

Lecture 9 - Analysis of Single Phase Full Controlled Converter-fed Separately Excited DC Motor

Lecture 10 - Speed Torque Characteristics of Full Controlled Converter-fed Separately Excited DC Motor, Analysis of Single Phase Half Controlled Converter-fed Separately Excited DC Motor

Lecture 11 - Analysis of Single Phase Half Controlled Converter-fed Separately Excited DC Motor.

Lecture 12 - Three Phase Full Controlled Converter-fed Separately Excited DC Motor, Multi-quadrant Operation of DC Motor

Lecture 13 - Dual Converter-fed DC Motor, Multi-quadrant Operation Using Field Current Reversal

Lecture 14 - DC Chopper-fed Separately Excited DC Motor for Motoring and Braking

Lecture 15 - Two-quadrant DC Chopper, Four-quadrant DC Chopper

Lecture 16 - Dynamic Braking of DC Motor by Chopper Controlled Resistor, Closed-loop Operation of DC Drives, Induction Motor Drives

Lecture 17 - Speed Torque Characteristics of Induction Motor, Operation of Induction Motor from Non-sinusoidal Supply

Lecture 18 - Operation of Induction Motor from Non-sinusoidal Supply

Lecture 19 - Stator Current of Induction Motor with Non-sinusoidal Supply, Operation of Induction Motor with Unbalanced Voltage Supply

Lecture 20 - Single Phasing of Induction Motor, Braking of Induction Motor

Lecture 21 - Dynamic braking of induction motor, AC dynamic braking, DC dynamic braking

Lecture 22 - Analysis of DC dynamic braking of induction motor

Lecture 23 - Self-excited dynamic braking of induction motor, Speed control of induction motor using stator voltage regulator, Variable voltage variable frequency control

Lecture 24 - Variable voltage variable frequency control of induction motor, Open loop V/F control

Lecture 25 - Slip speed control of induction motor, Constant Volt/Hz control with slip speed regulation

Lecture 26 - Closed-loop Volt/Hz control of induction motor with slip speed regulation, Multi-quadrant operation of induction motor drive

Lecture 27 - Current Source Inverter (CSI) fed induction motor drive

Lecture 28 - Closed-loop operation of current source inverter (CSI) fed induction motor drive, Control of slip ring induction motor - Static rotor resistance control

Lecture 29 - Closed-loop operation of slip ring induction motor with static rotor resistance control, Slip power recovery in slip ring induction motor - Static Kramer drive

Lecture 30 - Static Kramer drive and its closed-loop control, Introduction to synchronous motor

Lecture 31 - Various types of synchronous motors, Equivalent circuit and phasor diagram of cylindrical synchronous motor, Speed-torque characteristics of cylindrical synchronous motor

Lecture 32 - Phasor diagram of salient pole synchronous motor, Expression of power and torque for a salient pole synchronous motor, Synchronous reluctance motor, Open-loop V/f control of synchronous motor

Lecture 33 - Open-loop V/f control, Torque-speed characteristics, Self controlled synchronous motor drive employing load commutated thyristor inverter

Lecture 34 - Detailed analysis of commutation of load commutated thyrisor inverter, Derivation of overlap angle and margin angle, Closed-loop speed control scheme for load commutated inverter-fed synchronous motor drive

Lecture 35 - Low cost brushless DC motor (BLDCM), Trapezoidal permanent magnet AC motor

Lecture 36 - Trapezoidal permanent magnet AC motor, Derivation of power and torque, Closed-loop control of trapezoidal BLDC motor, Introduction to switched reluctance motor

Lecture 37 - Construction and operating principle of switched reluctance motor

Lecture 38 - Current/ voltage control for switched reluctance motor, operating modes of switched reluctance motor, Introduction to traction drives

Lecture 39 - Current collector for mainline trains, Nature of traction load, Duty cycle of traction drives

Lecture 40 - Duty cycle of traction drives, Distance between two stops, Calculation of total tractive effort and drive rating

NPTEL : NOC:Fuzzy Sets, Logic and Systems and Applications (Electrical Engineering)

Co-ordinators : Prof. Nishchal K Verma

Lecture 1 - Introduction: Fuzzy Sets, Logic and Systems and Applications

Lecture 2 - Introduction: Real Life Applications of Fuzzy Systems

Lecture 3 - Fuzzy Sets and Fuzzy Logic Toolbox in MATLAB - I

Lecture 4 - Fuzzy Sets and Fuzzy Logic Toolbox in MATLAB - II

Lecture 5 - Membership Functions - I

Lecture 6 - Membership Functions - II

Lecture 7 - Nomenclatures used in Fuzzy Set Theory - I

Lecture 8 - Nomenclatures used in Fuzzy Set Theory - II

Lecture 9 - Nomenclatures used in Fuzzy Set Theory - III

Lecture 10 - Set Theoretic Operations on Fuzzy Sets - I

Lecture 11 - Set Theoretic Operations on Fuzzy Sets - II

Lecture 12 - Properties of Fuzzy Sets - I

Lecture 13 - Properties of Fuzzy Sets - II

Lecture 14 - Properties of Fuzzy Sets - III

Lecture 15 - Properties of Fuzzy Sets - IV

Lecture 16 - Properties of Fuzzy Sets - V

Lecture 17 - Distance between Fuzzy Sets - I

Lecture 18 - Distance between Fuzzy Sets - II

Lecture 19 - Distance between Fuzzy Sets - III

Lecture 20 - Arithmetic Operations on Fuzzy Numbers - I

Lecture 21 - Arithmetic Operations on Fuzzy Numbers - II

Lecture 22 - Arithmetic Operations on Fuzzy Numbers - III

Lecture 23 - Complement of Fuzzy Sets

Lecture 24 - T-norm Operators

Lecture 25 - S-norm Operators

Lecture 26 - Parameterized T-Norm Operators

Lecture 27 - Parameterized S-Norm Operators

Lecture 28 - Fuzzy Relation - I

Lecture 29 - Fuzzy Relation - II

Lecture 30 - Operations on Crisp and Fuzzy Relations

Lecture 31 - Projection of Fuzzy Relation Set

Lecture 32 - Cylindrical Extension of Fuzzy Set

Lecture 33 - Properties of Fuzzy Relation - I

Lecture 34 - Properties of Fuzzy Relation - II

Lecture 35 - Extension Principle

Lecture 36 - Composition of Fuzzy Relations

Lecture 37 - Properties of Composition of Fuzzy Relations

Lecture 38 - Fuzzy Tolerance and Equivalence Relations - I

Lecture 39 - Fuzzy Tolerance and Equivalence Relations - II

Lecture 40 - Fuzzy Tolerance and Equivalence Relations - III

Lecture 41 - Linguistic Hedges

Lecture 42 - Linguistic Hedges and Negation/ Complement and Connectives

Lecture 43 - Concentration and Dilation and Composite Linguistic Term and Some Examples

Lecture 44 - Dilation and Composite Linguistic Term and Some Examples

Lecture 45 - Some Examples on Composite Linguistic Terms

Lecture 46 - Contrast Intensification of Fuzzy Sets

Lecture 47 - Orthogonality of Fuzzy Sets

Lecture 48 - Fuzzy Rules and Fuzzy Reasoning - I

Lecture 49 - Fuzzy Rules and Fuzzy Reasoning - II

Lecture 50 - Fuzzy Inference System

Lecture 51 - Mamdani Fuzzy Model - I

Lecture 52 - Mamdani Fuzzy Model - II

Lecture 53 - Mamdani Fuzzy Model - III

Lecture 54 - Example on Mamdani Fuzzy Model for Single Antecedent with Three Rules

Lecture 55 - Example on Mamdani Fuzzy Model for Two Antecedents with Four Rules

Lecture 56 - Larsen Fuzzy Model - I

Lecture 57 - Larsen Fuzzy Model - II

Lecture 58 - Larsen Fuzzy Model - III

Lecture 59 - Tsukamoto Fuzzy Model

Lecture 60 - TSK Fuzzy Model

NPTEL : NOC:Peer to Peer Networks (Electrical Engineering)

Co-ordinators : Prof. Yatindra N Singh

Lecture 1 - Introduction to Peer to Peer Networks

Lecture 2 - Peer to Peer Network in Telephony:Voice over Internet Telephony (VoIP) and Distributed Hash Table (DHT)

Lecture 3 - Building DHT Networks

Lecture 4 - Logarithmic Partitioning of Node ID Space and Index Entry Authenticity

Lecture 5 - Implementation of Voice over Internet Telephony in P2P Way

Lecture 6 - Leaf Nodes, Core Nodes and Type of Messages in DHT Networks

Lecture 7 - Static and Dynamic Partitioning of Node ID Space: Fixed and Floating Partitioning

Lecture 8 - PASTRY Protocol: The Efficient Use of Internet Infrastructure

Lecture 9 - Understanding the PASTRY Protocol through Example

Lecture 10 - Kademlia: A DHT Routing Protocol

Lecture 11 - Tapestry: An Evolution of Kademlia

Lecture 12 - Understanding the Tapestry Protocol through Example

Lecture 13 - Multi-dimensional Distributed Hash Table: Mapping of Peers into Multidimensional Space

Lecture 14 - Multi-Layer DHT: A Design for Multiple Services

Lecture 15 - Keeping Pairs at Correct Root Nodes

Lecture 16 - Abrupt and Graceful Exit of Root Node: Maintaining Pairs Alive

Lecture 17 - Resilience of Pairs

Lecture 18 - A P2P Distributed File System

Lecture 19 - Storage Space Problem and Incentives to Share Storage

Lecture 20 - P2P Nodes Communications Challenges in Heterogeneous Network Environments

Lecture 21 - P2P Overlaid Multicast: Basic Design

Lecture 22 - P2P Overlaid Multicast: Alternate Design

Lecture 23 - A Design of P2P Email System

Lecture 24 - P2P Mailing List Services: A Basic Design

Lecture 25 - P2P Mailing List Services: An Alternate Design

Lecture 26 - P2P Web: A Basic Design

Lecture 27 - P2P Web Search Engine: A Basic Design

Lecture 28 - P2P Internet: On Being Anonymous

Lecture 29 - P2P in Blockchain

Lecture 30 - P2P Anonymous Communication

Lecture 31 - The Anonymous Communication on the Internet through TOR Network

Lecture 32 - An Introduction To TOR Browser: The Anonymity Preserving Access of the Web Sites

Lecture 33 - Hidden Services on TOR Network

Lecture 34 - MOOC Wrap-Up : Summary of the Course

NPTEL : NOC:Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

Lecture 1 - Vector Properties: Addition, Linear Combination, Inner Product, Orthogonality, Norm

Lecture 2 - Vectors: Unit Norm Vector, Cauchy-Schwarz inequality, Radar Application

Lecture 3 - Inner Product Application: Beamforming in Wireless Communication Systems

Lecture 4 - Matrices, Definition, Addition and Multiplication of Matrices

Lecture 5 - Matrix: Column Space, Linear Independence, Rank of Matrix, Gaussian Elimination

Lecture 6 - Matrix: Determinant, Inverse Computation, Adjoint, Cofactor Concepts

Lecture 7 - Applications of Matrices: Solution of System of Linear equations, MIMO Wireless Technology

Lecture 8 - Applications of Matrices: Electric Circuits, Traffic flows

Lecture 9 - Applications of Matrices: Graph Theory, Social Networks, Dominance Directed Graph, Influential Node

Lecture 10 - Null Space of Matrix: Definition, Rank-Nullity Theorem, Application in Electric Circuits

Lecture 11 - Gram-Schmidt Orthogonalization

Lecture 12 - Gaussian Random Variable: Definition, Mean, Variance, Multivariate Gaussian, Covariance Matrix

Lecture 13 - Linear Transformation of Gaussian Random Vectors

Lecture 14 - Machine Learning Application: Gaussian Classification

Lecture 15 - Eigenvalue: Definition, Characteristic Equation, Eigenvalue Decomposition

Lecture 16 - Special Matrices: Rotation and Unitary Matrices, Application: Alamouti Code

Lecture 17 - Positive Semi-definite (PSD) Matrices: Definition, Properties, Eigenvalue Decomposition

Lecture 18 - Positive Semidefinite Matrix: Example and Illustration of Eigenvalue Decomposition

Lecture 19 - Machine Learning Application: Principle Component Analysis (PCA)

Lecture 20 - Computer Vision Application: Face Recognition, Eigenfaces

Lecture 21 - Least Squares (LS) Solution, Pseudo-Inverse Concept

Lecture 22 - Least Squares (LS) via Principle of Orthogonality, Projection Matrix, Properties

Lecture 23 - Application: Pseudo-Inverse and MIMO Zero Forcing (ZF) Receiver

Lecture 24 - Wireless Application: Multi-Antenna Channel Estimation

Lecture 25 - Machine Learning Application: Linear Regression

Lecture 26 - Computation Mathematics Application: Polynomial Fitting

Lecture 27 - Least Norm Solution

Lecture 28 - Wireless Application: Multi-user Beamforming

Lecture 29 - Singular Value Decomposition (SVD): Definition, Properties, Example

Lecture 30 - SVD Application in MIMO Wireless Technology: Spatial-Multiplexing and High Data Rates

Lecture 31 - SVD for MIMO wireless optimization, water-filling algorithm, optimal power allocation

Lecture 32 - SVD application for Machine Learning: Principal component analysis (PCA)

Lecture 33 - Multiple signal classification (MUSIC) algorithm: system model

Lecture 34 - MUSIC algorithm for Direction of Arrival (DoA) estimation

Lecture 35 - Linear minimum mean square error (LMMSE) principle

Lecture 36 - LMMSE estimate and error covariance matrix

Lecture 37 - LMMSE estimation in linear systems

Lecture 38 - LMMSE application: Wireless channel estimation and example

Lecture 39 - Time-series prediction via auto-regressive (AR) model

Lecture 40 - Recommender system: design and rating prediction

Lecture 41 - Recommender system: Illustration via movie rating prediction example

Lecture 42 - Fast Fourier transform (FFT) and Inverse fast Fourier transform (IFFT)

Lecture 43 - IFFT/ FFT application in Orthogonal Frequency Division Multiplexing (OFDM) wireless technology

Lecture 44 - OFDM system: Circulant matrices and properties

Lecture 45 - OFDM system model: Transmitter and receiver processing

Lecture 46 - Single-carrier frequency division for multiple access (SC-FDMA) technology

Lecture 47 - Linear dynamical systems: definition and solution via matrix exponential

Lecture 48 - Linear dynamical systems: matrix exponential via SVD

Lecture 49 - Machine Learning application: Support Vector Machines (SVM)

Lecture 50 - Support Vector Machines (SVM): Problem formulation via maximum hyperplane separation

Lecture 51 - Sparse regression: problem formulation and relation to Compressive Sensing (CS)

Lecture 52 - Sparse regression: solution via the Orthogonal Matching Pursuit (OMP) algorithm

Lecture 53 - OMP Example for Sparse Regression

Lecture 54 - Machine Learning Application: Clustering

Lecture 55 - K-Means Clustering algorithm

Lecture 56 - Introduction to Stochastic Processes and Markov Chains

Lecture 57 - Discrete Time Markov Chains and Transition Probability Matrix

Lecture 58 - Discrete Time Markov Chain Examples

Lecture 59 - m-STEP Transition Probabilities for Discrete Time Markov Chains

Lecture 60 - Limiting Behavior of Discrete Time Markov Chains

Lecture 61 - Least Squares Revisited: Rank Deficient Matrix

Lecture 62 - Least Squares using SVD

Lecture 63 - Weighted Least Squares

Lecture 64 - Weighted Least Squares Example

Lecture 65 - Woodbury Matrix Identity - Matrix Inversion Lemma

Lecture 66 - Woodbury Matrix Identity - Proof

Lecture 67 - Conditional Gaussian Density - Mean

Lecture 68 - Conditional Gaussian Density - Covariance

Lecture 69 - Scalar Linear Model for Gaussian Estimation

Lecture 70 - MMSE Estimate and Covariance for the Scalar Linear Model

NPTEL : NOC:Economic Operations and Control of Power Systems (Electrical Engineering)

Co-ordinators : Prof. Gururaj Mirle Vishwanath, Prof. Narayana Prasad Padhy

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

Lecture 37

Lecture 38

Lecture 39

Lecture 40

Lecture 41

Lecture 42

Lecture 43

Lecture 44

Lecture 45

Lecture 46

Lecture 47

Lecture 48

Lecture 49

Lecture 50

Lecture 51

Lecture 52

Lecture 53

Lecture 54

Lecture 55

Lecture 56

Lecture 57

Lecture 58

Lecture 59

Lecture 60

NPTEL : NOC:Digital Switching (Electrical Engineering)

Co-ordinators : Prof. Yatindra N Singh

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

Lecture 37

Lecture 38

NPTEL : NOC:Analog VLSI Design (Electrical Engineering)

Co-ordinators : Prof. Imon Mondal

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

Lecture 37

Lecture 38

Lecture 39

Lecture 40

Lecture 41

Lecture 42

Lecture 43

Lecture 44

Lecture 45

Lecture 46

Lecture 47

Lecture 48

Lecture 49

Lecture 50

Lecture 51

Lecture 52

Lecture 53

Lecture 54

Lecture 55

Lecture 56

Lecture 57

Lecture 58

Lecture 59

Lecture 60

Lecture 61

Lecture 62

Lecture 63

Lecture 64

Lecture 65

NPTEL : Electrical Machines I (Electrical Engineering)

Co-ordinators : Dr. D. Kastha

Lecture 1 - Introduction

Lecture 2 - Operating Principles and Construction of Single Phase Transformers

Lecture 3 - Modeling of Single Phase Transformers

Lecture 4 - Equivalent Circuits of Single Phase Transformers

Lecture 5 - Testing of Single Phase Transformers

Lecture 6 - Efficiency of Single Phase Transformers

Lecture 7 - Voltage Regulation of Single Phase Transformers

Lecture 8 - Parallel Operation of Single Phase Transformers

Lecture 9 - Harmonics and Switching Transients in Single Phase Transformers

Lecture 10 - Introduction to Three Phase Transformer

Lecture 11 - Construction of Three Phase Transformers

Lecture 12 - Three Phase Transformer Connections

Lecture 13 - Three Phase Transformer Phase Groups Part - I

Lecture 14 - Three Phase Transformer Phase Groups Part - II

Lecture 15 - Analysis and Testing of Three Phase Transformers

Lecture 16 - Operation of Three Phase Transformers

Lecture 17 - Auto Transformers

Lecture 18 - Three Winding Transformers

Lecture 19 - Scott Connected Transformers

Lecture 20 - Potential and Current Transformers

Lecture 21 - Operating Principles of DC Machines

Lecture 22 - Constructional Features of DC Machines

Lecture 23 - Generated EMF and Torque in DC Machines

Lecture 24 - Armature Reaction

Lecture 25 - Commutation in DC Machines

Lecture 26 - Separately Excited DC Generators

Lecture 27 - DC Shunt Generators

Lecture 28 - Compound DC Generators

Lecture 29 - Interconnected DC Generators

Lecture 30 - Characteristics of DC Shunt Motors

Lecture 31 - Starting of DC Shunt Motors

Lecture 32 - Speed Control of DC Shunt Motors

Lecture 33 - Braking of DC Shunt Motors

Lecture 34 - Electronic Control of DC Shunt Motors

Lecture 35 - Testing of DC Shunt Motors

Lecture 36 - Characteristics of DC Series Motors

Lecture 37 - Starting and Braking of DC Series Motors

Lecture 38 - Speed Control and of DC Series Motors

Lecture 39 - Testing of DC Series Motors

Lecture 40 - Characteristics of Compound DC Series Motors

NPTEL : Optimal Control (Electrical Engineering)

Co-ordinators : Prof. G.D. Ray

Lecture 1 - Introduction to Optimization Problem: Some Examples

Lecture 2 - Introduction to Optimization Problem: Some Examples (Continued.)

Lecture 3 - Optimality Conditions for Function of Several Variables

Lecture 4 - Optimality Conditions for Function of Several Variables (Continued.)

Lecture 5 - Unconstrained Optimization Problem (Numerical Techniques)

Lecture 6 - Solution of Unconstrained Optimization Problem Using Conjugate Quadient Method and Networks Methods

Lecture 7 - Solution of Unconstrained Optimization Problem Using Conjugate Quadient Method and Networks Methods (Continued.)

Lecture 8 - Solution of Constraint Optimization Problem-Karush-Kuhn Tucker (KKT) Conditions

Lecture 9 - Solution of Constraint Optimization Problem-Karush-Kuhn Tucker (KKT) Conditions (Continued.)

Lecture 10 - Problem and Solution Session

Lecture 11 - Post Optimality Analysis, Convex Function and its Properties

Lecture 12 - Post Optimality Analysis, Convex Function and its Properties (Continued.)

Lecture 13 - Quadratic Optimization Problem Using Linear Programming

Lecture 14 - Matrix form of the Simplex Method

Lecture 15 - Matrix form of the Simplex Method (Continued.)

Lecture 16 - Solution of Linear Programming Using Simplex Method:- Algebraic Approach

Lecture 17 - Solution of Linear Programming Using Simplex Method:- Algebraic Approach (Continued.)

Lecture 18 - Solution of LP Problems with Two Phase Method

Lecture 19 - Solution of LP Problems with Two Phase Method (Continued.)

Lecture 20 - Standard Primal and Dual Problems

Lecture 21 - Relationship Between Primal and Dual Variables

Lecture 22 - Solution of Quadratic Programming Problem Using Simplex Method

Lecture 23 - Interior Point Method for Solving Optimization Problems

Lecture 24 - Interior Point Method for Solving Optimization Problems (Continued.)

Lecture 25 - Solution of Nonlinear Programming Problem Using Exterior Penalty Function Method

Lecture 26 - Solution of Nonlinear Programming Problem Using Exterior Penalty Function Method (Continued.)

Lecture 27 - Solution of Nonlinear Programming Problem Using Interior Penalty Function Method

Lecture 28 - Solution of Nonlinear Programming Problem Using Interior Penalty Function Method (Continued.)

Lecture 29 - Multiobjective Optimization Problem

Lecture 30 - Dynamic Optimization Problem: Basic Concepts and Necessary and Sufficient Condition

Lecture 31 - Dynamic Optimization Problem: Basic Concepts and Necessary and Sufficient Condition (Continued...1)

Lecture 32 - Dynamic Optimization Problem: Basic Concepts and Necessary and Sufficient Condition (Continued...2)

Lecture 33 - Numerical Example and Solution of Optimal Control Problem using Calculus of Variation principle

Lecture 34 - Numerical Example and Solution of Optimal Control Problem using Calculus of Variation principle (Continued.)

Lecture 35 - Hamiltonian Formulation for solution of optimal Control problem and numerical example

Lecture 36 - Hamiltonian Formulation for solution of optimal Control problem and numerical example (Continued.)

Lecture 37 - Performance Indices and Linear Quadratic Regulator Problem

Lecture 38 - Performance Indices and Linear Quadratic Regulator Problem (Continued.)

Lecture 39 - Solution and Stability Analysis of Finite - time LQR Problem: Numerical Example

Lecture 40 - Solution and Infinite - time LQR Problem and Stability Analysis

Lecture 41 - Numerical Example and Methods for Solution of A.R.E.

Lecture 42 - Numerical Example and Methods for Solution of A.R.E. (Continued.)

Lecture 43 - Frequency Domain Interpretation of LQR Controlled System

Lecture 44 - Gain and Phase Margin of LQR Controlled System

Lecture 45 - The Linear Quadratic Gaussian Problem

Lecture 46 - Loop-Transfer Recovery

Lecture 47 - Dynamic Programming for Discrete Time Systems

Lecture 48 - Minimum â€“ Time Control of a Linear Time Invariant System

Lecture 49 - Solution of Minimum â€“ Time Control Problem with an Example

Lecture 50 - Constraint in Control Inputs and State Variables

Lecture 51 - Constraint in Control Inputs and State Variables (Continued...)

Lecture 52 - Norms for Vectors, Matrices, Signals and Linear Systems

Lecture 53 - Signal and System Norms

Lecture 54 - Internal Stability, Sensitivity and Complementary Sensitivity Functions

Lecture 55 - Internal Stability, Sensitivity and Complementary Sensitivity Functions (Continued...)

Lecture 56 - Plant Uncertainty and Standard form for Robust Stability Analysis

Lecture 57 - Plant Uncertainty and Standard form for Robust Stability Analysis (Continued...)

Lecture 58 - Frequency Response of Linear System and Singular Value Decomposition of System

Lecture 59 - Control Problem Statement in H- alpha Framework

Lecture 60 - Control Problem Statement in H - alpha Framework (Continued...)

NPTEL : Chaos, Fractals and Dynamic Systems (Electrical Engineering)

Co-ordinators : Prof. S. Banerjee

Lecture 1 - Representations of Dynamical Systems

Lecture 2 - Vector Fields of Nonlinear Systems

Lecture 3 - Limit Cycles

Lecture 4 - The Lorenz Equation - I

Lecture 5 - The Lorenz Equation - II

Lecture 6 - The Rossler Equation and Forced Pendulum

Lecture 7 - The Chua's Circuit

Lecture 8 - Discrete Time Dynamical Systems

Lecture 9 - The Logistic Map and Period doubling

Lecture 10 - Flip and Tangent Bifurcations

Lecture 11 - Intermittency Transcritical and pitchfork

Lecture 12 - Two Dimensional Maps

Lecture 13 - Bifurcations in Two Dimensional Maps

Lecture 14 - Introduction to Fractals

Lecture 15 - Mandelbrot Sets and Julia Sets

Lecture 16 - The Space Where Fractals Live

Lecture 17 - Interactive Function Systems

Lecture 18 - IFS Algorithms

Lecture 19 - Fractal Image Compression

Lecture 20 - Stable and Unstable Manifolds

Lecture 21 - Boundary Crisis and Interior Crisis

Lecture 22 - Statistics of Chaotic Attractors

Lecture 23 - Matrix Times Circle : Ellipse

Lecture 24 - Lyapunov Exponent

Lecture 25 - Frequency Spectra of Orbits

Lecture 26 - Dynamics on a Torus

Lecture 27 - Dynamics on a Torus

Lecture 28 - Analysis of Chaotic Time Series

Lecture 29 - Analysis of Chaotic Time Series

Lecture 30 - Lyapunou Function and Centre Manifold Theory

Lecture 31 - Non-Smooth Bifurcations

Lecture 32 - Non-Smooth Bifurcations

Lecture 33 - Normal from for Piecewise Smooth 2D Maps

Lecture 34 - Bifurcations in Piecewise Linear 2D Maps

Lecture 35 - Bifurcations in Piecewise Linear 2D Maps

Lecture 36 - Multiple Attractor Bifurcation and Dangerous

Lecture 37 - Dynamics of Discontinuous Maps

Lecture 38 - Introduction to Floquet Theory

Lecture 39 - The Monodromy Matrix and the Saltation Matrix

Lecture 40 - Control of Chaos

NPTEL : Digital Signal Processing (Electrical Engineering)

Co-ordinators : Prof. T.K. Basu

Lecture 1 - Discrete Time Signal and System

Lecture 2 - Discrete Time Signal and System (Continued...)

Lecture 3 - Discrete Time Signal and System (Continued...)

Lecture 4 - Frequency Domain Representation of Discrete Signals

Lecture 5 - Z-Transform

Lecture 6 - Z-Transform (Continued...)

Lecture 7 - Solution of Difference Equation

Lecture 8 - Tutorial on Discrete Time Signals & Their Transforms

Lecture 9 - Relation Between Discrete Time and Continuous Signals

Lecture 10 - Discrete Fourier Transform (DFT)

Lecture 11 - Discrete Fourier Transform (DFT) (Continued...)

Lecture 12 - Discrete Fourier Transform (DFT) (Continued...)

Lecture 13 - State Space Representation

Lecture 14 - Filters Introduction

Lecture 15 - FIR Filters

Lecture 16 - FIR Filters (Continued...) Introduction to IIR Filters

Lecture 17 - IIR Filters (Continued...)

Lecture 18 - IIR Filters (Continued...)

Lecture 19 - IIR Filters (Continued...)

Lecture 20 - Tutorial & Introduction to Computer Aided Design of Filters

Lecture 21 - Computer Aided Design of Filters

Lecture 22 - FFT and Computer Aided Design of Filters

Lecture 23 - Introduction to Lattice Filter

Lecture 24 - Lattice Filter (Continued...)

Lecture 25 - Effects of Quantization

Lecture 26 - Effects of Quantization (Continued...)

Lecture 27 - Effects of Quantization (Continued...)

Lecture 28 - Effects of Quantization (Continued...)

Lecture 29 - Random Signals

Lecture 30 - Relationship Between Real and Imaginary Parts of DTFT

Lecture 31 - Relationship Between Real and Imaginary Parts of DTFT

Lecture 32 - Relationship Between Real and Imaginary Parts of DTFT

Lecture 33 - Multi rate Signal Processing

Lecture 34 - Multi rate Signal Processing (Continued...)

Lecture 35 - Polyphase Decomposition

NPTEL : Dynamics of Physical Systems (Electrical Engineering)

Co-ordinators : Prof. S. Banerjee

Lecture 1 - Introduction to System Elements

Lecture 2 - Newton's Method and Constraints

Lecture 3 - Derivation of the Lagrangian Equation

Lecture 4 - Using the lagrangian Equation to Obtain Differential Equations (Part-I)

Lecture 5 - Using the lagrangian Equation to Obtain Differential Equations (Part-II)

Lecture 6 - Using the lagrangian Equation to Obtain Differential Equations (Part-III)

Lecture 7 - Using the lagrangian Equation to Obtain Differential Equations (Part-IV)

Lecture 8 - Obtaining First Order Equations

Lecture 9 - Application of the Hamiltonian Method

Lecture 10 - Obtaining Differential Equations Using Kirchoff's Laws

Lecture 11 - The Graph Theory Approach for Electrical Circuits (Part-I)

Lecture 12 - The Graph Theory Approach for Electrical Circuits (Part-II)

Lecture 13 - The Bond Graph Approach - I

Lecture 14 - The Bond Graph Approach - II

Lecture 15 - The Bond Graph Approach - III

Lecture 16 - The Bond Graph Approach - IV

Lecture 17 - The Bond Graph Approach - V

Lecture 18 - The Bond Graph Approach - VI

Lecture 19 - The Bond Graph Approach - VII

Lecture 20 - Numerical Solution of Differential Equations

Lecture 21 - Dynamics in the State Space

Lecture 22 - Vector Field Around Equilibrium Points - I

Lecture 23 - Vector Field Around Equilibrium Points - II

Lecture 24 - Vector Field Around Equilibrium Points - III

Lecture 25 - Vector Field Around Equilibrium Points - IV

Lecture 26 - High Dimensional Linear Systems

Lecture 27 - Linear Systems with External Input - I

Lecture 28 - Linear Systems with External Input - II

Lecture 29 - Linear Systems with External Input - III

Lecture 30 - Dynamics of Nonlinear Systems - I

Lecture 31 - Dynamics of Nonlinear Systems - II

Lecture 32 - Dynamics of Nonlinear Systems - III

Lecture 33 - Discrete-Time Dynamical Systems - I

Lecture 34 - Discrete-Time Dynamical Systems - II

NPTEL : Energy Resources and Technology (Electrical Engineering)

Co-ordinators : Prof. S. Banerjee

Lecture 1 - Thermodynamics: Fundamentals Of Energy - Energy Resources & Technology

Lecture 2 - Quality of Energy

Lecture 3 - Complete Cycle Analysis of Fossil Fuels

Lecture 4 - Energy in Transportation

Lecture 5 - Other Fossil Fuels

Lecture 6 - Energy Economics : Input-Output Analysis

Lecture 7 - Energy Economics : Input-Output Analysis

Lecture 8 - Thermal Power Plants

Lecture 9 - Thermal Power Plants

Lecture 10 - Hydroelectric Power

Lecture 11 - Hydroelectric Power

Lecture 12 - Nuclear Power Generation

Lecture 13 - Nuclear Fusion Reactors

Lecture 14 - Environmental Effects of Conventional Power

Lecture 15 - Solar Thermal Energy Conversion

Lecture 16 - Solar Concentrating Collectors

Lecture 17 - Photovoltaic Power Generation

Lecture 18 - Photovoltaic Power Generation (Continued.)

Lecture 19 - Photovoltaic Power Generation (Continued.)

Lecture 20 - Photovoltaic Power Generation (Continued.)

Lecture 21 - Wind Energy - I

Lecture 22 - Wind Energy - II

Lecture 23 - Wind Energy - III

Lecture 24 - Wind Energy - IV

Lecture 25 - Wind Energy - V

Lecture 26 - Wind Energy - VI

Lecture 27 - Wind Electrical Conversion - I

Lecture 28 - Wind Electrical Conversion - II

Lecture 29 - Wind Electrical Conversion - III

Lecture 30 - Tidal Energy

Lecture 31 - Tidal Energy

Lecture 32 - Tidal Energy

Lecture 33 - Ocean Thermal Energy Conversion

Lecture 34 - Solar Pond and Wave Power

Lecture 35 - Geothermal Energy

Lecture 36 - Solar Distillation and Biomass Energy

Lecture 37 - Energy Storage

Lecture 38 - Magneto hydrodynamic Power Generation

Lecture 39 - Magneto hydrodynamic Power Generation

Lecture 40 - Hydrogen Economy

NPTEL : Estimation of Signals and Systems (Electrical Engineering)

Co-ordinators : Prof. S. Mukhopadhyay

Lecture 1 - Introduction

Lecture 2 - Probability Theory

Lecture 3 - Random Variables

Lecture 4 - Function of Random Variable Joint Density

Lecture 5 - Mean and Variance

Lecture 6 - Random Vectors Random Processes

Lecture 7 - Random Processes and Linear Systems

Lecture 8 - Some Numerical Problems

Lecture 9 - Miscellaneous Topics on Random Process

Lecture 10 - Linear Signal Models

Lecture 11 - Linear Mean Sq.Error Estimation

Lecture 12 - Auto Correlation and Power Spectrum Estimation

Lecture 13 - Z-Transform Revisited Eigen Vectors/Values

Lecture 14 - The Concept of Innovation

Lecture 15 - Last Squares Estimation Optimal IIR Filters

Lecture 16 - Introduction to Adaptive Filters

Lecture 17 - State Estimation

Lecture 18 - Kalman Filter-Model and Derivation

Lecture 19 - Kalman Filter-Derivation (Continued...)

Lecture 20 - Estimator Properties

Lecture 21 - The Time-Invariant Kalman Filter

Lecture 22 - Kalman Filter-Case Study

Lecture 23 - System identification Introductory Concepts

Lecture 24 - Linear Regression-Recursive Least Squares

Lecture 25 - Variants of LSE

Lecture 26 - Least Square Estimation

Lecture 27 - Model Order Selection Residual Tests

Lecture 28 - Practical Issues in Identification

Lecture 29 - Estimation Problems in Instrumentation and Control

Lecture 30 - Conclusion

NPTEL : Illumination Engineering (Electrical Engineering)

Co-ordinators : Prof. N.K. Kishore

Lecture 1 - Introduction to Illumination Engineering

Lecture 2 - Instructional Objectives

Lecture 3 - Eye and Vision - I

Lecture 4 - Eye and Vision - II

Lecture 5 - Laws of Illumination

Lecture 6 - Photometry

Lecture 7 - Incandescent Lamps

Lecture 8 - Discharge Lamps - I

Lecture 9 - Discharge Lamps - II

Lecture 10 - Discharge Lamps - III

Lecture 11 - Illumination Systems - I

Lecture 12 - Illumination Systems - II

Lecture 13 - Glare

Lecture 14 - Color

Lecture 15 - Interior Lighting

Lecture 16 - Sports Lighting

Lecture 17 - Road Lighting

Lecture 18 - Lighting Calculations

Lecture 19 - Lighting Applications

Lecture 20 - Conclusions on Illumination Engineering

NPTEL : Industrial Automation and Control (Electrical Engineering)

Co-ordinators : Prof. S. Sen, Prof. S. Mukhopadhyay

Lecture 1 - Introduction

Lecture 2 - Architecture of Industrial Automation Systems

Lecture 3 - Measurement Systems Characteristics

Lecture 4 - Temperature Measurement

Lecture 5 - Pressure, Force and Torque Sensors

Lecture 6 - Motion Sensing

Lecture 7 - Flow Measurement

Lecture 8 - Signal Conditioning

Lecture 9 - Signal Conditioning (Continued.)

Lecture 10 - Data Acquisition Systems

Lecture 11 - Introduction to Automatic Control

Lecture 12 - P-I-D Control

Lecture 13 - PID Control Tuning

Lecture 14 - Feedforward Control Ratio Control

Lecture 15 - Time Delay Systems and Inverse Response Systems

Lecture 16 - Special Control Structures

Lecture 17 - Concluding Lesson on Process Control

Lecture 18 - Introduction to Sequence Control, PLC, RLL

Lecture 19 - Sequence Control. Scan Cycle,Simple RLL Programs

Lecture 20 - Sequence Control. More RLL Elements, RLL Syntax

Lecture 21 - A Structured Design Approach to Sequence

Lecture 22 - PLC Hardware Environment

Lecture 23 - Introduction To CNC Machines

Lecture 24 - Contour generation and Motion Control

Lecture 25 - Flow Control Valves

Lecture 26 - Hydraulic Control Systems - I

Lecture 27 - Hydraulic Control Systems - II

Lecture 28 - Industrial Hydraulic Circuit

Lecture 29 - Pneumatic Control Systems - I

Lecture 30 - Pneumatic Systems - II

Lecture 31 - Energy Savings with Variable Speed Drives

Lecture 32 - DC Motor Drives

Lecture 33 - DC and BLDC Servo Drives

Lecture 34 - Induction Motor Drives

Lecture 35 - Step Motor Drives BLDC Drives

Lecture 36 - Embedded Systems

Lecture 37 - The Fieldbus Network - I

Lecture 38 - The Fieldbus Network - II

Lecture 39 - Higher Level Automation Systems

Lecture 40 - Course Review and Conclusion

NPTEL : Industrial Instrumentation (Electrical Engineering)

Co-ordinators : Prof. Alok Barua

Lecture 1 - Introduction to Industrial Instrumentation

Lecture 2 - Dynamic Characteristics

Lecture 3 - Dynamic Characteristics (Continued.)

Lecture 4 - Strain gauge

Lecture 5 - Load cell

Lecture 6 - Torque Measurement

Lecture 7 - Thermistor

Lecture 8 - Thermocouples

Lecture 9 - Resistance Temperature Detector

Lecture 10 - LVDT

Lecture 11 - Capacitance Transducers

Lecture 12 - Flowmeter - I

Lecture 13 - Flowmeter - II

Lecture 14 - Flowmeter - III

Lecture 15 - Flowmeter - IV

Lecture 16 - Flowmeter - V

Lecture 17 - Problems on Temperature Sensors

Lecture 18 - Pressure Sensors

Lecture 19 - Low Pressure Measurement

Lecture 20 - pH and Viscosity Measurement

Lecture 21 - Problem and Solutions On Industrial Instrumentation

Lecture 22 - Signal Conditioning Circuits - I

Lecture 23 - Signal Conditioning Circuits - II

Lecture 24 - Piezoelectric Sensors

Lecture 25 - Ultrasonic Sensors

Lecture 26 - Nucleonic Instrumentation

Lecture 27 - Measurement Of Magnetic Field

Lecture 28 - Optoelectronic Sensor - I

Lecture 29 - Optoelectronic Sensor - II

Lecture 30 - Synchro

Lecture 31 - Dissolved Oxygen Sensors - I

Lecture 32 - Dissolved Oxygen Sensors - II

Lecture 33 - Flapper - Nozzle

Lecture 34 - Smart Sensors

Lecture 35 - Chromatography - I

Lecture 36 - Chromatography - II

Lecture 37 - Pollution Measurement

Lecture 38 - Control Valve - I

Lecture 39 - Control Valve - II

Lecture 40 - Signal Conditioning Integrated Circuits

NPTEL : Networks Signals and Systems (Electrical Engineering)

Co-ordinators : Prof. T.K. Basu

Lecture 1 - Introduction to Network Elements and Sources

Lecture 2 - Introduction to Linearity and Nonlinearity

Lecture 3 - Distributed & Lumped Parameters 2-port Networks

Lecture 4 - Two-port Parameters Short Circuit,Open Circuit

Lecture 5 - Tutorial

Lecture 6 - Locus Diagram - Introduction to Signals

Lecture 7 - Signals (Continued.) Laplace Transforms

Lecture 8 - Laplace Transform (Continued.)

Lecture 9 - Tutorial on Laplace Transform

Lecture 10 - Frequency Response Bode Plot

Lecture 11 - Bode Plot (Continued.)

Lecture 12 - Bode Plot (Continued.) - Poles & Zeros

Lecture 13 - Driving Point Immittance Functions - Realisability Conditions

Lecture 14 - Two - Element Synthesis

Lecture 15 - Two - Element Synthesis (Continued.)

Lecture 16 - Tutorial

Lecture 17 - Tutorial

Lecture 18 - Graph Theory

Lecture 19 - Graph Theory (Continued.)

Lecture 20 - Graph Theory (Continued.)

Lecture 21 - Graph Theory (Continued.)

Lecture 22 - Image Impedance, Iterative Impedance

Lecture 23 - Image Impedance, Iterative Impedance

Lecture 24 - Characteristic Impedance and Design of Filters

Lecture 25 - Analysis of Resistive Networks Computer Aided

Lecture 26 - R-L-C Two-Terminal Network

Lecture 27 - Parts of Network Functions

Lecture 28 - Parts of Network Functions (Continued.)

Lecture 29 - Tutorial

Lecture 30 - Tutorial (Continued.)

Lecture 31 - Tutorial

Lecture 32 - Synthesis of 2-port Network

Lecture 33 - Synthesis of 2-port Network (Continued.)

Lecture 34 - Synthesis of 2-port Network (Continued.)

Lecture 35 - Fourier Series

Lecture 36 - Fourier Series (Continued.)

NPTEL : Power System Analysis (Electrical Engineering)

Co-ordinators : Prof. A.K. Sinha

Lecture 1 - Introduction to Power system analysis

Lecture 2 - Introduction to Single Line Diagram

Lecture 3 - Transmission Line Parameters

Lecture 4 - Inductance Calculation (Three Phase)

Lecture 5 - Transmission Line Capacitance

Lecture 6 - Transmission Line Capacitance (Continued..)

Lecture 7 - Transmission Line Modeling

Lecture 8 - Transmission Line Modeling Long Line

Lecture 9 - Transmission Line Steady State Operation

Lecture 10 - Transmission Line Steady State Control Voltage

Lecture 11 - Transmission System A Review

Lecture 12 - Transformer Model

Lecture 13 - Synchronous Machine Model

Lecture 14 - Synchronous Machine Model

Lecture 15 - Load Model

Lecture 16 - Power Flow - I

Lecture 17 - Power Flow - II

Lecture 18 - Power Flow - III

Lecture 19 - Power Flow - IV

Lecture 20 - Power Flow - V

Lecture 21 - Power Flow - VI

Lecture 22 - Power Flow - VII

Lecture 23 - Review of Power System Component Models

Lecture 24 - Review of Power Flow Study

Lecture 25 - Short Circuit Analysis

Lecture 26 - Symmetrical Component Analysis

Lecture 27 - Sequence Networks

Lecture 28 - Unbalanced Fault Analysis

Lecture 29 - Unbalanced Fault Analysis

Lecture 30 - Fault Analysis for Large power Systems

Lecture 31 - Bus Impedance Matrix

Lecture 32 - Asymmetrical Fault Analysis Using Z - Bus

Lecture 33 - Power System Stability - I

Lecture 34 - Power System Stability - II

Lecture 35 - Power System Stability - III

Lecture 36 - Power System Stability - IV

Lecture 37 - Power System Stability - V

Lecture 38 - Power System Stability - VI

Lecture 39 - Power System Stability - VII

Lecture 40 - Power System Stability - VIII

NPTEL : NOC:Industrial Automation and Control (Electrical Engineering)

Co-ordinators : Prof. S. Mukhopadhyay

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Architecture of Industrial Automation Systems

Lecture 4 - Architecture of Industrial Automation Systems (Continued...)

Lecture 5 - Measurement Systems Characteristics

Lecture 6 - Measurement Systems Characteristics (Continued...)

Lecture 7 - Data Acquisition Systems

Lecture 8 - Data Acquisition Systems (Continued...)

Lecture 9 - Introduction to Automatic Control

Lecture 10 - Introduction to Automatic Control (Continued...)

Lecture 11 - P-I-D Control

Lecture 12 - P-I-D Control (Continued...)

Lecture 13 - PID Controller Tuning

Lecture 14 - PID Controller Tuning (Continued...)

Lecture 15 - Feedforward Control Ratio Control

Lecture 16 - Feedforward Control Ratio Control (Continued...)

Lecture 17 - Time Delay Systems and Inverse Response Systems

Lecture 18 - Time Delay Systems and Inverse Response Systems (Continued...)

Lecture 19 - Special Control Structures

Lecture 20 - Special Control Structures (Continued...)

Lecture 21 - Concluding Lesson on Process Control (Self-study)

Lecture 22 - Introduction to Sequence Control, PLC, RLL

Lecture 23 - Introduction to Sequence Control, PLC, RLL (Continued...)

Lecture 24 - Sequence Control, Scan Cycle, Simple RLL Programs

Lecture 25 - Sequence Control, Scan Cycle, Simple RLL Programs (Continued...)

Lecture 26 - Sequence Control, More RLL Elements, RLL Syntax

Lecture 27 - Sequence Control, More RLL Elements, RLL Syntax (Continued...)

Lecture 28 - A Structured Design Approach to Sequence Control

Lecture 29 - A Structured Design Approach to Sequence Control (Continued...)

Lecture 30 - PLC Hardware Environment

Lecture 31 - PLC Hardware Environment (Continued...)

Lecture 32 - Flow Control Valves

Lecture 33 - Flow Control Valves (Continued...)

Lecture 34 - Hydraulic Control Systems - I

Lecture 35 - Hydraulic Control Systems - I (Continued...)

Lecture 36 - Hydraulic Control Systems - II

Lecture 37 - Hydraulic Control Systems - II (Continued...)

Lecture 38 - Industrial Hydraulic Circuit

Lecture 39 - Industrial Hydraulic Circuit (Continued...)

Lecture 40 - Pneumatic Control Systems - I

Lecture 41 - Pneumatic Control Systems - I (Continued...)

Lecture 42 - Pneumatic Systems - II

Lecture 43 - Pneumatic Systems - II (Continued...)

Lecture 44 - Energy Savings with Variable Speed Drives

Lecture 45 - Energy Savings with Variable Speed Drives (Continued...)

Lecture 46 - Introduction To CNC Machines

Lecture 47 - Introduction To CNC Machines

Lecture 48 - The Fieldbus Network - I

Lecture 49 - The Fieldbus Network - I (Continued...)

Lecture 50 - Higher Level Automation Systems

Lecture 51 - Higher Level Automation Systems (Continued...)

Lecture 52 - Course Review and Conclusion (Self Study)

NPTEL : NOC:Medical Image Analysis (Electrical Engineering)

Co-ordinators : Prof. Debdoot Sheet

Lecture 1 - Introduction to Medical Image Analysis

Lecture 2 - X Ray and CT Imaging

Lecture 3 - Magnetic Resonance Imaging

Lecture 4 - Ultrasound Imaging

Lecture 5 - Optical Microscopy and Molecular Imaging

Lecture 6 - Texture in Medical Images

Lecture 7 - Region Growing and Clustering

Lecture 8 - Random Walks for Segmentation

Lecture 9 - Active Contours for Segmentation

Lecture 10 - Systematic Evaluation and Validation

Lecture 11 - Decision Trees for Segmentation and Classification

Lecture 12 - Random Forests for Segmentation and Classification

Lecture 13 - Neural Networks for Segmentation and Classification

Lecture 14 - Deep Learning for Medical Image Analysis

Lecture 15 - Deep Learning for Medical Image Analysis (Continued...)

Lecture 16 - Retinal Vessel Segmentation

Lecture 17 - Vessel Segmentation in Computed Tomography Scan of Lungs

Lecture 18

Lecture 19 - Tissue Characterization in Ultrasound

Lecture 20

NPTEL : NOC:Biomedical Signal Processing (Electrical Engineering)

Co-ordinators : Prof. Sudipta Mukhopadhyay

Lecture 1 - Motivation

Lecture 2 - Preliminaries

Lecture 3 - Biomedical Signal Origin and Dynamics

Lecture 4 - Biomedical Signal Origin and Dynamics (Continued...)

Lecture 5 - Biomedical Signal Origin and Dynamics (Continued...)

Lecture 6 - Biomedical Signal Origin and Dynamics (Continued...)

Lecture 7 - Artifact Removal

Lecture 8 - Artifact Removal (Continued...)

Lecture 9 - Artifact Removal (Continued...)

Lecture 10 - Artifact Removal (Continued...)

Lecture 11 - Artifact Removal (Continued...)

Lecture 12 - Artifact Removal (Continued...)

Lecture 13 - Artifact Removal (Continued...)

Lecture 14 - Artifact Removal (Continued...)

Lecture 15 - Artifact Removal (Continued...)

Lecture 16 - Artifact Removal (Continued...)

Lecture 17 - Artifact Removal (Continued...)

Lecture 18 - Event Detection

Lecture 19 - Event Detection (Continued...)

Lecture 20 - Event Detection (Continued...)

Lecture 21 - Event Detection (Continued...)

Lecture 22 - Event Detection (Continued...)

Lecture 23 - Event Detection (Continued...)

Lecture 24 - Event Detection (Continued...)

Lecture 25 - Homomorphic Processing

Lecture 26 - Homomorphic Processing (Continued...)

Lecture 27 - Waveform Analysis

Lecture 28 - Waveform Analysis (Continued...)

Lecture 29 - Waveform Analysis

Lecture 30 - Waveform Analysis (Continued...)

Lecture 31 - Waveform Analysis (Continued...)

Lecture 32 - Waveform Analysis (Continued...)

Lecture 33 - Waveform Analysis (Continued...)

Lecture 34 - Frequency Domain Characterisation

Lecture 35 - Frequency Domain Characterisation (Continued...)

Lecture 36 - Frequency Domain Characterisation (Continued...)

Lecture 37 - Frequency Domain Characterisation (Continued...)

Lecture 38 - Frequency Domain Characterisation (Continued...)

Lecture 39 - Frequency Domain Characterisation (Continued...)

Lecture 40 - Modelling of Biomedical Systems

Lecture 41 - Modelling of Biomedical Systems (Continued...)

Lecture 42 - Modelling of Biomedical Systems (Continued...)

Lecture 43 - Modelling of Biomedical Systems (Continued...)

Lecture 44 - Modelling of Biomedical Systems (Continued...)

Lecture 45 - Modelling of Biomedical Systems (Continued...)

Lecture 46 - Modelling of Biomedical Systems (Continued...)

Lecture 47 - Tutorial - I

Lecture 48 - Tutorial - I (Continued...)

Lecture 49 - Tutorial - I (Continued...)

Lecture 50 - Tutorial - II

Lecture 51 - Tutorial - II (Continued...)

Lecture 52 - Tutorial - II (Continued...)

Lecture 53 - Tutorial - III

Lecture 54 - Tutorial - III (Continued...)

Lecture 55 - Tutorial - III (Continued...)

Lecture 56 - Tutorial - III (Continued...)

Lecture 57 - Tutorial - IV

Lecture 58 - Tutorial - IV (Continued...)

Lecture 59 - Tutorial - IV (Continued...)

Lecture 60 - Tutorial - IV (Continued...)

Lecture 61 - Tutorial - IV (Continued...)

Lecture 62 - Tutorial - IV (Continued...)

Lecture 63 - Tutorial - V

Lecture 64 - Tutorial - V (Continued...)

Lecture 65 - Tutorial - V (Continued...)

Lecture 66 - Tutorial - V (Continued...)

Lecture 67 - Tutorial - V (Continued...)

Lecture 68 - Live Session

NPTEL : NOC:Microprocessors and Microcontrollers (Electrical Engineering)

Co-ordinators : Prof. Santanu Chattopadhyay

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Introduction (Continued...)

Lecture 4 - Basic Computer Organization

Lecture 5 - Basic computer organization

Lecture 6 - Basic Computer Organization

Lecture 7 - 8085 Microprocessors

Lecture 8 - 8085 Microprocessors (Continued...)

Lecture 9 - 8085 Microprocessors (Continued...)

Lecture 10 - 8085 Microprocessors (Continued...)

Lecture 11 - 8085 Microprocessors (Continued...)

Lecture 12 - 8085 Microprocessors (Continued...)

Lecture 13 - 8085 Microprocessors (Continued...)

Lecture 14 - 8085 Microprocessors (Continued...)

Lecture 15 - 8085 Microprocessors (Continued...)

Lecture 16 - 8085 Microprocessors (Continued...)

Lecture 17 - 8085 Microprocessors (Continued...)

Lecture 18 - 8085 Microprocessors (Continued...)

Lecture 19 - 8085 Microprocessors (Continued...)

Lecture 20 - 8085 Microprocessors (Continued...)

Lecture 21 - 8085 Microprocessors (Continued...)

Lecture 22 - 8085 Microprocessors (Continued...)

Lecture 23 - 8051 Microcontroller

Lecture 24 - 8051 Microcontroller (Continued...)

Lecture 25 - 8051Microcontroller (Continued...)

Lecture 26 - 8051 Microcontroller (Continued...)

Lecture 27 - 8051 Microcontroller (Continued...)

Lecture 28 - 8051 Microcontroller (Continued...)

Lecture 29 - 8051 Microcontroller (Continued...)

Lecture 30 - 8051 Microcontroller (Continued...)

Lecture 31 - 8051 Microcontroller (Continued...)

Lecture 32 - 8051 Microcontroller (Continued...)

Lecture 33 - 8051 Microcontroller (Continued...)

Lecture 34 - 8051 Microcontroller (Continued...)

Lecture 35 - 8051 Microcontroller (Continued...)

Lecture 36 - 8051 Programming Examples

Lecture 37 - 8051 Programming Examples (Continued...)

Lecture 38 - 8051 Programming Examples (Continued...)

Lecture 39 - 8051 Programming Examples (Continued...)

Lecture 40 - 8051 Programming Examples (Continued...)

Lecture 41 - ARM

Lecture 42 - ARM (Continued...)

Lecture 43 - ARM (Continued...)

Lecture 44 - ARM (Continued...)

Lecture 45 - ARM (Continued...)

Lecture 46 - ARM (Continued...)

Lecture 47 - ARM (Continued...)

Lecture 48 - ARM (Continued...)

Lecture 49 - PIC

Lecture 50 - PIC, AVR

Lecture 51 - AVR (Continued...)

Lecture 52 - AVR (Continued...)

Lecture 53 - Interfacing

Lecture 54 - Interfacing (Continued...)

Lecture 55 - Interfacing (Continued...)

Lecture 56 - Interfacing (Continued...)

Lecture 57 - Interfacing (Continued...)

Lecture 58 - Interfacing (Continued...)

Lecture 59 - 8086

Lecture 60 - 8086 (Continued...)

Lecture 61 - 8086 (Continued...)

Lecture 62 - 8086 (Continued...)

Lecture 63 - 8086 (Continued...)

Lecture 64 - 8087

NPTEL : NOC:Deep Learning For Visual Computing (Electrical Engineering)

Co-ordinators : Prof. Debdoot Sheet

Lecture 1 - Introduction to Visual Computing

Lecture 2 - Feature Extraction for Visual Computing

Lecture 3 - Feature Extraction with Python

Lecture 4 - Neural Networks for Visual Computing

Lecture 5 - Classification with Perceptron Model

Lecture 6 - Introduction to Deep Learning with Neural Networks

Lecture 7 - Introduction to Deep Learning with Neural Networks

Lecture 8 - Multilayer Perceptron and Deep Neural Networks

Lecture 9 - Multilayer Perceptron and Deep Neural Networks

Lecture 10 - Classification with Multilayer Perceptron

Lecture 11 - Autoencoder for Representation Learning and MLP Initialization

Lecture 12 - MNIST handwritten digits classification using autoencoders

Lecture 13 - Fashion MNIST classification using autoencoders

Lecture 14 - ALL-IDB Classification using autoencoders

Lecture 15 - Retinal Vessel Detection using autoencoders

Lecture 16 - Stacked Autoencoders

Lecture 17 - MNIST and Fashion MNIST with Stacked Autoencoders

Lecture 18 - Denoising and Sparse Autoencoders

Lecture 19 - Sparse Autoencoders for MNIST classification

Lecture 20 - Denoising Autoencoders for MNIST classification

Lecture 21 - Cost Function

Lecture 22 - Classification cost functions

Lecture 23 - Optimization Techniques and Learning Rules

Lecture 24 - Gradient Descent Learning Rule

Lecture 25 - SGD and ADAM Learning Rules

Lecture 26 - Convolutional Neural Network Building Blocks

Lecture 27 - Simple CNN Model: LeNet

Lecture 28 - LeNet Definition

Lecture 29 - Training a LeNet for MNIST Classification

Lecture 30 - Modifying a LeNet for CIFAR

Lecture 31 - Convolutional Autoencoder and Deep CNN

Lecture 32 - Convolutional Autoencoder for Representation Learning

Lecture 33 - AlexNet

Lecture 34 - VGGNet

Lecture 35 - Revisiting AlexNet and VGGNet for Computational Complexity

Lecture 36 - GoogLeNet - Going very deep with convolutions

Lecture 37 - GoogLeNet

Lecture 38 - ResNet - Residual Connections within Very Deep Networks and DenseNet - Densely connected networks

Lecture 39 - ResNet

Lecture 40 - DenseNet

Lecture 41 - Space and Computational Complexity in DNN

Lecture 42 - Assessing the space and computational complexity of very deep CNNs

Lecture 43 - Domain Adaptation and Transfer Learning in Deep Neural Networks

Lecture 44 - Transfer Learning a GoogLeNet

Lecture 45 - Transfer Learning a ResNet

Lecture 46 - Activation pooling for object localization

Lecture 47 - Region Proposal Networks (rCNN and Faster rCNN)

Lecture 48 - GAP + rCNN

Lecture 49 - Semantic Segmentation with CNN

Lecture 50 - UNet and SegNet for Semantic Segmentation

Lecture 51 - Autoencoders and Latent Spaces

Lecture 52 - Principle of Generative Modeling

Lecture 53 - Adversarial Autoencoders

Lecture 54 - Adversarial Autoencoder for Synthetic Sample Generation

Lecture 55 - Adversarial Autoencoder for Classification

Lecture 56 - Understanding Video Analysis

Lecture 57 - Recurrent Neural Networks and Long Short-Term Memory

Lecture 58 - Spatio-Temporal Deep Learning for Video Analysis

Lecture 59 - Activity recognition using 3D-CNN

Lecture 60 - Activity recognition using CNN-LSTM

NPTEL : NOC:Power System Engineering (Electrical Engineering)

Co-ordinators : Prof. Debapriya Das

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11 - Cables (Continued...)

Lecture 12 - Transient over voltages and Insulation coordination

Lecture 13 - Transient over voltages and Insulation coordination (Continued...)

Lecture 14 - Transient over voltages and Insulation coordination (Continued...)

Lecture 15 - Transient over voltages and Insulation coordination (Continued...)

Lecture 16 - Transient over voltages and Insulation coordination (Continued...)

Lecture 17 - Transient over voltages and Insulation coordination (Continued...)

Lecture 18 - Transient over voltages and Insulation coordination (Continued...)

Lecture 19 - Transient over voltages and Insulation coordination (Continued...)

Lecture 20 - Corona

Lecture 21 - Corona (Continued...)

Lecture 22 - Corona (Continued...)

Lecture 23 - Corona (Continued...), Sag and Tension Analysis

Lecture 24 - Sag and Tension Analysis (Continued...)

Lecture 25 - Sag and Tension Analysis (Continued...)

Lecture 26 - Sag and Tension Analysis (Continued...)

Lecture 27 - Sag and Tension Analysis (Continued...)

Lecture 28 - Sag and Tension Analysis (Continued...)

Lecture 29 - Load flow of radial distribution networks

Lecture 30 - Load flow of radial distribution networks (Continued...)

Lecture 31 - Load flow of radial distribution networks (Continued...)

Lecture 32 - Load flow of radial distribution networks (Continued...)

Lecture 33 - Load flow of radial distribution networks (Continued...)

Lecture 34 - Load flow of radial distribution networks (Continued...)

Lecture 35 - Load flow of radial distribution networks (Continued...)

Lecture 36 - Load flow of radial distribution networks (Continued...)

Lecture 37 - Load flow of radial distribution networks (Continued...), Voltage stability of distribution network

Lecture 38 - Voltage stability of distribution network, Approximate method

Lecture 39 - Application of capacitors in distribution system

Lecture 40 - Application of capacitors in distribution system (Continued...)

Lecture 41 - Application of capacitors in distribution system (Continued...)

Lecture 42 - Application of capacitors in distribution system (Continued...)

Lecture 43 - Application of capacitors in distribution system (Continued...)

Lecture 44 - Application of capacitors in distribution system (Continued...), Load frequency control

Lecture 45 - Load frequency control (Continued...)

Lecture 46 - Load frequency control (Continued...)

Lecture 47 - Load frequency control (Continued...)

Lecture 48 - Load frequency control (Continued...)

Lecture 49 - Load frequency control (Continued...)

Lecture 50 - Load frequency control (Continued...)

Lecture 51 - Load frequency control (Continued...)

Lecture 52 - Load frequency control (Continued...)

Lecture 53 - Load frequency control (Continued...)

Lecture 54 - Load frequency control (Continued...)

Lecture 55 - Load frequency control (Continued...)

Lecture 56 - Load frequency control (Continued...)

Lecture 57 - Automatic generation control

Lecture 58 - Automatic generation control (Continued...)

Lecture 59 - Automatic generation control (Continued...), Unit commitment

Lecture 60 - Unit commitment (Continued...)

Lecture 61 - Live Session

NPTEL : NOC:Fundamentals of Electrical Engineering (Electrical Engineering)

Co-ordinators : Prof. Debapriya Das

Lecture 1 - Basic Concepts, Examples

Lecture 2 - Basic Concepts, Examples (Continued...)

Lecture 3 - Basic Concepts, Examples (Continued...)

Lecture 4 - Basic Concepts, Examples (Continued...)

Lecture 5 - Basic Laws

Lecture 6 - Basic Laws (Continued...)

Lecture 7 - Basic Laws (Continued...)

Lecture 8 - Basic Laws (Continued...)

Lecture 9 - Basic Laws (Continued...)

Lecture 10 - Basic Laws (Continued...)

Lecture 11 - Methods of Circuit Analysis

Lecture 12 - Methods of Circuit Analysis (Continued...)

Lecture 13 - Methods of Circuit Analysis (Continued...)

Lecture 14 - Methods of Circuit Analysis (Continued...)

Lecture 15 - Methods of Circuit Analysis (Continued...)

Lecture 16 - Methods of Circuit Analysis (Continued...)

Lecture 17 - Mesh analysis with current sources, Examples

Lecture 18 - Methods of Circuit Analysis (Continued...) and Circuit Theorems

Lecture 19 - Circuit Theorems (Continued...)

Lecture 20 - Circuit Theorems (Continued...)

Lecture 21 - Circuit Theorems (Continued...)

Lecture 22 - Circuit Theorems (Continued...)

Lecture 23 - Circuit Theorems (Continued...)

Lecture 24 - Circuit Theorems (Continued...)

Lecture 25 - Circuit Theorems (Continued...) and Capacitors and Inductors

Lecture 26 - Capacitors and Inductors (Continued...)

Lecture 27 - Capacitors and Inductors (Continued...)

Lecture 28 - Capacitors and Inductors (Continued...)

Lecture 29 - First Order Circuits

Lecture 30 - First Order Circuits (Continued...)

Lecture 31 - First Order Circuits (Continued...)

Lecture 32 - First Order Circuits (Continued...)

Lecture 33 - First Order Circuits (Continued...)

Lecture 34 - First Order Circuits (Continued...)

Lecture 35 - First Order Circuits (Continued...)

Lecture 36 - First Order Circuits (Continued...)

Lecture 37 - Single phase AC circuits

Lecture 38 - Single phase AC circuits (Continued...)

Lecture 39 - Single phase AC circuits (Continued...)

Lecture 40 - Single phase AC circuits (Continued...)

Lecture 41 - Single phase AC circuits (Continued...)

Lecture 42 - Single phase AC circuits (Continued...)

Lecture 43 - Single phase AC circuits (Continued...)

Lecture 44 - Resonance and Maximum Power Transfer Theorem

Lecture 45 - Resonance and Maximum Power Transfer Theorem (Continued...)

Lecture 46 - Resonance and Maximum Power Transfer Theorem (Continued...)

Lecture 47 - Three phase circuits

Lecture 48 - Three phase circuits (Continued...)

Lecture 49 - Three phase circuits (Continued...)

Lecture 50 - Three phase circuits (Continued...)

Lecture 51 - Magnetic Circuits

Lecture 52 - Magnetic Circuits (Continued...)

Lecture 53 - Magnetic Circuits (Continued...)

Lecture 54 - Single Phase Transformer

Lecture 55 - Single Phase Transformer (Continued...)

Lecture 56 - Single Phase Transformer (Continued...)

Lecture 57 - Single Phase Transformer (Continued...)

Lecture 58 - Three phase Induction Motors

Lecture 59 - Three phase Induction Motors (Continued...)

Lecture 60 - Three phase Induction Motors (Continued...)

Lecture 61 - Three phase Induction Motors (Continued...)

Lecture 62 - DC Motors

Lecture 63 - DC Motors (Continued...)

Lecture 64 - DC Motors (Continued...)

NPTEL : NOC:Digital Circuits (Electrical Engineering)

Co-ordinators : Prof. Santanu Chattopadhyay

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Number System

Lecture 4 - Number System (Continued...)

Lecture 5 - Number System (Continued...)

Lecture 6 - Number System (Continued...)

Lecture 7 - Number System (Continued...)

Lecture 8 - Boolean Algebra

Lecture 9 - Boolean Algebra (Continued...)

Lecture 10 - Boolean Algebra (Continued...)

Lecture 11 - Boolean Algebra (Continued...)

Lecture 12 - Boolean Algebra (Continued...)

Lecture 13 - Boolean Algebra (Continued...)

Lecture 14 - Logic Gates

Lecture 15 - Logic Gates (Continued...)

Lecture 16 - Logic Gates (Continued...)

Lecture 17 - Logic Gates (Continued...)

Lecture 18 - Logic Gates (Continued...)

Lecture 19 - Logic Gates (Continued...)

Lecture 20 - Arithmetic Circuits

Lecture 21 - Arithmetic Circuits (Continued...)

Lecture 22 - Arithmetic Circuits (Continued...)

Lecture 23 - Decoders, Multiplexers, PLA

Lecture 24 - Decoders, Multiplexers, PLA (Continued...)

Lecture 25 - Decoders, Multiplexers, PLA (Continued...)

Lecture 26 - Decoders, Multiplexers, PLA (Continued...)

Lecture 27 - Decoders, Multiplexers, PLA (Continued...)

Lecture 28 - Sequential Circuits

Lecture 29 - Sequential Circuits (Continued...)

Lecture 30 - Sequential Circuits (Continued...)

Lecture 31 - Sequential Circuits (Continued...)

Lecture 32 - Sequential Circuits (Continued...)

Lecture 33 - Sequential Circuits (Continued...)

Lecture 34 - Sequential Circuits (Continued...)

Lecture 35 - Finite State Machine

Lecture 36 - Finite State Machine (Continued...)

Lecture 37 - Data Converters

Lecture 38 - Data Converters (Continued...)

Lecture 39 - Data Converters (Continued...)

Lecture 40 - Data Converters (Continued...)

Lecture 41 - Memory

Lecture 42 - Memory (Continued...)

Lecture 43 - Memory (Continued...)

Lecture 44 - FPGA

Lecture 45 - FPGA (Continued...)

Lecture 46 - VHDL

Lecture 47 - VHDL(Continued...)

Lecture 48 - 8085 Microprocessor

Lecture 49 - 8085 Microprocessor (Continued...)

Lecture 50 - 8085 Microprocessor (Continued...)

Lecture 51 - 8085 Microprocessor (Continued...)

Lecture 52 - 8085 Microprocessor (Continued...)

Lecture 53 - 8085 Microprocessor (Continued...)

Lecture 54 - 8085 Microprocessor (Continued...)

Lecture 55 - 8085 Microprocessor (Continued...)

Lecture 56 - 8085 Microprocessor (Continued...)

Lecture 57 - 8085 Microprocessor (Continued...)

Lecture 58 - 8085 Microprocessor (Continued...)

Lecture 59 - 8085 Microprocessor (Continued...)

Lecture 60 - 8085 Microprocessor (Continued...)

Lecture 61 - 8085 Microprocessor (Continued...)

Lecture 62 - 8085 Microprocessor (Continued...)

Lecture 63 - 8086 Microprocessor

Lecture 64 - 8086 Microprocessor (Continued...)

Lecture 65 - 8086 Microprocessor (Continued...)

NPTEL : NOC:Analysis and Design Principles of Microwave Antennas (Electrical Engineering)

Co-ordinators : Dr. Amitabha Bhattacharya

Lecture 1 - Concept of Scalar and Vector Potentials

Lecture 2 - Radiation From a Current Element (Hertzian Dipole)

Lecture 3 - Specific Properties of the Radiated Fields from a Current Element

Lecture 4 - General Properties of Radiated Fields from an Antenna

Lecture 5 - Farfield and Radiation Pattern of an Antenna

Lecture 6 - Directivity and Gain of an Antenna

Lecture 7 - Idea of Efficiency, Beamwidth, Polarisation and Bandwidth

Lecture 8 - Polarization of Antenna

Lecture 9 - Impedance of Antenna

Lecture 10 - Effective Aperture of an Antenna

Lecture 11 - Friss Transmission Equation and Antenna Temperature

Lecture 12 - Dipole And Monopole Antena

Lecture 13 - Dipole And Monopole Antena (Continued...)

Lecture 14 - BALUN

Lecture 15 - Loop Antenna

Lecture 16 - Folded Dipole Antenna

Lecture 17 - Introduction to Antenna Array

Lecture 18 - Antenna Array Theory

Lecture 19 - Broadside Uniform Linear Array

Lecture 20 - Endfire Linear Uniform Array

Lecture 21 - Parasitic Array and Log Periodic Antenna

Lecture 22 - Analysis Procedures of Aperture Antennas

Lecture 23 - Analysis Procedures of Aperture Antenna (Continued...)

Lecture 24 - Horn Antenna

Lecture 25 - Horn Antenna (Continued...)

Lecture 26 - Reflector Antennas

Lecture 27 - Paraboloid Reflector Antenna (Continued...)

Lecture 28 - Paraboloid Reflector Antenna (Continued...)

Lecture 29 - Dual Reflector Antenna

Lecture 30 - Generalised Analysis of Antenna

Lecture 31 - Solution of Wave Equation for Electric and Magnetic Current Densities

Lecture 32 - Farfield Evaluation of Spherical Wave Radiation by Generalised Antenna

Lecture 33 - Slot Antenna

Lecture 34 - Open Ended Waveguide Antenna and Microstrip Antenna

Lecture 35 - Numerical Evaluation of Wire Antenna Currents

Lecture 36 - Solution of Intregral Equation by Moment Method

Lecture 37 - Array Pattern Synthesis

Lecture 38 - Array Pattern Synthesis (Continued...)

Lecture 39 - Ultra Wideband Antennas

Lecture 40 - Antenna Measurements

NPTEL : NOC:Architectural Design of Digital Integrated Circuits (Electrical Engineering)

Co-ordinators : Prof. Indranil Hatai

Lecture 1 - Introduction to VLSI Design Flow

Lecture 2 - Introduction to VLSI Design Flow

Lecture 3 - Introduction to VLSI Design Flow

Lecture 4 - Algorithm to Efficient Architecture Mapping

Lecture 5 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 6 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 7 - Tutorial on Algorithm to Efficient Architecture Mapping

Lecture 8 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 9 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 10 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 11 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 12 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 13 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 14 - Algorithm to Efficient Architecture Mapping (Continued...)

Lecture 15 - Efficient Adder Architecture

Lecture 16 - Efficient Adder Architecture (Continued...)

Lecture 17 - Efficient Adder Architecture (Continued...)

Lecture 18 - Efficient Adder Architecture

Lecture 19 - Efficient Adder Architecture

Lecture 20 - Efficient Adder Architecture

Lecture 21 - Efficient Adder Architecture

Lecture 22 - Efficient Adder Architecture

Lecture 23 - Efficient Adder Architecture

Lecture 24 - Efficient Adder Architecture

Lecture 25 - Pipelining and Parallel Processing

Lecture 26 - Pipelining and Parallel Processing

Lecture 27 - Multiplier Architecture

Lecture 28 - Multiplier Architecture

Lecture 29 - Multiplier Architecture

Lecture 30 - Multiplier Architecture

Lecture 31 - Multiplier Architecture

Lecture 32 - Multiplier Architecture

Lecture 33 - Multiplier Architecture

Lecture 34 - Multiplier Architecture

Lecture 35 - Squaring Circuit Design

Lecture 36 - Reconfigurable Constant Multiplier Design

Lecture 37 - Reconfigurable Constant Multiplier Design

Lecture 38 - Reconfigurable Constant Multiplier Design

Lecture 39 - Fixed Point Number Representation

Lecture 40 - Fixed Point Number Representation

Lecture 41 - CORDIC Architecture

Lecture 42 - CORDIC Architecture

Lecture 43 - CORDIC Architecture

Lecture 44 - CORDIC Architecture

Lecture 45 - Timing Analysis

Lecture 46 - Timing Analysis

Lecture 47 - Timing Analysis

Lecture 48 - Logic Hazard

Lecture 49 - FFT Architecture

Lecture 50 - FFT Architecture (Continued...)

Lecture 51 - Timing analysis Basics

Lecture 52 - Timing analysis Basics (Continued...)

Lecture 53 - Timing analysis Basics (Continued...)

Lecture 54 - Timing Issuesin Digital IC Design

Lecture 55 - Timing Issuesin Digital IC Design (Continued...)

Lecture 56 - Timing Issuesin Digital IC Design (Continued...)

Lecture 57 - Timing Issuesin Digital IC Design (Continued...)

Lecture 58 - Architectural Design of Digital Integrated Circuits

Lecture 59 - Design Tips for Basic Circuits Design (Continued...)

Lecture 60 - Design Tips for Basic Circuits Design (Continued...)

Lecture 61 - Design Tips for Basic Circuits Design (Continued...)

Lecture 62 - Low Power Digital Design

Lecture 63 - Low Power Digital Design (Continued...)

Lecture 64 - Low Power Digital Design

Lecture 65 - Low Power Digital Design (Continued...)

Lecture 66 - Hardware for Machine Learning: Design Considerations Design Tips

Lecture 67 - Hardware for Machine Learning: Design Considerations Design Tips (Continued...)

NPTEL : NOC:Electrical Machines-II (Electrical Engineering)

Co-ordinators : Prof.Tapas Kumar Bhattacharya

Lecture 1 - Inductance, Self and Mutual

Lecture 2 - Relationship of Inductances in Transformer

Lecture 3 - Equivalent Circuit from Circuit KVL Equations

Lecture 4 - Co-efficient of Coupling , Energy Stored in Coupled Coils

Lecture 5 - A Single Conductor Generator and Motor

Lecture 6 - Analysis of Single Conductor Generator and Motor

Lecture 7 - Analysis of Single Conductor Generator and Motor (Continued...)

Lecture 8 - Flux Density Distribution in Space and Nature emf

Lecture 9 - Flux Density Distribution in Space and Nature emf (Continued...)

Lecture 10 - From Linear to Rotating Machine

Lecture 11 - From Linear to Rotating Machine (Continued...)

Lecture 12 - Basic Underlying Principle of Operation of Rotating Machine

Lecture 13 - Basic Underlying Principle of Operation of Rotating Machine (Continued...)

Lecture 14 - Flux Density Distribution along the Air Gap

Lecture 15 - Flux Density Distribution along the Air Gap (Continued...)

Lecture 16 - Induced Voltage in a Coil in a Rotating Machine

Lecture 17 - Induced Voltage in a Coil in a Rotating Machine (Continued...)

Lecture 18 - Induced Voltage in a Coil in a Rotating Machine (Continued...)

Lecture 19 - Induced Voltage due to Fundamental and Harmonic Components of Flux Density Distribution

Lecture 20 - Distributed Coils Connected in Series Resultant Voltage

Lecture 21 - Distribution Factor

Lecture 22 - Pitch Factor and Winding Factor

Lecture 23 - How to decide about Short Pitch Angle ÃÂµ

Lecture 24 - Double Layer 3-phase Winding - An Introduction

Lecture 25 - Winding Table for 3-phase Distributed Winding

Lecture 26 - Winding Table for 3-phase Distributed Winding with Examples

Lecture 27 - Winding Table for 3-phase Distributed Winding with Examples (Continued...)

Lecture 28 - 120 degree Phase Spread Winding with Examples

Lecture 29 - Winding Table of 120 degree Phase Spread Coils and Group Connection

Lecture 30 - Introduction to Rotating Magnetic Field

Lecture 31 - Rotating Magnetic Field (Continued...), Mechanical and Electrical Speed

Lecture 32 - Speed and Direction of Rotating Field

Lecture 33 - Synchronous Speed and How to Calculate Induced Voltage in a Coil

Lecture 34 - Introduction to Induction Motor

Lecture 35 - Introduction to Induction Motor (Continued...)

Lecture 36 - General Expression of Torque in Terms of Stator and Rotor Fields

Lecture 37 - Torque Angle and Torque Expression

Lecture 38 - How to Fix Up Positions of Net Field, Rotor Field and Stator Field

Lecture 39 - Slip: Its Importance and Range for Motor Operation

Lecture 40 - Equivalent Circuit of 3-Phase Induction Motor

Lecture 41 - Equivalent Circuit of 3-Phase Induction Motor (Continued...)

Lecture 42 - Equivalent Circuit of 3-Phase Induction Motor (Continued...)

Lecture 43 - Expression for Electromagnetic Torque in terms of Equivalent Circuit Parameters

Lecture 44 - Maximum Electromagnetic Torque and Slip at Which it Occurs

Lecture 45 - Typical Torque Slip Characteristic and Operating Point

Lecture 46 - Change in Torque-slip Characteristic as Supply Voltage and Rotor Resistance are Varied

Lecture 47 - Types of Induction Motor - Slip Ring Type

Lecture 48 - Introduction to Cage Induction Motor

Lecture 49 - Cage Motor Can Operate for Different Stator Poles

Lecture 50 - Core Loss in Induction Motor and Simplified Equivalent Circuit

Lecture 51 - Torque Expression from Simplified Equivalent Circuit and Introduction to Circle Diagram

Lecture 52 - Circle Diagram (Continued...)

Lecture 53 - Exact Power Flow Diagram and Circle Diagram

Lecture 54 - Circle Diagram (Continued...)

Lecture 55 - Circle Diagram: Slip Line

Lecture 56 - Circle Diagram from Test Data

Lecture 57 - Starting of 3 Phase Induction Motor - Introduction

Lecture 58 - DOL and Reactor Starting

Lecture 59 - DOL and Auto Transformer Starting

Lecture 60 - Introduction to Speed Control

Lecture 61 - Idea of VVVF Speed Control of Induction Motor

Lecture 62 - Speed Contro Using Two Motors

Lecture 63 - Electrical Braking of 3 Phase Induction Motor

Lecture 64 - Braking (Continued...)

Lecture 65 - Introduction to Single Phase Induction Motor - Sequence Currents

Lecture 66 - Development of Equivalent Circuit

Lecture 67 - Development of Equivalent Circuit (Continued...)

Lecture 68 - Torque-slip Ch. of 1 ph. I-M Running on Single Winding

Lecture 69 - Introduction to Starting of 1ph. Induction Motor

Lecture 70 - Expression for Starting Torque and Need for Phase Splitting

Lecture 71 - Resistor Split 1 ph. Induction Motor

Lecture 72 - Capacitor Split 1 ph Induction Motor

Lecture 73 - Starting of 1 ph. Induction Motor (Continued...)

Lecture 74 - Synchronous Machine Construction

Lecture 75 - Synchronous Generator - Introduction

Lecture 76 - Synchronisation

Lecture 77 - Expression for Induced Voltage and O.C. Phasor Diagram

Lecture 78 - Loaded Synchronous Generator - Resultant Field

Lecture 79 - Armature Reaction and Synchronous Reactance. Basic Phasor Diagram

Lecture 80 - General Mode of Operation - Rotro Field, Stator Field and Resultant Field

Lecture 81 - Complete Phasor Diagram and Expression for Complex Power

Lecture 82 - Synchronous Motor Operation, Phasor Diagram and Power Expression

Lecture 83 - Effect of Variation of Field Current in Generator

Lecture 84 - Effect of Variation Field Current in Synchronous Motor, Introduction to Salient Pole Machine

Lecture 85 - Analysis of Salient Pole Synchronous Machine

Lecture 86 - Phasor Diagram of Salient Pole Synchronous Machine for Generator and Motor Mode

Lecture 87 - Expression for Load Angle and Expression for Power

Lecture 88 - Phasor Diagrams of Salient Pole Synchronous Generator under Various Conditions

Lecture 89 - Phasor Diagrams of Salient Pole Synchronous Motor under Various Conditions

Lecture 90 - O.C and S.C Test on Synchronous Generator

NPTEL : NOC:Digital Electronic Circuits (Electrical Engineering)

Co-ordinators : Prof. Goutam Saha

Lecture 1 - Introduction

Lecture 2 - Transistor as a switch

Lecture 3 - Performance Issues and Introduction to TTL

Lecture 4 - Transistor Transistor Logic (TTL)

Lecture 5 - CMOS Logic

Lecture 6 - Basic Gates and their representations

Lecture 7 - Fundamentals of Boolean Algebra

Lecture 8 - Boolean Function to Truth Table and Implementaion Issues

Lecture 9 - Truth Table to Boolean Function and Implementaion Issues

Lecture 10 - Karnugh Map and Digital Circuit Realization

Lecture 11 - Karnaugh Map to Entered Variable Map

Lecture 12 - Quine - McClusky (QM) Algorithm

Lecture 13 - Cost Criteria and Minimization of Multiple Output Functions

Lecture 14 - Static 1 Hazard

Lecture 15 - Static 0 Hazard and Dynamic Hazard

Lecture 16 - Multiplexer: Part I

Lecture 17 - Multiplexer: Part II

Lecture 18 - Demultiplexer / Decoder

Lecture 19 - Decoder with BCD Input and Encoder

Lecture 20 - Parity Generator and Checker

Lecture 21 - Number System

Lecture 22 - Negative Number and 2s Complement Arithmetic

Lecture 23 - Arithmetic Building Blocks - I

Lecture 24 - Arithmetic Building Blocks - II

Lecture 25 - Overflow Detection and BCD Arithmetic

Lecture 26 - Magnitude Comparator

Lecture 27 - Arithmetic Logic Unit (ALU)

Lecture 28 - Unweighted Code

Lecture 29 - Error Detection and Correction Code

Lecture 30 - Multiplication and Division

Lecture 31 - SR Latch and Introduction to Clocked Flip-Flop

Lecture 32 - Edge-Triggered Flip-Flop

Lecture 33 - Representations of Flip-Flops

Lecture 34 - Analysis of Sequential Logic Circuit

Lecture 35 - Conversion of Flip-Flops and Flip-Flop Timing Parameters

Lecture 36 - Register and Shift Register: PIPO and SISO

Lecture 37 - Shift Register: SIPO, PISO and Universal Shift Register

Lecture 38 - Application of Shift Register

Lecture 39 - Linear Feedback Shift Register

Lecture 40 - Serial Addition, Multiplication and Division

Lecture 41 - Asynchronous Counter

Lecture 42 - Decoding Logic and Synchronous Counter

Lecture 43 - Cascading: Mod 2, 3, 5 to Mod 6, 10, 1000 Counter

Lecture 44 - Counter Design with Asynchronous Reset and Preset

Lecture 45 - Counter Design as Synthesis Problem and Few Other Uses of Counter

Lecture 46 - Synthesis of Sequential Logic Circuit: Moore Model and Mealy Model

Lecture 47 - Moore Model and Mealy Model: Realization of Digital Logic Circuit

Lecture 48 - Algorithmic State Machine (ASM) Chart and Synthesis of Sequential Logic Circuit

Lecture 49 - Circuit Realization from ASM Chart and State Minimization

Lecture 50 - State Minimization by Implication Table and Partitioning Method

Lecture 51 - Digital to Analog Conversion - I

Lecture 52 - Digital to Analog Conversion - II

Lecture 53 - Analog to Digital Conversion - I

Lecture 54 - Analog to Digital Conversion - II

Lecture 55 - Certain Performance Issue of ADC and DAC

Lecture 56 - Introduction to Memory

Lecture 57 - Static Random Access Memory (SRAM)

Lecture 58 - Dynamic RAM (DRAM) and Memory Expansion

Lecture 59 - Read Only Memory (ROM)

Lecture 60 - PAL, PLA, CPLD, FPGA

NPTEL : NOC:Power System Dynamics, Control and Monitoring (Electrical Engineering)

Co-ordinators : Prof. Debapriya Das

Lecture 1 - Power System stability

Lecture 2 - Power System stability (Continued...)

Lecture 3 - Power System stability (Continued...)

Lecture 4 - Power System stability (Continued...)

Lecture 5 - Power System stability (Continued...)

Lecture 6 - Power System Stability (Continued...)

Lecture 7 - Power System Stability (Continued...)

Lecture 8 - Power System Stability (Continued...)

Lecture 9 - Power System Stability (Continued...)

Lecture 10 - Power System Stability (Continued...)

Lecture 11 - Power System Stability (Continued...)

Lecture 12 - Power System Stability (Continued...)

Lecture 13 - Power System Stability (Continued...)

Lecture 14 - Power System Stability (Continued...)

Lecture 15 - Power System Stability (Continued...)

Lecture 16 - Power System Stability (Continued...)

Lecture 17 - Power System Stability (Continued...)

Lecture 18 - Power System Stability (Continued...)

Lecture 19 - Power System Stability (Continued...)

Lecture 20 - Power System Stability (Continued...)

Lecture 21 - Power System stability (Continued...)

Lecture 22 - Power System stability, Eigen properties of the state matrix

Lecture 23 - Power System stability, Eigen properties of the state matrix (Continued...)

Lecture 24 - Power System stability, Eigen properties of the state matrix (Continued...)

Lecture 25 - Power System stability, Eigen properties of the state matrix (Continued...)

Lecture 26 - Power System stability, Eigen properties of the state matrix (Continued...)

Lecture 27 - Power System stability, Eigen properties of the state matrix, Transient stability

Lecture 28 - Transient stability

Lecture 29 - Transient stability (Continued...)

Lecture 30 - Transient stability (Continued...)

Lecture 31 - Transient stability

Lecture 32 - Transient stability, Automatic generation control conventional scenario

Lecture 33 - Automatic generation control conventional scenario

Lecture 34 - Automatic generation control conventional scenario

Lecture 35 - Automatic generation control conventional scenario

Lecture 36 - Automatic generation control conventional scenario

Lecture 37 - Automatic generation control conventional scenario

Lecture 38 - Automatic generation control conventional scenario

Lecture 39 - Automatic generation control conventional scenario

Lecture 40 - Automatic generation control conventional scenario

Lecture 41 - AGC in deregulated system

Lecture 42 - AGC in deregulated system (Continued...)

Lecture 43 - AGC in deregulated system (Continued...)

Lecture 44 - AGC in deregulated system (Continued...)

Lecture 45 - AGC in deregulated system (Continued...)

Lecture 46 - AGC in deregulated system (Continued...)

Lecture 47 - AGC in deregulated system (Continued...)

Lecture 48 - AGC in deregulated system (Continued...)

Lecture 49 - AGC in deregulated system, Reactive power and voltage control

Lecture 50 - Reactive power and voltage control

Lecture 51 - Reactive power and voltage control, State extimation in power system

Lecture 52 - State estimation in power system

Lecture 53 - State estimation in power system (Continued...)

Lecture 54 - State estimation in power system (Continued...)

Lecture 55 - State estimation in power system (Continued...)

Lecture 56 - State estimation in power system (Continued...)

Lecture 57 - Hydraulic turbine modelling

Lecture 58 - Hydraulic turbine modelling (Continued...)

Lecture 59 - Subsynchronous oscillation

Lecture 60 - Subsynchronous oscillation, Windup and non windup limits

NPTEL : NOC:Evolution of Air Interface towards 5G (Electrical Engineering)

Co-ordinators : Prof. Suvra Sekhar Das

Lecture 1 - Evolution of wireless Communication

Lecture 2 - Evolution of wireless Communication Standards From 2G to 5G

Lecture 3 - Evolution of wireless Communication Standards From 2G to 5G (Continued...)

Lecture 4 - Evolution of wireless Communication Standards From 2G to 5G (Continued...)

Lecture 5 - Evolution of wireless Communication Standards From 2G to 5G (Continued...)

Lecture 6 - Requirements and operating scenarios of 5G

Lecture 7 - Requirements and operating scenarios of 5G (Continued....)

Lecture 8 - 5G scenarios

Lecture 9 - Ultra reliable low latency communication

Lecture 10 - Designing 5G new radio

Lecture 11 - Fundamental Framework for waveform analysis

Lecture 12 - Fundamental Framework for waveform analysis (Continued...)

Lecture 13 - Waveform Design Aspects of 2G

Lecture 14 - Waveforms in 3G

Lecture 15 - Waveforms in 3G (Continued...)

Lecture 16 - Waveform in 4G and 5G (OFDM)

Lecture 17 - Waveform in 4G and 5G (OFDM) (Continued...)

Lecture 18 - Waveform in 4G and 5G (OFDM) (Continued...)

Lecture 19 - Waveform in 4G and 5G (OFDMA)

Lecture 20 - Waveform in 4G and 5G (OFDMA, SCFDMA, SCFDE)

Lecture 21 - Waveform in 4G and 5G (SCFDMA Continued...)

Lecture 22 - Waveform in 5G

Lecture 23 - Waveform in 5G Numerology

Lecture 24 - Frame Structure in 5G NR

Lecture 25 - Numerology in 5G and adaptive subcarrier bandwidth

Lecture 26 - Numerology in 5G (Continued...)

Lecture 27 - Waveforms beyond 5G

Lecture 28 - Waveforms beyond 5G (Continued...)

Lecture 29 - Waveforms beyond 5G (Continued...)

Lecture 30 - Waveforms beyond 5G (Continued...)

Lecture 31 - Waveform beyond 5G (Precoded GFDM)

Lecture 32 - Comparison of waveforms

Lecture 33 - Channel models for performance evaluation - Part I

Lecture 34 - Channel models for performance evaluation - Part II

Lecture 35 - Channel models for performance evaluation - Part III

Lecture 36 - MIMO Signal Processing (Receive Diversity)

Lecture 37 - MIMO Signal Processing

Lecture 38 - MIMO Signal Processing (Capacity)

Lecture 39 - MIMO Signal Processing (Capacity and Massive MIMO)

Lecture 40 - Hybrid beamforming (mmWave)

NPTEL : NOC:Electrical Measurement and Electronic Instruments (Electrical Engineering)

Co-ordinators : Prof. Avishek Chatterjee

Lecture 1 - PMMC Instruments

Lecture 2 - Electrodynamic Instrument

Lecture 3 - Demonstration of PMMC and Electrodynamic Instruments

Lecture 4 - Features of PMMC and Electrodynamic Instruments

Lecture 5 - Moving Iron Instruments

Lecture 6 - Demonstration of Moving Iron Instrument

Lecture 7 - Electrostatic Instrument

Lecture 8 - Derivation of Deflecting Torque in Electrodynamic, Electrostatic and Moving Iron Instrument

Lecture 9 - Damping and Eddy Current Damping

Lecture 10 - Dynamics of the Moving Coil and Damping

Lecture 11 - Dynamics of the Moving Coil and Damping (Continued...)

Lecture 12 - Ballistic Galvanometer

Lecture 13 - Ammeter - I

Lecture 14 - Ammeter - II

Lecture 15 - Voltmeter

Lecture 16 - Ohmmeters - I

Lecture 17 - Ohmmeters - II

Lecture 18 - Rectifier based Voltmeters and Ammeter - I

Lecture 19 - Rectifier based Voltmetesr and Ammeter - II

Lecture 20 - Resistance measurement with a Voltmeter and an Ammeter

Lecture 21 - Four-Terminal Resistance

Lecture 22 - Problems: Four Terminal Resistance

Lecture 23 - Error Calculation

Lecture 24 - Sensitivity, Accuracy, and Resolution of Wheatstone Bridge

Lecture 25 - Kelvin Double Bridge

Lecture 26 - High Resistance Measurement

Lecture 27 - Wattmeter Connection and Compensated Wattmeter

Lecture 28 - Single Phase Energy Meter

Lecture 29 - Demonstration: 1. Eddy Current Braking 2.Creation of Magnetic Field Without Moving Objects

Lecture 30 - Single Phase Energy Meter (Continued...)

Lecture 31 - Connection of Energy Meter, Wattmeter, and Three Phase Supply

Lecture 32 - DC Potentiometer

Lecture 33 - AC Potentiometer

Lecture 34 - Polar potentiometer and phase shifter

Lecture 35 - Polar potentiometer

Lecture 36 - Co-ordinate potentiometer

Lecture 37 - Kelvin-Varley potential divider

Lecture 38 - Impedance measurement

Lecture 39 - AC bridges - I

Lecture 40 - AC bridges - II

Lecture 41 - AC bridges - III

Lecture 42 - Current transformer and potential transformer

Lecture 43 - Review of transformer and magnetic circuit

Lecture 44 - Errrors in Instrument ransformer

Lecture 45 - Flux density measurement with Ballistic Galvanometer

Lecture 46 - Flux density measurement with Ballistic Galvanometer (Continued...)

Lecture 47 - Background: From Flip Flop to Counters - I

Lecture 48 - Background: From Flip Flop to Counters - II

Lecture 49 - Background: Operational Amplifiers - I

Lecture 50 - Background: Operational Amplifiers - II

Lecture 51 - Background: Operational Amplifiers - III

Lecture 52 - Background: Operational Amplifiers - IV

Lecture 53 - Inverting amplifier versus Schmitt Trigger

Lecture 54 - Non-inverting amplifier versus Schmitt Trigger

Lecture 55 - Difference amplifier - I

Lecture 56 - Difference amplifier - II

Lecture 57 - Difference amplifier - III

Lecture 58 - Digital frequency meter

Lecture 59 - Digital frequency meter and Schmitt Trigger

Lecture 60 - Schmitt Trigger

Lecture 61 - Schmitt Trigger

Lecture 62 - Digital frequency meter

Lecture 63 - Linear ramp type digital voltmeter

Lecture 64 - Dual slope digital voltmeter - I

Lecture 65 - Dual slope digital voltmeter - II

Lecture 66 - Dual slope digital voltmeter and Integrator circuit

Lecture 67 - Digital ramp type voltmeter

Lecture 68 - Digital ramp type voltmeter and Successive approximation type voltmeter

Lecture 69 - ADC and DAC - I

Lecture 70 - ADC and DAC - II

Lecture 71 - Why we need electronic Instruments

Lecture 72 - Instruments with op-amp based amplifiers - I

Lecture 73 - Instruments with op-amp based amplifiers - II

Lecture 74 - Instruments with op-amp based amplifiers - III

Lecture 75 - Instrumentation Amplifier

Lecture 76 - Function generator

Lecture 77 - 555-Timer circuit

Lecture 78 - Astable and monostable oscillator circuits

Lecture 79 - Pulse generator

Lecture 80 - Oscilloscope - I

Lecture 81 - Oscilloscope - II

Lecture 82 - Emitter follower voltmeter

Lecture 83 - Linear ohmmeter

Lecture 84 - Ramp generator

NPTEL : NOC:Principles and Techniques of Modern Radar Systems (Electrical Engineering)

Co-ordinators : Dr. Amitabha Bhattacharya

Lecture 1 - Historical Development and Application

Lecture 2 - Radar Bands and System Modeling

Lecture 3 - Radar Equation

Lecture 4 - Some Basic Concepts of Pulsed Radar

Lecture 5 - Some Basic Concepts of Pulsed Radar (Continued...)

Lecture 6 - Some Basic Concepts of Pulsed Radar (Continued...)

Lecture 7 - Some Basic Concepts of Pulsed Radar (Continued...)

Lecture 8 - Tutorial Problems on Basic Concepts of Radar - Part I

Lecture 9 - Tutorial Problems on Basic Concepts of Radar - Part II

Lecture 10 - CW Radar

Lecture 11 - CW Radar Mathematical Model and Applications

Lecture 12 - FM-CW Radar

Lecture 13 - Double Frequency CW Radar

Lecture 14 - Pulsed Radar

Lecture 15 - MTI Filter

Lecture 16 - Clutter and Single DLC

Lecture 17 - Double DLC and Recursive MTI Filter

Lecture 18 - Multiple prf MTI Radar

Lecture 19 - Multiple prf MTI Radar and Clutter Attenuation

Lecture 20 - MTI Improvement Factor

Lecture 21 - Tutorial Problems on CW and Pulsed Radar - Part I

Lecture 22 - Tutorial Problems on CW and Pulsed Radar - Part II

Lecture 23 - Pulsed Doppler Radar

Lecture 24 - Pulsed Doppler Radar (Continued...) and Search Radar

Lecture 25 - Tracking Radar

Lecture 26 - Tracking Radar (Continued...)

Lecture 27 - Tracking Radar (Continued...)

Lecture 28 - Tracking Radar (Continued...)

Lecture 29 - Tracking Radar (Continued...)

Lecture 30 - Tracking Radar (Continued...)

Lecture 31 - Tracking Radar (Continued...)

Lecture 32 - Tutorial Problems on Search and Tracking Radar

Lecture 33 - Detection in Radar Receiver

Lecture 34 - Detection in Radar Receiver (Continued...)

Lecture 35 - Detection in Radar Receiver (Continued...)

Lecture 36 - Detection in Radar Receiver (Continued...)

Lecture 37 - Detection in Radar Receiver (Continued...)

Lecture 38 - Detection in Radar Receiver (Continued...)

Lecture 39 - Detection in Radar Receiver (Continued...)

Lecture 40 - Detection in Radar Receiver (Continued...)

Lecture 41 - Detection in Radar Receiver (Continued...)

Lecture 42 - Detection in Radar Receiver (Continued...)

Lecture 43 - Detection in Radar Receiver (Continued...)

Lecture 44 - Detection in Radar Receiver (Continued...)

Lecture 45 - Detection in Radar Receiver (Continued...)

Lecture 46 - Detection in Radar Receiver (Continued...)

Lecture 47 - Tutorial Problems on Detection in Radar Receiver

Lecture 48 - SAR Processing

Lecture 49 - SAR Processing (Continued...)

Lecture 50 - SAR Processing (Continued...)

Lecture 51 - SAR Processor

Lecture 52 - Tutorial

Lecture 53 - Statistical Detection Theory: Introduction

Lecture 54 - Statistical Detection Theory (Continued...)

Lecture 55 - Statistical Detection Theory (Continued...)

Lecture 56 - Statistical Detection Theory (Continued...)

Lecture 57 - Statistical Detection Theory (Continued...)

Lecture 58 - Tutorial

Lecture 59 - Ground Penetrating Radar

Lecture 60 - GPR Measurements and Microwave Tomography

NPTEL : NOC:Electrical Machines-I (Electrical Engineering)

Co-ordinators : Prof.Tapas Kumar Bhattacharya

Lecture 1 - Magnetic Circuit and Transformer

Lecture 2 - Magnetising Current from B-H Curve

Lecture 3 - Ideal Transformer, Dot Convention and Phasor Diagram

Lecture 4 - Operation of Ideal Operation with Load Connected

Lecture 5 - Equivalent Circuit of Ideal Transformer

Lecture 6 - Rating of Single Phase Transformer: Rated Current and Rated Voltage with Example

Lecture 7 - Transformer with Multiple Coils

Lecture 8 - Modelling of Practical Transformer - I

Lecture 9 - Modelling of Practical Transformer - II

Lecture 10 - Modelling of Practical Transformer - III

Lecture 11 - Core Loss - Eddy Current Loss

Lecture 12 - Factors on Eddy Current Loss Depends

Lecture 13 - Hysteresis Loss

Lecture 14 - Exact Equivalent Circuit

Lecture 15 - Approximate Equivalent Circuit

Lecture 16 - Determination of Equivalent Circuit Parameters - No Load Test

Lecture 17 - Short Circuit Test

Lecture 18 - Choosing Sides to Carry Out O.C / S.C Test

Lecture 19 - Efficiency of Transformer - Losses

Lecture 20 - Efficiency (Continued...)

Lecture 21 - Condition for Maximum Efficiency When Load Power Factor Constant

Lecture 22 - Family of Efficiency Curve at Various Power Factor and Energy Efficiency

Lecture 23 - Load Description and Energy Efficiency

Lecture 24 - Regulation: its Expression

Lecture 25 - Regulation: its Expression (Continued...)

Lecture 26 - Auto Transformer - Introduction

Lecture 27 - AutoTransformer versus Two Winding Transformer

Lecture 28 - AutoTransformer versus Two Winding Transformer (Continued...)

Lecture 29 - Numerical Problems on Ideal Auto Transformer

Lecture 30 - Two Winding Transformer Connected as Auto Transformer

Lecture 31 - Practical Auto Transformer

Lecture 32 - Equivalent Circuit of an Auto Transformer

Lecture 33 - Polarity Test and Sumpner Test

Lecture 34 - 3 Phase Transformer Using 3 Single Phase Transformer

Lecture 35 - Various Connections of 3-Phase Transformer - I

Lecture 36 - Various Connections of 3-Phase Transformer - II

Lecture 37 - Vector Group of 3-Phase Transformer

Lecture 38 - Vector Group (Continued...)

Lecture 39 - Open Delta Connection

Lecture 40 - 3-Phase Cone Type and Shell Type Transformer

Lecture 41 - Zig Zag Connection

Lecture 42 - Effect 3rd Harmonic Exciting Current and Flux

Lecture 43 - Choosing Transformer Connection

Lecture 44 - Choosing Transformer Connection (Continued...)

Lecture 45 - Phase Conversion using Transformer: Scott Connection

Lecture 46 - Scott Connection (Continued...)

Lecture 47 - 3 Phase to 6 Phase Conversion O.C / S.C Test on 3 Phase Transformer

Lecture 48 - Parallel Operation of Transformers - I

Lecture 49 - Parallel Operation of Transformers - II

Lecture 50 - Parallel Operation of Transformers - III

Lecture 51 - Specific Magnetic and Electric Loadings

Lecture 52 - ooling of Transformer and Fillings of Transformer

Lecture 53 - Output Equation of 3- Phase Transformer

Lecture 54 - Introduction to D.C Machine

Lecture 55 - Single Conductor D.C Generator / Motor Operation

Lecture 56 - Homopolar D.C Generator

Lecture 57 - Homopolar D.C Motor

Lecture 58 - Introduction to Rotating D.C Machines

Lecture 59 - Armature Winding of D.C Machine - I

Lecture 60 - Armature Winding of D.C Machine - II

Lecture 61 - Armature Winding of D.C Machine - III

Lecture 62 - Generated Voltage Across the Armature

Lecture 63 - Electromagnetic Troque in D.C Machine

Lecture 64 - Generator and Motor Operation - Basics

Lecture 65 - O.C.C and Load Characteristic of Separately Excited Generators

Lecture 66 - Voltage Build Up in Shunt Generator

Lecture 67 - Load Characteristic of Shunt Generator

Lecture 68 - Qualitative Discussion on Armature Reaction

Lecture 69 - Ill Effects of Armature Reaction

Lecture 70 - Compensating and Interpoles

Lecture 71 - Armature Reaction (Continued...)

Lecture 72 - Field Flux Density, Armature Flux Density and Resultant Field Distribution

Lecture 73 - Field Patterns for Both Motor and Generators

Lecture 74 - Demagnetising and Cross Magnetising mmf for Brush Shifted Machine

Lecture 75 - Calculation of Compensating, Interpole and Series Field Turns

Lecture 76 - Estimating Armature and Field Resistance from its Rating

Lecture 77 - Power Flow Diagram, Rotational Loss

Lecture 78 - Shunt Motor: Basic Equation

Lecture 79 - Starting of D.C Motor - 3-Point Starter

Lecture 80 - Speed Control of Shunt Motor - I

Lecture 81 - Speed Control of Shunt Motor - II

Lecture 82 - Speed Control of Shunt Motor - III

Lecture 83 - Field Control (Continued...)

Lecture 84 - D.C Motor Braking

Lecture 85 - Introduction to Series Motor

Lecture 86 - Series Motor Characteristics

Lecture 87 - Series Motor Speed Control

Lecture 88 - Universal Motor

Lecture 89 - Swinburne Test

Lecture 90 - Hopkinson Test

Lecture 91 - Efficiency Calculation

Lecture 92 - Field Test on D.C Series Motor

Lecture 93 - Simplex Wave winding

Lecture 94 - Wave Winding (Continued...)

NPTEL : NOC:VLSI Signal Processing (Electrical Engineering)

Co-ordinators : Prof. Mrityunjay Chakraborty

Lecture 1 - Graphical Representation of Signals

Lecture 2 - Signal Flow Graph

Lecture 3 - Data Flow Graph, Critical Path

Lecture 4 - Dependence Graph, Basics of Retiming

Lecture 5 - Retiming Theorem

Lecture 6 - Forward Path and Loop Retiming

Lecture 7 - Loop Bound and Iteration Bound

Lecture 8 - Cutset Retiming

Lecture 9 - Retiming IIR Filters

Lecture 10 - Adaptive Filter Basics (LMS Algorithm)

Lecture 11 - Retiming LMS

Lecture 12 - Retiming Delayed LMS

Lecture 13 - Parallel Processing in DSP by Unfolding

Lecture 14 - Basic Unfolding Relation

Lecture 15 - Retiming for Unfolding

Lecture 16 - Loop Unfolding

Lecture 17 - Iteration bound for Loops

Lecture 18 - Bitserial, Digit serial and Word serial Structures

Lecture 19 - Unfolding a Switch

Lecture 20 - Unfolding Bit Serial Systems

Lecture 21 - Folding of DFG

Lecture 22 - Folding Examples - IIR Filter

Lecture 23 - Retiming for Folding

Lecture 24 - Introduction to Delay Optimization by Folding

Lecture 25 - Life Time Analysis of Storage Variables

Lecture 26 - Foward Backward Data Allocation

Lecture 27 - Life Time Analysis of Storage Variables in a Digital Filter

Lecture 28 - Delay Folded Realization of a Digital Filter

Lecture 29 - Polyphase Decomposition of Sequences

Lecture 30 - Hardware Efficient 2 - Parallel FIR Filters

Lecture 31 - Hardware Efficient 3 - Parallel FIR Filters

Lecture 32 - Introduction to First Level Architectures

Lecture 33 - 2's Complement Number Systems

Lecture 34 - Multiplication of Two Binary Numbers

Lecture 35 - Carry Ripple and Carry Save Array

Lecture 36 - Bit Serial Multipliers

Lecture 37 - Bit Serial Digital Filters

Lecture 38 - Baugh Wooley Multiplier

Lecture 39 - Distributed Arithmetic

NPTEL : NOC:Analog Electronic Circuits (Electrical Engineering)

Co-ordinators : Prof. Pradip Mandal

Lecture 1 - Introduction to the course

Lecture 2 - Introduction to the constituent topics of the course and the Layout

Lecture 3 - Revisit to pre-requisite topics

Lecture 4 - Revisit to pre-requisite topics (Continued...)

Lecture 5 - Analysis of Simple Non-Linear Circuit

Lecture 6 - Analysis of Simple Non-linear Circuit (Continued...)

Lecture 7 - Revisiting BJT Characteristic

Lecture 8 - Revisiting BJT Characteristics (Continued...)

Lecture 9 - Revisiting BJT Characteristics (Continued...)

Lecture 10 - Revisiting MOSFET

Lecture 11 - Revisiting MOSFET (Continued...)

Lecture 12 - Revisiting MOSFET (Continued...)

Lecture 13 - Revisiting MOSFET (Continued...)

Lecture 14 - Analysis of simple non-linear circuit containing a BJT

Lecture 15 - Analysis of simple non-linear circuit containing a BJT (Continued...)

Lecture 16 - Analysis of simple non-linear circuit containing a MOSFET

Lecture 17 - Analysis of simple non-linear circuit containing a MOSFET (Continued...)

Lecture 18 - Linearization of non-linear circuit containing BJT

Lecture 19 - Linearization of non-linear circuit containing BJT (Continued...)

Lecture 20 - Linearization of non-linear circuit containing MOSFET

Lecture 21 - Linearization of non-linear circuit containing MOSFET (Continued...)

Lecture 22 - Linear models of Amplifiers - Part A

Lecture 23 - Linear models of Amplifiers - Part B

Lecture 24 - Common Emitter Amplifier - Part A

Lecture 25 - Common Emitter Amplifier - Part B

Lecture 26 - Common Emitter Amplifier (Continued...) - Part A

Lecture 27 - Common Emitter Amplifier (Continued...) - Part B

Lecture 28 - Common Emitter Amplifier (Continued...) - Numerical examples - Part A

Lecture 29 - Common Emitter Amplifier (Continued...) - Numerical examples - Part B

Lecture 30 - Common Emitter Amplifier (Continued...) - Design guidelines - Part A

Lecture 31 - Common Emitter Amplifier (Continued...) - Design guidelines - Part B

Lecture 32 - Common Source Amplifier - Part A

Lecture 33 - Common Source Amplifier - Part B

Lecture 34 - Common Source Amplifier (Continued...) Numerical examples and design guidelines - Part B

Lecture 35 - Frequency Response of CE and CS Amplifiers - Part A

Lecture 36 - Frequency Response of CE and CS Amplifiers - Part B

Lecture 37 - Frequency Response of CE and CS Amplifiers - Part C

Lecture 38 - Frequency Response of CE and CS Amplifiers (Continued...) - Part A

Lecture 39 - Frequency Response of CE And CS Amplifiers (Continued...) - Part B

Lecture 40 - Frequency Response of CE/CS Amplifiers Considering High Frequency Models of BJT and MOSFET - Part A

Lecture 41 - Frequency Response of CE/CS Amplifiers Considering High Frequency Models of BJT and MOSFET - Part B

Lecture 42 - Frequency Response of CE/CS Amplifiers Considering High Frequency Models of BJT And MOSFET - Part C

Lecture 43 - Limitation of CE and CS Amplifiers in Cascading

Lecture 44 - Common Collector and Common Drain Amplifiers

Lecture 45 - Common Collector and Common Drain Amplifiers (Continued...): Analysis - Part A

Lecture 46 - Common Collector and Common Drain Amplifiers (Continued...): Analysis - Part B

Lecture 47 - Common Collector and Common Drain Amplifiers (Continued...): Numerical Examples - Part A

Lecture 48 - Common Collector and Common Drain Amplifiers (Continued...): Numerical Examples - Part B

Lecture 49 - Common Base and Common Gate Amplifiers : Analysis - Part A

Lecture 50 - Common Base and Common Gate Amplifiers : Analysis - Part B

Lecture 51 - Common Base and Common Gate Amplifiers (Continued...) : Numerical Examples - Part A

Lecture 52 - Common Base and Common Gate Amplifiers (Continued...) : Numerical Examples - Part B

Lecture 53 - Common Base and Common Gate Amplifiers (Continued...) : Numerical Examples - Part C

Lecture 54 - Common Base and Common Gate Amplifiers (Continued...) : Numerical Examples - Part D

Lecture 55 - Multi-Transistor Amplifiers: Operation and Analysis - Part A

Lecture 56 - Multi-Transistor Amplifiers: Operation and Analysis - Part B

Lecture 57 - Multi-Transistor Amplifiers: Operation and Analysis - Part C

Lecture 58 - Multi-Transistor Amplifiers (Continued...): Numerical Examples - Part A

Lecture 59 - Multi-Transistor Amplifiers (Continued...): Numerical Examples - Part B

Lecture 60 - Multi-Transistor Amplifiers (Continued...): Numerical Examples - Part C

Lecture 61 - Multi-Transistor Amplifiers: Cascode Amplifier - Part A

Lecture 62 - Multi-Transistor Amplifiers: Cascode Amplifier - Part B

Lecture 63 - Multi-Transistor Amplifiers: Cascode Amplifier (Continued...) - Numerical Examples - Part A

Lecture 64 - Multi-Transistor Amplifiers: Cascode Amplifier (Continued...) - Numerical Examples - Part B

Lecture 65 - Multi-Transistor Amplifiers: Cascode Amplifier (Continued...) - Numerical Examples - Part C

Lecture 66 - Multi-Transistor Amplifiers: Amplifier With Active Load - Part A

Lecture 67 - Multi-Transistor Amplifiers: Amplifier With Active Load - Part B

Lecture 68 - Multi-Transistor Amplifiers: Amplifier With Active Load (Continued...) - Numerical Examples - Part A

Lecture 69 - Multi-Transistor Amplifiers: Amplifier With Active Load (Continued...) - Numerical Examples - Part B

Lecture 70 - Single-ended Vs Differential Signaling and Basic Model of a Differential Amplifier

Lecture 71 - Single-ended Vs Differential Signaling and Basic Model of a Differential Amplifier (Continued...)

Lecture 72 - Single-ended Vs Differential Signaling and Basic Model of a Differential Amplifier (Continued...)

Lecture 73 - Single-ended Vs Differential Signaling and Basic Model of a Differential Amplifier (Continued...)

Lecture 74 - Single-ended Vs Differential Signaling and Basic Model of a Differential Amplifier (Continued...)

Lecture 75 - Differential Amplifier : Basic Structure and Principle of Operation

Lecture 76 - Differential Amplifier : Basic Structure and Principle of Operation (Continued...)

Lecture 77 - Differential Amplifier : Analysis and Numerical Examples

Lecture 78 - Differential Amplifier : Analysis and Numerical Examples (Continued...)

Lecture 79 - Differential Amplifier : Analysis and Numerical Examples (Continued...)

Lecture 80 - Differential Amplifier : Analysis and Numerical Examples (Continued...)

Lecture 81 - Current mirror circuits - Part A

Lecture 82 - Current mirror circuits - Part B

Lecture 83 - Usage of current mirror - Part A

Lecture 84 - Usage of current mirror - Part B

Lecture 85 - Usage of current mirror - Part C

Lecture 86 - Numerical examples on current mirror and its applications - Part A

Lecture 87 - Numerical examples on current mirror and its applications - Part B

Lecture 88 - Numerical examples on current mirror and its applications - Part C

Lecture 89 - Numerical examples on current mirror and its applications - Part D

Lecture 90 - Feedback system - Part A

Lecture 91 - Feedback system - Part B

Lecture 92 - Feedback system - Part C

Lecture 93 - Feedback system - Part D

Lecture 94 - Feedback system - Part E

Lecture 95 - Effect of feedback on frequency response - Part A

Lecture 96 - Effect of feedback on frequency response - Part B

Lecture 97 - Applications of feedback in amplifier circuits - Part A

Lecture 98 - Applications of feedback in amplifier circuits - Part B

Lecture 99 - Applications of feedback in amplifier circuits - Part C

NPTEL : NOC:Network Analysis (Electrical Engineering)

Co-ordinators : Prof. T.K. Bhattacharya

Lecture 1 - Introduction: KVL, KCL and Power Balance

Lecture 2 - Voltage and Current Sources

Lecture 3 - Simple Networks with Voltage and Current Sources

Lecture 4 - Mesh Analysis - I

Lecture 5 - Mesh Analysis - II

Lecture 6 - Nodal Analysis - I

Lecture 7 - Nodal Analysis - II

Lecture 8 - Nodal Analysis - III

Lecture 9 - Inductor - I

Lecture 10 - Initial Condition for Inductor

Lecture 11 - Energy Stored in Inductor with Example

Lecture 12 - R-L Series Circuit Analysis

Lecture 13 - Retrieving Energy or Discharging of Inductor Energy

Lecture 14 - Capacitor: Relationship of Voltage and Current and Initial Condition

Lecture 15 - Charging of a Capacitor - Voltage, Current and Energy During Charging

Lecture 16 - Discharge of a Charged Capacitor

Lecture 17 - Linearity of R,L,C - Inductor with Initial Current and Capacitor with Initial Voltage

Lecture 18 - General Method for Solving Linear Differential Equation - I

Lecture 19 - General Method for Solving Linear Differential Equation - II

Lecture 20 - General Method for Solving Linear Differential Equation - III

Lecture 21 - Problem Solving: Application

Lecture 22 - R-L Circuit with Sinusoidal Excitation

Lecture 23 - R-C Circuit with Sinusoidal Exponential

Lecture 24 - Solution Due to Exponential Forcing Function

Lecture 25 - Mesh and Nodal Analysis with Time Varying Source

Lecture 26 - Circuit Analysis with Phasor - I

Lecture 27 - Circuit Analysis with Phasor - II

Lecture 28 - Circuit Analysis with Phasor - III

Lecture 29 - Concept of Active and Reactive Power in A.C Circuit - I

Lecture 30 - Concept of Active and Reactive Power in A.C Circuit - II

Lecture 31 - Expression for Complex Power in A.C Circuit

Lecture 32 - Numerical Example

Lecture 33 - Mesh and Nodal Analysis in A.C Circuit, Introduction to Impulse Function

Lecture 34 - Odd and Even Functions, Relation between Unit Step and Impulse Function

Lecture 35 - Solution of Differential Equation with Impulse Excitation

Lecture 36 - Numerical Example when Excitation is Impulse

Lecture 37 - Self and Mutual Inductances - I

Lecture 38 - Dot Convention in Mutually Coupled Coils

Lecture 39 - Mutually Coupled Coils in Series and Parallel

Lecture 40 - Energy Stored in Mutually Coupled Coils

Lecture 41 - Steady State Response with Sinusoidal Excitation when the Coils are Mutually Coupled

Lecture 42 - Basics of Signals in Brief

Lecture 43 - Laplace Transform - I

Lecture 44 - Laplace Transform - II

Lecture 45 - Laplace Transform Applied to Circuit Analysis - I

Lecture 46 - Laplace Transform Applied to Circuit Analysis - II

Lecture 47 - Numerical Examples - I

Lecture 48 - Numerical Examples - II

Lecture 49 - General Second Order Circuit Analysis with L.T - I

Lecture 50 - General Second Order Circuit Analysis with L.T - II

Lecture 51 - Network Theorem - I

Lecture 52 - Network Theorem - II

Lecture 53 - Norton's Theorem

Lecture 54 - Thevenin Theorem

Lecture 55 - Star-Delta and Delta-Star Transformation

Lecture 56 - Telligen's Theorem

Lecture 57 - Reciprocity Theorem

Lecture 58 - Maximum Power Transfer Theorem

Lecture 59 - Graph Theory Applied to Network Analysis - I

Lecture 60 - Graph Theory Applied to Network Analysis - II

Lecture 61 - Graph Theory Applied to Network Analysis - III

Lecture 62 - Graph Theory Applied to Network Analysis - IV

Lecture 63 - Graph Theory Applied to Network Analysis - V

Lecture 64 - Mesh Analysis with Graph Theory

Lecture 65 - Nodal Analysis with Graph Theory

Lecture 66 - Cut-Set Analysis with Graph Theory

Lecture 67 - Numerical Examples of Network Analysis with Graph Theory

Lecture 68 - Circuit Analysis with Dependent Sources - I

Lecture 69 - Circuit Analysis with Dependent Sources - II

Lecture 70 - Circuit Analysis with Dependent Sources - III

Lecture 71 - Two Port Network - I

Lecture 72 - Two Port Network - II

Lecture 73 - Two Port Network - III

Lecture 74 - Two Port Network - IV

Lecture 75 - Two Port Network - V

Lecture 76 - Two Port Network - VI

Lecture 77 - Two Port Network - VII

Lecture 78 - Gyrator

Lecture 79 - Ideal Op - Amp

Lecture 80 - Examples of Ideal Op-Amp Circuits - I

Lecture 81 - Examples of Ideal Op-Amp Circuits - II

Lecture 82 - General Impedance Transfer Circuit and Concluding Remarks

NPTEL : NOC:Power System Protection (Electrical Engineering)

Co-ordinators : Prof. Ashok Kumar Pradhan

Lecture 1 - Faults in Power System

Lecture 2 - Elements and Features of Protection Scheme

Lecture 3 - Fault Analysis Review - Sequence Components

Lecture 4 - Fault Analysis Review - Sequence Components (Continued...)

Lecture 5 - Numerical Relaying Concept

Lecture 6 - Discrete Fourier Transform

Lecture 7 - Recursive and Half Cycle DFT and Cosine Filter

Lecture 8 - Least Square Technique

Lecture 9 - Frequency Response of Phasor Estimation techniques

Lecture 10 - In the Presence of Decaying DC

Lecture 11 - Overcurrent Relay Characteristics

Lecture 12 - Overcurrent Relay Coordination

Lecture 13 - Relay Coordination with Fuse

Lecture 14 - Introduction to Directional Relaying

Lecture 15 - Positive Sequence Directional Relay

Lecture 16 - Negative and Zero Sequence Directional Relay

Lecture 17 - Superimposed Component Based Directional Relaying

Lecture 18 - Introduction to Distance Relay

Lecture 19 - Fault Classification

Lecture 20 - Apparent Impedance Calculation

Lecture 21 - Distance Relay Implementation

Lecture 22 - Application to Double Circuit Line

Lecture 23 - Multi-terminal Lines

Lecture 24 - Protection of series compensated lines - Part I

Lecture 25 - Protection of series compensated lines - Part II

Lecture 26 - Effect of Fault Resistance

Lecture 27 - Load Encroachment

Lecture 28 - Power Swing

Lecture 29 - Power Swing Detection Techniques - Part I

Lecture 30 - Power Swing Detection Techniques - Part II

Lecture 31 - Adaptive Distance Relaying

Lecture 32 - Communication Assisted Relaying Scheme

Lecture 33 - Current Transformer - Part I

Lecture 34 - Current Transformer - Part II

Lecture 35 - Capacitor Voltage Transformer

Lecture 36 - Fiber Optic Sensors

Lecture 37 - Introduction to Transformer Protection

Lecture 38 - Differential Relay

Lecture 39 - Steps in Differential Relay Processing

Lecture 40 - Inrush Detection

Lecture 41 - CT Saturation, Negative Sequence Differential and Restricted Earth Fault Relay

Lecture 42 - Line Differential - Part I

Lecture 43 - Line Differential - Part II

Lecture 44 - Busbar Protection

Lecture 45 - Fault Characteristics of Renewable Sources

Lecture 46 - Protection Challenges of Distribution Systems with Renewables

Lecture 47 - Protection challenges of transmission systems with renewables

Lecture 48 - Traveling Wave Basics

Lecture 49 - Protection using Travelling Waves

Lecture 50 - Fault Location using Travelling Wave

Lecture 51 - Wide Area Measurement Basics

Lecture 52 - Wide Area Measurement for Protection

NPTEL : NOC:Signal Processing for mm Wave communication for 5G and beyond (Electrical Engineering)

Co-ordinators : Prof. Amit Kumar Dutta

Lecture 1 - Tx- Rx Structure

Lecture 2 - Rx -Structure

Lecture 3 - Fundamental of Ray-Tracing model

Lecture 4 - General channel model - Part I

Lecture 5 - General channel model - Part I (Continued...)

Lecture 6 - General channel model - Part I (Continued...)

Lecture 7 - General channel model - Part II

Lecture 8 - Wireless channel-A ray tracing model - Part II

Lecture 9 - Wireless channel-A ray tracing model - Part II (Continued...)

Lecture 10 - Wireless channel-A ray tracing model - Part II (Continued...)

Lecture 11 - Wireless channel-A ray tracing model - Part II (Continued...)

Lecture 12 - RMS Delay spread and Doppler Effect on channel

Lecture 13 - Time Varing Model

Lecture 14 - Doppler Impact on coherence BW

Lecture 15 - Introduction to time series

Lecture 16 - AR,ARMA,MA process

Lecture 17 - Doppler with AR process model

Lecture 18 - Coherence time and parameter summery

Lecture 19 - Basic ISI channel

Lecture 20 - Channel estimation and Equalizer

Lecture 21 - precoder and MIMO

Lecture 22 - precoder and MIMO (Continued...)

Lecture 23 - Basics of mmwave spectrum

Lecture 24 - Angle of arrival and angle of departure

Lecture 25 - 3D concepts, AoA,AoD

Lecture 26 - mmWave channel model with RX beaming

Lecture 27 - mmWave channel model with RX beaming (Continued...)

Lecture 28 - mmWave channel model with RX beaming (Continued...)

Lecture 29 - mmWave channel model with RX beaming (Continued...)

Lecture 30 - mmwave channel model (Continued...)

Lecture 31 - mmWave channel model (Continued...) -Tx side multiple antenna

Lecture 32 - Basics of Beamforming

Lecture 33 - Single Antenna beamforming

Lecture 34 - Concept of antenna many fold vector

Lecture 35 - 3D Concept of antenna many fold vector

Lecture 36 - Different Geometry of antennafrom electrical point of view

Lecture 37 - Basics of Beamforming pattern - Part I

Lecture 38 - Basics of Beamforming pattern - Part II

Lecture 39 - SISO Beamforming

Lecture 40 - MIMO Beamforming

Lecture 41 - Structural implementation of MIMO Beamforming

Lecture 42 - Different Level of Beamforming

Lecture 43 - MIMO Beamforming in Transmitter side

Lecture 44 - MIMO Beamforming in Receiver side - Part I

Lecture 45 - MIMO Beamforming in Receiver side - Part II

Lecture 46 - Mathematical description of MIMO Beamforming (Continued...)

Lecture 47 - Equalizer based detector

Lecture 48 - Parameter to be designed in MIMO Beamforming

Lecture 49 - OFDM Data Model

Lecture 50 - OFDM Data model (Continued...)

Lecture 51 - General OFDM

Lecture 52 - OFDM spectrum and CFO

Lecture 53 - MIMO OFDM structure

Lecture 54 - MIMO OFDM decode and beamforming

Lecture 55 - Design parameter estimation - Part 1

Lecture 56 - Design parameter estimation - Part 2

Lecture 57 - Design parameter estimation - Part 3

Lecture 58 - Design parameter estimation - Part 4

Lecture 59 - Design parameter estimation - Part 5

Lecture 60 - MU System

Lecture 61 - CFO and other impairment and their effects

Lecture 62 - Multi User Hybrid beam and impairment and analysis - Part 3

Lecture 63 - Multi User Hybrid beam and Impairment and analysis - Part 4

Lecture 64 - Multi User Hybrid beam and Impairment and analysis - Part 5

NPTEL : NOC:Control and Tuning Methods in Switched Mode Power Converters (Electrical Engineering)

Co-ordinators : Prof. Santanu Kapat

Lecture 1 - DC Power Conversion Systems - Introduction

Lecture 2 - Overview of voltage regulators

Lecture 3 - Switched mode power converter (SMPC)

Lecture 4 - Model Development for MATLAB Simulation

Lecture 5 - Demonstration of MATLAB Simulation

Lecture 6 - Demonstration of MATLAB Simulation (Continued...)

Lecture 7 - Power Stage Design of Basic SMPCs: Summary

Lecture 8 - Fixed Frequency Modulation Techniques

Lecture 9 - Variable Frequency Modulation Techniques

Lecture 10 - Modulation in Discontinuous Conduction Mode (DCM)

Lecture 11 - Synchronizing Simulation and Script files in MATLAB

Lecture 12 - Interactive MATLAB Simulation and Case Studies

Lecture 13 - Converterâ€™s Objectives and Control Implications

Lecture 14 - Feedforward Control in SMPC

Lecture 15 - Single and Multi Loop Feedback Control Methods

Lecture 16 - Feedback Control of Cascaded SMPCs

Lecture 17 - Combined feedback and feedforward control

Lecture 18 - State feedback control

Lecture 19 - Variable Frequency Control - Understanding Opportunities and Challenges

Lecture 20 - Constant On-time Control Methods

Lecture 21 - Constant Off-time Control Methods

Lecture 22 - Hysteresis Control Methods in SMPCs

Lecture 23 - Stability and Performance Comparison using MATLAB Simulation

Lecture 24 - Light Load Control Methods and Interactive MATLAB Simulation

Lecture 25 - Overview of Modeling Techniques

Lecture 26 - State space averaging and model validation

Lecture 27 - Circuit Averaging Techniques and Equivalent Circuit

Lecture 28 - DC Analysis using Equivalent Circuit Model

Lecture 29 - Derivation of Small-Signal Transfer Functions

Lecture 30 - Small-Signal Model Validation using MATLAB and Time Domain Correlation

Lecture 31 - Small-signal Modeling with Closed Current Loop

Lecture 32 - Impedance Analysis and Stability

Lecture 33 - Loop Gain Analysis and Understanding Model Limits using MATLAB

Lecture 34 - PID Control Design and Tuning under VMC with MATLAB Case Studies

Lecture 35 - Shaping Output Impedance of a Buck Converter under VMC

Lecture 36 - Design of VMC Boost Converter and MATLAB Design Case Studies

Lecture 37 - Accurate Small-signal Modelling under CMC and Verification using MATLAB

Lecture 38 - Design CMC in a Buck Converter and MATLAB based Model Validation

Lecture 39 - Design of CMC Boost Converter - Output and State Feedback Approaches

Lecture 40 - Loop Interactions in CMC and Design of Average CMC

Lecture 41 - Dynamics of SMPCs and Overview of Model-based Nonlinear Control

Lecture 42 - Dynamics of LTIs and Vector Field with MATLAB Demonstration

Lecture 43 - Geometric Perspectives of Eigenvalues and Eigenvectors in SMPCs

Lecture 44 - Small-signal and Large-signal Model based Nonlinear Control

Lecture 45 - Introduction to Sliding Mode Control in SMPCs

Lecture 46 - Sliding Mode Control Design in a Buck Converter

Lecture 47 - Boundary Control Techniques and Selection of Switching Surfaces

Lecture 48 - Time Optimal Control and Identifying Physical Limits in SMPCs

Lecture 49 - Linking Switching Boundary and PID Controller Structure in SMPCs

Lecture 50 - Large-Signal Controller Tuning in Buck Converter: Objectives and Derivations

Lecture 51 - Large-Signal Controller Tuning in Boost and Buck-Boost Converters

Lecture 52 - Large-Signal Controller Tuning in Fixed- and Variable-Frequency Control

Lecture 53 - Critical Performance Limits in Dynamic Voltage Scaling and Possible Solutions

Lecture 54 - Nonlinear Control vs. Large-Signal Tuning: Comparative Study using MATLAB

Lecture 55 - Small-Signal vs. Large-Signal Tuning: Comparison using MATLAB Simulation

Lecture 56 - Performance Improvement and Size Reduction using Large-Signal based Control

Lecture 57 - Digital Control in High Frequency SMPCs - Introduction and Motivations

Lecture 58 - Overview of Fixed and Variable Frequency Digital Control Architectures

Lecture 59 - Challenges and Opportunities in Digitally Controlled High Frequency SMPCs

Lecture 60 - Course Summary, Key Takeaways, Few Emerging Applications and Future Scopes

NPTEL : NOC:Advanced Microwave Guided-Structures and Analysis (Electrical Engineering)

Co-ordinators : Prof. Bratin Ghosh

Lecture 1 - Scattering Matrix Concepts

Lecture 2 - Scattering Matrix Concepts (Continued...)

Lecture 3 - Scattering Matrix Concepts (Continued...)

Lecture 4 - Scattering Matrix Concepts (Continued...)

Lecture 5 - Scattering Matrix Concepts Tutorials

Lecture 6 - Scattering Matrix Concepts Tutorials (Continued...)

Lecture 7 - Scattering Matrix Concepts Tutorials (Continued...)

Lecture 8 - Instantaneous form of Maxwellâ€™s equations

Lecture 9 - Instantaneous form of Maxwellâ€™s equations (Continued....)

Lecture 10 - Instantaneous form of Maxwellâ€™s equations (Continued...)

Lecture 11 - Instantaneous form of Maxwellâ€™s equations (Continued...)

Lecture 12 - Instantaneous form of Maxwellâ€™s equations (Continued...)

Lecture 13 - Instantaneous form of Maxwellâ€™s equations Tutorials

Lecture 14 - Instantaneous form of Maxwellâ€™s equations Tutorials (Continued...)

Lecture 15 - Harmonic form of Maxwellâ€™s equations

Lecture 16 - Harmonic form of Maxwellâ€™s equations (Continued...)

Lecture 17 - Harmonic form of Maxwellâ€™s equations (Continued...)

Lecture 18 - Harmonic form of Maxwellâ€™s equations Tutorials

Lecture 19 - Wave Equation and Solution

Lecture 20 - Relation between wavenumbers

Lecture 21 - Radiation from an electric current source (Continued...)

Lecture 22 - Radiation from an electric current source (Continued...)

Lecture 23 - Radiation from an electric current source (Continued...)

Lecture 24 - Wave Equation and Solution Tutorials

Lecture 25 - Radiation from an electric current source Tutorials

Lecture 26 - Radiation from a magnetic current source

Lecture 27 - Radiation from a magnetic current source (Continued...)

Lecture 28 - Radiation from a magnetic current source (Continued...)

Lecture 29 - Application of the magnetic current source (Continued...)

Lecture 30 - Radiation from a magnetic current source Tutorials

Lecture 31 - Radiation from a magnetic current source Tutorials (Continued....)

Lecture 32 - Rectangular waveguide - I

Lecture 33 - Rectangular waveguide - I Tutorials

Lecture 34 - Rectangular waveguide - II

Lecture 35 - Rectangular waveguide - II (Continued...)

Lecture 36 - Rectangular waveguide - II Tutorials

Lecture 37 - Rectangular waveguide - II Tutorials (Continued...)

Lecture 38 - Rectangular cavity resonator

Lecture 39 - Rectangular cavity resonator Tutorials

Lecture 40 - Rectangular cavity resonator Tutorials (Continued...)

Lecture 41 - The Reciprocity Theorem, Computation of Amplitudes of Forward and Backward (Continued...)

Lecture 42 - The Reciprocity Theorem, Computation of Amplitudes of Forward and Backward (Continued...)

Lecture 43 - The Reciprocity Theorem, Computation of Amplitudes Tutorials

Lecture 44 - The Reciprocity Theorem, Computation of Amplitudes Tutorials (Continued...)

Lecture 45 - Analysis of Guided Structures

Lecture 46 - Analysis of Guided Structures (Continued...)

Lecture 47 - Analysis of Guided Structures (Continued...)

Lecture 48 - Analysis of Guided Structures (Continued...)

Lecture 49 - Analysis of Guided Structures (Continued...)

Lecture 50 - Analysis of Guided Structures (Continued...)

Lecture 51 - Analysis of Guided Structures (Continued...)

Lecture 52 - Analysis of Guided Structures (Continued...)

Lecture 53 - Analysis of Guided Structures (Continued...)

Lecture 54 - Analysis of Guided Structures (Continued...)

Lecture 55 - Analysis of Guided Structures (Continued...)

Lecture 56 - Analysis of Guided Structures (Continued...)

Lecture 57 - Analysis of Guided Structures Tutorials

Lecture 58 - Analysis of Guided Structures Tutorials (Continued...)

Lecture 59 - Cylindrical Wave Functions

Lecture 60 - Cylindrical Wave Functions (Continued...)

Lecture 61 - Cylindrical Wave Functions (Continued...)

Lecture 62 - Circular Waveguide

Lecture 63 - Circular Cavity

Lecture 64 - Cylindrical Wave Functions Tutorials

Lecture 65 - Cylindrical Wave Functions Tutorials (Continued...)

Lecture 66 - Application to the Coupling Problem : Aperture-Coupled, Probe-Coupled and Waveguide

Lecture 67 - Application to the Coupling Problem : Aperture-Coupled, Probe-Coupled and Waveguide (Continued...)

Lecture 68 - Application to the Coupling Problem : Aperture-Coupled, Probe-Coupled and Waveguide (Continued...)

Lecture 69 - Application to the Coupling Problem : Aperture-Coupled, Probe-Coupled and Waveguide (Continued...)

NPTEL : NOC:Cognition and its Computation (Electrical Engineering)

Co-ordinators : Prof. Rajlakshmi Guha, Prof. Sharba Bandyopadhyay

Lecture 1 - Introduction

Lecture 2 - Historical Origin of Cognition Studies

Lecture 3 - The Cognitive Revolution

Lecture 4 - Anatomical Structures of the Brain

Lecture 5 - Frontal Lobes and Cognition

Lecture 6 - Neuropsychological Testing

Lecture 7 - Eye Tracking and Cognition

Lecture 8 - EEG, fMRI, MEG

Lecture 9 - Single neuron level measurements

Lecture 10 - Single Neuron Imaging and Manipulation of Neural Activity

Lecture 11 - Introduction to Computation

Lecture 12 - Currency of Computation in Neurobiology - Action Potential

Lecture 13 - Synapse and Synaptic Transmission

Lecture 14 - Synaptic Plasticity

Lecture 15 - Short Term Plasticity and STDP

Lecture 16 - Coding by neurons

Lecture 17 - Sensory Circuits: Visual - I

Lecture 18 - Sensory Circuits: Visual - II

Lecture 19 - Sensory Circuits: Auditory - I

Lecture 20 - Sensory Circuits: Auditory - II

Lecture 21 - Sensory Circuits: Somatosensory

Lecture 22 - Sensory Circuits: Olfactory and Gustatory

Lecture 23 - Motor circuits - Sensory-motor

Lecture 24 - Reward Circuits

Lecture 25 - Executive Circuits

Lecture 26 - Types of Attention, Theories Broadbent Triessman

Lecture 27 - Alerting Orientation and Executive Network

Lecture 28 - Disorders of Attention

Lecture 29 - Basics of Perception - Object, Depth and Movement

Lecture 30 - Constancy and Illusions

Lecture 31 - Neurobiology of attention, Working Memory

Lecture 32 - Cholinergic System, Bottom up and Top down

Lecture 33 - Object Recognition

Lecture 34 - Visual Search and Pattern Recognition

Lecture 35 - Auditory Scene Analysis, McGurk Effect

Lecture 36 - Learning Processes

Lecture 37 - Learning Processes (Continued...)

Lecture 38 - Memory

Lecture 39 - Learning Disorders

Lecture 40 - Memory Failure - Forgetting

Lecture 41 - Learning in biological neural networks

Lecture 42 - Examples

Lecture 43 - Different types of Plasticity

Lecture 44 - Developmental Plasticity/Learning/Critical Period

Lecture 45 - Examples of Disorders in Plasticity

Lecture 46 - Introduction to speech and language (Development)

Lecture 47 - Components of Speech, Speech Production

Lecture 48 - Speech Perception

Lecture 49 - Lessons from Animal Communication

Lecture 50 - Language and Thought - Speech Language Disorders

Lecture 51 - Theories of Emotion

Lecture 52 - Neurophysiology of emotions - Limbic System

Lecture 53 - Problem Solving

Lecture 54 - Decision Making

Lecture 55 - Frontal cortex in decision making

Lecture 56 - Topics in current research - I

Lecture 57 - Topics in current research - II

Lecture 58 - Topics in current research - III

Lecture 59 - Topics in current research - IV

Lecture 60 - Topics in current research - V

NPTEL : NOC:Digital Control in Switched Mode Power Converters and FPGA-based Prototyping (Electrical Engineering)

Co-ordinators : Prof. Santanu Kapat

Lecture 1 - Digital Control in Switched Mode Power Converters - Course Introduction

Lecture 2 - Digital Control of SMPCs - Course Instructions, Guidelines and Resources

Lecture 3 - Examples of Some Commercial Digital Control Solutions

Lecture 4 - Overview of Digital Control Implementation Platforms

Lecture 5 - Introducing Basic Digitization in Power Electronic Converters

Lecture 6 - Recap of Feedback and Feedforward Control Methods in SMPCs

Lecture 7 - Recap of Fixed and Variable Frequency Modulation Techniques

Lecture 8 - Levels of Digitization in Single-loop Feedback Control in SMPCs

Lecture 9 - Levels of Digitization in Multi-loop Feedback Control in SMPCs

Lecture 10 - SMPC Topologies and Power Stage Design for Hardware Demonstrations

Lecture 11 - Basics of Sampling under Fixed and Variable Frequency Modulation

Lecture 12 - Voltage Mode Digital Pulse Width Modulators and Sampling Methods

Lecture 13 - Overview of Digital Pulse Width Modulator Architectures

Lecture 14 - Sampling Methods under Fixed Frequency Current Mode Control

Lecture 15 - Overview of Fixed Frequency Current Mode Control Architectures

Lecture 16 - Sampling Methods under Constant On/Off - Time Digital Modulation

Lecture 17 - Constant On/Off- Time Mixed-Signal Current Mode Control Architectures

Lecture 18 - Sampling Methods under Digital Hysteresis Control Methods

Lecture 19 - Overview of Digital Hysteresis Control Architectures

Lecture 20 - Summary of Digital Current Mode Control Architectures

Lecture 21 - Recap of Voltage and Current Mode Control Implementation using MATLAB

Lecture 22 - MATLAB Model Development for Basic Digital Control Blocks

Lecture 23 - MATLAB Model Development for Fixed Frequency Digital Control

Lecture 24 - MATLAB Models for Digital Controllers using Difference Equations

Lecture 25 - MATLAB Model Development for Digital Voltage Mode Control

Lecture 26 - MATLAB Model Development for Mixed-Signal Current Mode Control

Lecture 27 - MATLAB Model Development for Fully Digital Current Mode Control

Lecture 28 - MATLAB Model Development for Constant-On Time Control

Lecture 29 - MATLAB Model Development for Constant-Off Time Control

Lecture 30 - MATLAB Model Development for Digital Current Hysteresis Control

Lecture 31 - Continuous-Time Small-Signal Modeling under Digital Control

Lecture 32 - Discrete Time Modeling with Closed Current Loop

Lecture 33 - State-Space Modeling and Steps For Deriving Discrete-Time Models

Lecture 34 - Derivation of Discrete-Time Large-Signal Models

Lecture 35 - Validation of Discrete-Time Large-Signal Models using MATLAB - Part I

Lecture 36 - Validation of Discrete-Time Large-Signal Models using MATLAB - Part II

Lecture 37 - Derivation of Discrete-Time Small-Signal Models - I

Lecture 38 - Derivation of Discrete-Time Small-Signal Models - II

Lecture 39 - Discrete-Time Transfer Functions and Closed Loop Block Diagrams

Lecture 40 - Model Accuracy with MATLAB Case Studies - Comparative Study

Lecture 41 - Continuous-Time to Discrete-Time Conversion Methods - A Summary

Lecture 42 - Recap of Frequency Domain Design of Analog VMC and CMC

Lecture 43 - Design under Digital Voltage Mode Control - Frequency Domain Approaches

Lecture 44 - Design under Digital Current Mode Control - Frequency Domain Approaches

Lecture 45 - Design Case Study and MATLAB Simulation of Digital Voltage Mode Control

Lecture 46 - Design Case Study and MATLAB Simulation of Digital Current Mode Control

Lecture 47 - Time Optimal Control of a Buck Converter and Identifying Performance Limits

Lecture 48 - Trajectory based CMC Design for Proximate Time Optimal Recovery

Lecture 49 - Trajectory based Digital CMC Tuning and MATLAB Case Studies

Lecture 50 - Digital Pulse Skipping Control and MATLAB Simulation Case Studies

Lecture 51 - Selection of ADC and DAC in Digitally Controlled SMPCs

Lecture 52 - High Frequency Current Sensing Techniques in Digitally Controlled SMPCs

Lecture 53 - Current Sensing Techniques in Digitally Controlled High Power Converters

Lecture 54 - Signal Conditioning Circuits and PCB Design for Mixed-Signal Implementation

Lecture 55 - Reference Power Stage Design and Schematic for Buck and Boost Converters - I

Lecture 56 - Reference Power Stage Design and Schematic for Buck and Boost Converters - II

Lecture 57 - Step-by-Step Guidelines for Digital Control Implementation using FPGA

Lecture 58 - Test and Measurement of a Buck Converter using Digital Storage Oscilloscope

Lecture 59 - Functionalities in Mixed Signal Oscilloscope for Validating Digital Control

Lecture 60 - Power Spectrum Analysis of SMPCs using Mixed-Signal Oscilloscope

Lecture 61 - Introduction to Verilog Hardware Description Language (HDL)

Lecture 62 - Guidelines for Verilog HDL Programming - Some Key Rules

Lecture 63 - Structural and Dataflow Modeling in Verilog HDL for Combinational Logics

Lecture 64 - Behavioral Modeling in Verilog HDL for Sequential Digital Circuits

Lecture 65 - Simulation of Verilog-HDL based Design using Xilinx Webpack - I

Lecture 66 - Simulation of Verilog-HDL based Design using Xilinx Webpack - II

Lecture 67 - Fixed Point Implementation in Embedded Control System

Lecture 68 - Fixed Point Arithmetic and Concept of Q Format

Lecture 69 - Counter-based DPWM with Deadtime and Verilog HDL Programming

Lecture 70 - Simulating Counter-based DPWM with Deadtime using Xilinx ISE Simulator

Lecture 71 - Top Down Design Methodology in Digital Voltage Mode Control - I

Lecture 72 - Top Down Design Methodology in Digital Voltage Mode Control - II

Lecture 73 - Digital PID Control Implementation using Verilog HDL Programming

Lecture 74 - Digital PID Controller - Hardware Implementation and Experimental Results

Lecture 75 - Top Down Design Methodology in Mixed-Signal Current Mode Control

Lecture 76 - Top Down Design Method and Verilog HDL Programming of Mixed-Signal CMC

Lecture 77 - Verilog HDL based Digital PI Control Implementation of Mixed-Signal CMC

Lecture 78 - Hardware Implementation of Mixed-Signal CMC and Experimental Results

Lecture 79 - Voltage based Digital Pulse Skip Modulation and Top Down Design Method

Lecture 80 - Implementing Digital Pulse Skip Modulation and Experimental Results

Lecture 81 - STM32 Overview and STM32G4x ecosystem

Lecture 82 - Getting started with STM32CubeMX - Part I

Lecture 83 - Getting started with STM32CubeMX - Part II

Lecture 84 - Practical implementation of LLC converters - Part I

Lecture 85 - Practical implementation of LLC converters - Part II

Lecture 86 - Texas Instruments C2000 Real-time Microcontroller Devices

Lecture 87 - Getting Started with C2000 - Software and Hardware Development

Lecture 88 - Texas Instruments C2000 key peripheral differentiations

Lecture 89 - Texas Instruments TIDM-02008 Reference Design Overview

Lecture 90 - Texas Instruments TIDM-02008 Reference Design Software Overview

Lecture 91 - Steps for FPGA Implementation of Digital Voltage Mode Control

Lecture 92 - Steps for FPGA Implementation of Mixed-Signal Current Mode Control

Lecture 93 - Instability in Digital CMC and Ramp Compensation with Experimental Results

Lecture 94 - Benefits of Constant Off-Time and On-Time Digital CMC Techniques

Lecture 95 - Top Down Design Methodology of Constant On/Off-Time Control

Lecture 96 - Verilog HDL Implementation of Voltage based Constant On-Time Control

Lecture 97 - FPGA Implementation of Constant On/Off-Time Mixed-Signal CMC

Lecture 98 - Stability Comparison of Fixed and Variable Freq. Digital CMC with Experimental Results

Lecture 99 - Assessment of Digital Control Techniques for Light Load DC-DC Converters

Lecture 100 - Adaptive On-Time Digital Control in DCM with Verilog HDL Implementation

Lecture 101 - MATLAB Simulation of a Practical Digital VMC Buck Converter in CCM

Lecture 102 - Data Acquisition and Steps for Validating Simulation and Experimental Results

Lecture 103 - Loop Shaping and Design of Digital Voltage Mode Control in a Buck Converter

Lecture 104 - Digital VMC Design for Shaping Output Impedance in a Buck Converter

Lecture 105 - Hardware Case Studies and Transient Performance in Digital VMC Buck Converter

Lecture 106 - Design and Simulation Case Studies in a Mixed-Signal CMC Buck Converter

Lecture 107 - Hardware Case Studies and Transient Performance in a Digital CMC Buck Converter

Lecture 108 - Analysis of Output Impedance in Digital CMC with Load Current Feedforward

Lecture 109 - Load Current Feedforward in Digital CMC Buck Converter: Experimental Results

Lecture 110 - Need for Multi-Mode Digital Control and Design Requirements in SMPCs

Lecture 111 - Implementing Bi-frequency Spread Spectrum in Digital VMC using Verilog HDL

Lecture 112 - Performance of Bi-frequency Spread Spectrum DPWM and Experimental Results

Lecture 113 - Top Down Design Methodology of PWM/PSM Multi-Mode Digital Control

Lecture 114 - Verilog HDL based FPGA Prototyping of PWM/PSM Multi-Mode Digital Control

Lecture 115 - FPGA Prototyping of Peak Current based PWM/PFM Multi-Mode Digital Control - I

Lecture 116 - FPGA Prototyping of Peak Current based PWM/PFM Multi-Mode Digital Control - II

Lecture 117 - Industry-Driven Architectures for Digital Control IC in High Frequency SMPC

Lecture 118 - Industry-Driven Architectures for Digital Control System Solutions in SMPCs

Lecture 119 - Exploration of Architectures, Modeling, Design, and Control - Course Summary

Lecture 120 - Key Takeaways and Course Usefulness for Skilled Manpower Development

NPTEL : NOC:VLSI Interconnects (Electrical Engineering)

Co-ordinators : Prof. Sarang Pendharker

Lecture 1 - Introduction to VLSI interconnects

Lecture 2 - The distributed RC interconnect model

Lecture 3 - The Elmore delay

Lecture 4 - Elmore delay in interconnects

Lecture 5 - Elmore delay in branched RC interconnects

Lecture 6 - Equivalent circuit for RC interconnects

Lecture 7 - Scaling effects in interconnects

Lecture 8 - Delay mitigation in RC interconnects

Lecture 9 - RC interconnect simulation

Lecture 10 - Inductive effects in interconnects

Lecture 11 - Distributed RLC interconnect model

Lecture 12 - Transmission line equations

Lecture 13 - When to consider the inductive effects?

Lecture 14 - The transfer function of an RLC interconnect

Lecture 15 - Time domain response of a lumped RLC circuit

Lecture 16 - Equivalent Elmore model for RLC interconnects

Lecture 17 - Two-pole model of RLC interconnects from ABCD parameters

Lecture 18 - RLC interconnect simulation

Lecture 19 - Origin of the skin effect

Lecture 20 - Effective resistance at high frequencies

Lecture 21 - Equivalent circuit to simulate skin effect

Lecture 22 - Power dissipation due to interconnects

Lecture 23 - Optimum interconnect width for minimizing total power dissipation

Lecture 24 - Heating effects and thermal modeling

Lecture 25 - Compact thermal modeling with equivalent electrical circuits

Lecture 26 - Electromigration in interconnects

Lecture 27 - Mitigation of electromigration

Lecture 28 - Capacitive coupling in interconnects

Lecture 29 - Cross-talk and timing jitters in two identical interconnects

Lecture 30 - Coupling effects and mitigation techniques

Lecture 31 - Matrix formulation of coupled interconnects

Lecture 32 - Coupled RLC interconnects

Lecture 33 - Decoupling of interconnects by diagonalization of matrix

Lecture 34 - Analysis of coupled interconnects: Examples - 1

Lecture 35 - Analysis of coupled interconnects: Examples - 2

Lecture 36 - Simulation of RC coupled interconnects

Lecture 37 - Extraction of capacitance - Part 1

Lecture 38 - Extraction of capacitance - Part 2

Lecture 39 - Extraction of inductance - Part 1

Lecture 40 - Extraction of inductance - Part 2

Lecture 41 - Estimation of interconnect parameters from S-parameters

NPTEL : NOC:Semiconductor Device Modeling and Simulation (Electrical Engineering)

Co-ordinators : Prof. Vivek Dixit

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Crystal Concept

Lecture 4 - Crystal Concept

Lecture 5 - Crystal Concept

Lecture 6 - Reciprocal Space

Lecture 7 - Problem Session - 1

Lecture 8 - Doping In Semiconductors

Lecture 9 - Bandstructure

Lecture 10 - Effective Mass

Lecture 11 - Density of States

Lecture 12 - Mobility

Lecture 13 - Problem Session - 2

Lecture 14 - Semiconductor statistics

Lecture 15 - Semiconductor statistics (Continued...)

Lecture 16 - P-N Junction

Lecture 17 - P-N Junction (Continued...)

Lecture 18 - P-N Junction (Continued...)

Lecture 19 - Problem Session - 3

Lecture 20 - BJT

Lecture 21 - Bipolar Junction Transistor

Lecture 22 - Bipolar Junction Transistor (Continued...)

Lecture 23 - Bipolar Junction Transistor (Continued...)

Lecture 24 - Problem Session - 4

Lecture 25 - Metal- Semiconductor Interface

Lecture 26 - Schottky junction

Lecture 27 - Field Effect Transistor

Lecture 28 - MOS Capacitor

Lecture 29 - MOS-CV

Lecture 30 - REAL MOS (Continued...)

Lecture 31 - MOSFET

Lecture 32 - MOSFET (Continued...)

Lecture 33 - Problem Session - 5

Lecture 34 - Semiclassical Transport

Lecture 35 - Semiclassical Transport (Continued...)

Lecture 36 - Semiclassical Transport (Continued...)

Lecture 37 - Semiclassical Transport (Continued...)

Lecture 38 - Semiclassical Transport (Continued...)

Lecture 39 - Problem Session - 6

Lecture 40 - Drift-diffusion model

Lecture 41 - Drift-diffusion model (Continued...)

Lecture 42 - Drift-diffusion model (Continued...)

Lecture 43 - Drift-diffusion model (Continued...)

Lecture 44 - Generation-Recombination

Lecture 45 - Generation-Recombination (Continued...)

Lecture 46 - Solving DD Equations (Continued...)

Lecture 47 - Solving DD Equations (Continued...)

Lecture 48 - Problem Session - 7

Lecture 49 - Hydrodynamic Model

Lecture 50 - Hydrodynamic Model (Continued...)

Lecture 51 - Hydrodynamic Model (Continued...)

Lecture 52 - Monte Carlo simuations

Lecture 53 - Problem Session - 8

Lecture 54 - Quantum Mechanics

Lecture 55 - Solving Schrodinger Equation

Lecture 56 - Quantum Correction Models

Lecture 57 - Quantum Transport

Lecture 58 - Transfer Matrix Approach

Lecture 59 - TCAD Tools

Lecture 60 - ATLAS SILVACO

Lecture 61 - Simulating Junctions

Lecture 62 - Models and Simulation Concepts

Lecture 63 - Mixed-mode Simulation

NPTEL : NOC:RF and Microwave Networks (Electrical Engineering)

Co-ordinators : Prof. Bratin Ghosh

Lecture 1 - The network concept

Lecture 2 - One-port network

Lecture 3 - One-port network, Two-port network

Lecture 4 - Two-port network, Signal flow graph

Lecture 5 - Tutorial - 1

Lecture 6 - General analysis of cylindrical waveguides

Lecture 7 - TE to z mode analysis of cylindrical waveguides

Lecture 8 - TE to z mode analysis of cylindrical waveguides (Continued...), TM to z mode analysis

Lecture 9 - Normalization of mode vectors, Characteristics of eigen values and eigen functions

Lecture 10 - Wave impedance for TE and TM to z modes, Transmission line analogy for mode voltage

Lecture 11 - Transmission line equivalence for TE and TM modes, Power calculation using

Lecture 12 - Tutorial - 2

Lecture 13 - Modal expansion in cylindrical waveguides, Concept of mode orthogonality

Lecture 14 - Concept of mode orthogonality (continued), Determination of arbitrary mode

Lecture 15 - Power orthogonality in cylindrical waveguides

Lecture 16 - Tutorial - 3

Lecture 17 - Modal expansion of fields in rectangular waveguides

Lecture 18 - Modal expansion of fields in rectangular waveguides (Continued), Capacitive rectangular

Lecture 19 - Capacitive rectangular waveguide junction (Continued...)

Lecture 20 - Inductive rectangular waveguide junction (Continued...)

Lecture 21 - Inductive rectangular waveguide junction (Continued...), Construction of solutions

Lecture 22 - Cylindrical waveguide junctions (Continued...)

Lecture 23 - Cylindrical waveguide junctions (Continued...)

Lecture 24 - Cylindrical waveguide junctions (Continued...), Example of capacitive rectangular

Lecture 25 - Cylindrical waveguide junctions (Continued...), Example of capacitive rectangular

Lecture 26 - Example of inductive waveguide junction (Continued...), Alternative equivalent circuit

Lecture 27 - Tutorial - 4

Lecture 28 - Obstacles in waveguides

Lecture 29 - Obstacles in waveguides (Continued...)

Lecture 30 - Obstacles in waveguides (Continued...)

Lecture 31 - Small obstacles in waveguides

Lecture 32 - Small obstacles in waveguides (Continued...)

Lecture 33 - Small obstacles in waveguides, Reciprocity

Lecture 34 - Reciprocity

Lecture 35 - Reciprocity (Continued...)

Lecture 36 - Tutorial - 5

Lecture 37 - Posts in rectangular waveguide

Lecture 38 - Posts in rectangular waveguide (Continued...)

Lecture 39 - Posts in rectangular waveguide (Continued...)

Lecture 40 - Posts in rectangular waveguide (Continued...)

Lecture 41 - Diaphragms in waveguide

Lecture 42 - Diaphragms in waveguide (Continued...)

Lecture 43 - Diaphragms in waveguide (Continued...)

Lecture 44 - Diaphragms in waveguide (Continued...)

Lecture 45 - Tutorial - 6

Lecture 46 - Currents in Waveguides

Lecture 47 - Currents in Waveguides (Continued...)

Lecture 48 - Coaxial to waveguide junction with matched termination

Lecture 49 - Coaxial to waveguide feeds with arbitrary termination

Lecture 50 - Coaxial to waveguide feeds with arbitrary termination (Continued...)

Lecture 51 - Coaxial to waveguide feeds with arbitrary termination (Continued...)

Lecture 52 - Coaxial to waveguide feeds with arbitrary termination (Continued...)

Lecture 53 - Tutorial - 7

Lecture 54 - Apertures in the ground plane

Lecture 55 - Apertures in the ground plane (Continued...)

Lecture 56 - Apertures in the ground plane (Continued...)

Lecture 57 - Apertures in the ground plane (Continued...), Plane current sheets

Lecture 58 - Plane current sheets (Continued...)

Lecture 59 - Tutorial - 8

Lecture 60 - Excitation of Apertures

Lecture 61 - Tutorial - 9

Lecture 62 - Modal expansion in cavities

Lecture 63 - Probes in cavities

Lecture 64 - Tutorial - 10

Lecture 65 - Aperture coupling to cavities

Lecture 66 - Aperture coupling to cavities (Continued...)

Lecture 67 - Wave interaction with cylindrical structures

Lecture 68 - Wave interaction with cylindrical structures (Continued...)

Lecture 69 - Wave interaction with cylindrical structures (Continued...)

Lecture 70 - Wave interaction with cylindrical structures (Continued...)

Lecture 71 - Wave interaction with cylindrical structures (Continued...)

Lecture 72 - Wave interaction with cylindrical structures (Continued...)

Lecture 73 - Wave interaction with cylindrical structures (Continued...)

Lecture 74 - Wave interaction with cylindrical structures (Continued...)

Lecture 75 - Tutorial - 12

NPTEL : NOC:Introduction to Adaptive Signal Processing (Electrical Engineering)

Co-ordinators : Prof. Mrityunjoy Chakraborty

Lecture 1 - Introduction to Adaptive Filters

Lecture 2 - Probability and Random Variables

Lecture 3 - General Set of Random Variables

Lecture 4 - Statistical Impedance, Covariance Matrices

Lecture 5 - Multivariate Gaussian Density

Lecture 6 - Complex Random Variables

Lecture 7 - Introduction to Hermitian Matrices

Lecture 8 - Eigenvalues and eigenvectors of Hermitian Matrices

Lecture 9 - Spectral Decomposition of Hermitian Matrices

Lecture 10 - Positive Definite and Semidefinite Matrices

Lecture 11 - Introduction to Discrete Time Random Processes

Lecture 12 - Power Spectral Density (PSD)

Lecture 13 - PSD and Linear Time Invariant Systems

Lecture 14 - Optimal FIR Filter

Lecture 15 - Optimal FIR Filter (Continued...)

Lecture 16 - LMS Algorithm

Lecture 17 - Convergence Proof of LMS Algorithm

Lecture 18 - Convergence Proof of LMS Algorithm (Continued...)

Lecture 19 - Application of Adaptive Filter

Lecture 20 - Application of Adaptive Filter (Continued...)

Lecture 21 - Application of Adaptive Filter (Continued...)

Lecture 22 - Applications of Adaptive Filter

Lecture 23 - Applications of Adaptive Filter

Lecture 24 - Second Order Analysis of LMS Algorithm

Lecture 25 - Second Order Analysis of LMS Algorithm (Continued...)

Lecture 26 - Second Order Analysis of LMS Algorithm (Continued...)

Lecture 27 - Second Order Analysis of LMS Algorithm (Continued...)

Lecture 28 - NLMS Algorithm

Lecture 29 - NLMS Algorithm

Lecture 30 - Affine Projection Algorithm (APA)

Lecture 31 - Affine Projection Algorithm (APA)

Lecture 32 - Introduction to RLS Algorithm

Lecture 33 - Introduction to RLS Algorithm (Continued...)

Lecture 34 - Introduction to RLS Algorithm (Continued...)

Lecture 35 - Formulation of the RLS Algorithm

Lecture 36 - Introduction to RLS Algorithm

Lecture 37 - Introduction to RLS Algorithm

Lecture 38 - Formulation of the RLS Algorithm

Lecture 39 - Derivation of the RLS transversal adaptive filter

Lecture 40 - Derivation of the RLS transversal adaptive filter

Lecture 41 - Derivation of the RLS transversal adaptive filter

NPTEL : NOC:Nanobiophotonics: Touching Our Daily Life (Electrical Engineering)

Co-ordinators : Dr. Basudev Lahiri

Lecture 1 - What is Nano Bio Photonics?

Lecture 2 - Why is Nano Bio Photonics?

Lecture 3 - Why do this?

Lecture 4 - Why Photonics?

Lecture 5 - Why Biology?

Lecture 6 - Nature of Light

Lecture 7 - Light-Matter Interactions

Lecture 8 - Introduction to Fluorescence

Lecture 9 - The Cell

Lecture 10 - The Central Dogma

Lecture 11 - Facts of Matter

Lecture 12 - Introduction to Nanotechnology

Lecture 13 - Nanotechnology: The art of small

Lecture 14 - Synthesis of Nanomaterials : Top-Down Approach

Lecture 15 - Applications of Nanomaterials in Photonics

Lecture 16 - Interaction of Light with Cells

Lecture 17 - Light-matter interactions in molecules (Basic of Spectroscopy)

Lecture 18 - Imaging for Biological Matters

Lecture 19 - Fluorophores and Fluorescence Microscopy Techniques

Lecture 20 - Primary Examples

Lecture 21 - Basics of Flow Cytometry - Part 1

Lecture 22 - Basics of Flow Cytometry - Part 2

Lecture 23 - Data manipulation and presentation

Lecture 24 - Application of Flow cytometry in Biology

Lecture 25 - Raman Assisted Flow cytometry

Lecture 26 - Genetic Code

Lecture 27 - Biosensing Background

Lecture 28 - Basics of Microarray Technology

Lecture 29 - DNA Microarray Technology

Lecture 30 - Protein Microarray Technology

Lecture 31 - Laser Principles and Operation

Lecture 32 - Nonlinear Optical Processes

Lecture 33 - In Vivo Photoexcitation

Lecture 34 - Light/Laser Activated Therapy

Lecture 35 - Laser Tissue Contouring

Lecture 36 - Metamaterials

Lecture 37 - Metamaterials as Biosensors

Lecture 38 - Biosensing with Optical Nano-Antennas

Lecture 39 - Nanoscale Chemical Imaging

Lecture 40 - Optical Tweezers

Lecture 41 - Introduction to Optogenetics

Lecture 42 - Controlling the Brain with Light

Lecture 43 - The Nervous System

Lecture 44 - The Neural Circuits

Lecture 45 - Optical Neuroimaging and Tomography

Lecture 46 - Functional Near-Infrared Spectroscopy (fNIRS) of the Brain

Lecture 47 - Neuro imaging with Light-Sheet Microscopy

Lecture 48 - Brain imaging with Two Photon Microscopy

Lecture 49 - Brain imaging with functional optoacoustic Imaging

Lecture 50 - Tomographic technique for Brain imaging

Lecture 51 - Optogenetic Modulation of Neural Circuits

Lecture 52 - Nanoparticles for Optical Modulation of Neuronal Behavior

Lecture 53 - Optical Stimulation of Neural Circuits in Freely Moving Animals

Lecture 54 - Higher Harmonic Generation Imaging for Neuropathology

Lecture 55 - Multi-Photon Nanosurgery

Lecture 56 - Bioinspired materials for photonics

Lecture 57 - Bioderived Materials

Lecture 58 - Bioinspired Materials

Lecture 59 - Biotemplates

Lecture 60 - Summary and Revisiting Few Topics

NPTEL : NOC:EMI-EMC and Signal Integrity: Principles, Techniques and Applications (Electrical Engineering)

Co-ordinators : Prof. Amitabha Bhattacharya

Lecture 1 - Introduction to Electromagnetic Environment

Lecture 2 - Introduction to Electromagnetic Compatibility

Lecture 3 - EMC Standards

Lecture 4 - EMC Units and Signal Spectrum

Lecture 5 - Single Sided Spectrum

Lecture 6 - Response of Linear Systems to Periodic Input Signals

Lecture 7 - Important Computational Techniques

Lecture 8 - Fourier Coefficient for Piecewise Linear Periodic Waveforms

Lecture 9 - Fourier Coefficient for Piecewise Linear Periodic Waveforms (Continued...)

Lecture 10 - Trapezoidal Clock

Lecture 11 - Spectral Bounds for Trapezoidal Clock

Lecture 12 - Spectral estimation of trapezoidal clock

Lecture 13 - Effect of Rise/Fall Time on Spectral Bound of a Clock

Lecture 14 - Effect of Ringing on Spectral Bounds

Lecture 15 - Spectral Bounds for Linear System Output

Lecture 16 - Resolution Bandwidth of a Spectrum Analyser

Lecture 17 - Detector of Spectrum Analyser

Lecture 18 - Radiated Emission Model Subproblem - I

Lecture 19 - Farfield Characteristics of Current Element: Some Discussion

Lecture 20 - Farfield of Dipole Antena

Lecture 21 - Farfield models of wire antenna and current models

Lecture 22 - Differential mode current emission model

Lecture 23 - Differential mode current emission model (Continued...)

Lecture 24 - Common Mode Current Emission Model

Lecture 25 - Current Measurement

Lecture 26 - Radiated Susceptibility Models

Lecture 27 - Determination of Per Unit Length Inductance (Continued...)

Lecture 28 - Per Unit Length Parameters of Various Two Wire Lines

Lecture 29 - Radiated Susceptibility Model

Lecture 30 - Radiated Susceptibility Model (Continued...)

Lecture 31 - Radiated Susceptibility Model (Continued...)

Lecture 32 - Crosstalk

Lecture 33 - Development of Multi Conductor Transmission Line Equation

Lecture 34 - Per Unit Length Parameter of a Three Conductor System

Lecture 35 - Parameters of Three Conductor Systems (Continued...)

Lecture 36 - Parameters of Three Conductor Systems (Continued...)

Lecture 37 - Development of crosstalk model infrequency domain

Lecture 38 - Determination of Terminal Currents of a three conductor system

Lecture 39 - Derivation of Chain Parameter Matrix

Lecture 40 - Determination of Crosstalk in a Lossless Line Immersed in Homogeneous Medium

Lecture 41 - Determination of Crosstalk (Continued...)

Lecture 42 - Determination of Crosstalk (Continued...)

Lecture 43 - Determination of Crosstalk (Continued...)

Lecture 44 - Inductive and Capacitive coupling

Lecture 45 - Time Domain Crosstalk

Lecture 46 - Time Domain Crosstalk (Continued...)

Lecture 47 - Inclusion of Losses in Transient Crosstalk

Lecture 48 - Conducted emission and susceptibility

Lecture 49 - Shielding

Lecture 50 - Shielding Effectiveness for Farfield Source

Lecture 51 - Shielding Effectiveness Due to Farfield Source (Continued...)

Lecture 52 - SE Due to Farfield Sources (Continued...) and Free Space Impedance Ar Nearfield

Lecture 53 - Shielding for Nearfield Source

Lecture 54 - EMC System Aspect for Shielding

Lecture 55 - Grounding

Lecture 56 - Grounding (Continued...)

Lecture 57 - Bonds and Joints

Lecture 58 - EMC Case Studies

Lecture 59 - Electrostatic Discharge (ESD)

NPTEL : NOC:Embedded Sensing, Actuation and Interfacing Systems (Electrical Engineering)

Co-ordinators : Prof. Banibrata Mukherjee

Lecture 1 - Introduction

Lecture 2 - Real-life Examples Illustration

Lecture 3 - Sensor Structure and Characteristics

Lecture 4 - Sensor and Actuator Characteristics and Numerical Problem

Lecture 5 - Temperature Sensors and its Signal Conditioning Circuits

Lecture 6 - Motion Sensors and its Interfacing Aspects

Lecture 7 - Gyroscope and Strain Gauge

Lecture 8 - Strain Gauge and Optical Sensor

Lecture 9 - Optical Encoder, Gas Sensor and Chemical Sensor

Lecture 10 - Magnetic Sensor and Actuator

Lecture 11 - Electrical Actuator

Lecture 12 - Electrical Actuator: Stepper Motor and Heater

Lecture 13 - Smart Material Actuator

Lecture 14 - Metamaterial and Other Actuators

Lecture 15 - Op-amp based circuits and amplifier

Lecture 16 - Various Op-amp Configurations

Lecture 17 - Instrumentation Amplifier and Filter

Lecture 18 - Passive and Active Filters

Lecture 19 - Universal Filter and Data Converter

Lecture 20 - ADC and DAC

Lecture 21 - Sampling Issue and Communication Protocol

Lecture 22 - Bridge Circuits and their Linearity Improvement

Lecture 23 - Linearization and error reduction schemes

Lecture 24 - Principle of Direct Interfacing Scheme

Lecture 25 - Various Aspects of Direct Interfacing

Lecture 26 - Direct Interfacing for Differential and Bridge Type Resistive Sensor

Lecture 27 - Measurement Uncertainties and Interface of Sensor Array

Lecture 28 - Various Configurations of Capacitive Sensors

Lecture 29 - Analog Interface Circuit and Direct Interfacing Scheme

Lecture 30 - Direct Interfacing Scheme for Differential Capacitive Sensor

Lecture 31 - Lossy Capacitive Sensor and its Interfacing Aspect

Lecture 32 - Advanced Interfacing Circuits for Lossy Capacitive Sensor

Lecture 33 - Autobalance Active Bridge Interfacing Circuit

Lecture 34 - Background of Miniaturization

Lecture 35 - Micromachining Technology for MEMS Devices

Lecture 36 - Bulk and Surface Micromachining and Fabrication Steps

Lecture 37 - MEMS Fabrication Process - Part 1

Lecture 38 - MEMS Fabrication Process - Part 2

Lecture 39 - MEMS Fabrication Process - Part 3

Lecture 40 - MEMS Fabrication Process - Part 4

Lecture 41 - MEMS-IC Integration Aspects and Miniaturized Sensor

Lecture 42 - MEMS Pressure Sensor and Interfacing Electronics

Lecture 43 - MEMS Accelerometer

Lecture 44 - MEMS Capacitive Accelerometer and Interfacing Electronics

Lecture 45 - Interfacing Electronics Details for MEMS Accelerometer

Lecture 46 - MEMS Gyroscope and Flow sensor

Lecture 47 - MEMS Actuator

Lecture 48 - MEMS Electrostatic Actuator Analysis

Lecture 49 - Background of Renewable Energy Harvesting

Lecture 50 - Various Transduction Mechanisms for Energy Harvester

Lecture 51 - Vibration Energy Harvester and its Interfacing Aspects

Lecture 52 - Interfacing Power Management Circuit for Vibration Energy Harvester

Lecture 53 - Demonstration of Energy Harvester Set-up and Self-powered Embedded System

Lecture 54 - Background of Embedded Sensors and Actuators in Automotives

Lecture 55 - Applications in Safety System of Automotive

Lecture 56 - Applications in Safety System and Engine Control System

Lecture 57 - Application in Cardiovascular Measurements

Lecture 58 - Applications in Remote Healthcare and Smart Medical Devices

Lecture 59 - Electronic Nose and its Applications in Disease Detection

Lecture 60 - Virtual Sensing, Research Scopes, Summary and Key Takeaways of the Course

NPTEL : Modelling and Analysis of Electric Machines (Electrical Engineering)

Co-ordinators : Dr. Krishna Vasudevan

Lecture 1 - Introduction

Lecture 2 - Magnetic Fields

Lecture 3 - Magnetic Circuit

Lecture 4 - Singly Excited Linear Motion System

Lecture 5 - Linear and Cylindrical Motion Systems

Lecture 6 - Systems with Multiple Excitations

Lecture 7 - Non-linear Magnetic Systems

Lecture 8 - Inductances in Constant Air gap Machines

Lecture 9 - Inductance in Salient Pole Machine - I

Lecture 10 - Inductance in Salient Pole Machine - II

Lecture 11 - Inductance in Salient Pole Machine - III

Lecture 12 - Inductance in Salient Pole Machine - IV

Lecture 13 - Inductance in Salient Pole Machine - V

Lecture 14 - Inductances of Distributed Winding - I

Lecture 15 - Inductances of Distributed Winding - II

Lecture 16 - Inductances of Distributed Winding - III

Lecture 17 - Dynamic Equations of Induction Machines

Lecture 18 - Dynamic Equations of Salient Pole Synchronous Machine

Lecture 19 - Three-to-Two Phase Transformation

Lecture 20 - Induction Machine in Two-Phase Reference Frame

Lecture 21 - The Pseudo-Stationary Reference Frame

Lecture 22 - Induction Machine in Pseudo-Stationary Reference Frame

Lecture 23 - The Primitive Machine Equations

Lecture 24 - Dynamic Equations of DC Machines

Lecture 25 - Small Signal Model of DC Machine

Lecture 26 - Small Signal Behaviour of DC Machine

Lecture 27 - The Arbitrary Reference Frame

Lecture 28 - Induction Machine Equations in Arbitrary, Synchronous Reference Frames and Small Signal Modelling

Lecture 29 - Introduction to Field Oriented Control of Induction Machines

Lecture 30 - Space Vector Formulation of Induction Machine Equations

Lecture 31 - Modelling of Salient Pole Synchronous Machines - I

Lecture 32 - Modelling of Salient Pole Synchronous Machines - II

Lecture 33 - Modelling of Salient Pole Synchronous Machines - III

Lecture 34 - Steady State Models - Induction Machine

Lecture 35 - Steady State Models - Salient Pole Synchronous Machine

Lecture 36 - Solution of Dynamic Equations of Induction Machine - I

Lecture 37 - Solution of Dynamic Equations of Induction Machine - II

Lecture 38 - Reactances of Salient Pole Synchronous Machines - I

Lecture 39 - Reactances of Salient Pole Synchronous Machines - II

Lecture 40 - Reactances of Salient Pole Synchronous Machines - III

Lecture 41 - Suddent Short Circuit of Three Phase Alternator - Analytical Solution

Lecture 42 - Suddent Short Circuit of Three Phase Alternator - Numerical Simulation

Lecture 43 - Course Recapitulation and Assignments

NPTEL : Analog ICs (Electrical Engineering)

Co-ordinators : Prof. K. Radhakrishna Rao

Lecture 1 - Basic Building Blocks In Analog ICs

Lecture 2 - Current Mirrors

Lecture 3 - Translinear Networks

Lecture 4 - Differential Amplifier

Lecture 5 - Differential Amplifier Characteristics

Lecture 6 - Video Amplifier and RF/IF Amplifiers

Lecture 7 - Cascade Amplifier

Lecture 8 - IC Negative Feedback Wide Band Amplifiers

Lecture 9 - IC Negative Feedback Amplifiers

Lecture 10 - Voltage Sources And References

Lecture 11 - IC Voltage Regulator

Lecture 12 - Characteristics and Parameters Of Voltage

Lecture 13 - Protection Circuitry For Voltage Regulator

Lecture 14 - Switched Mode Regulator And Operational

Lecture 15 - IC Operational Voltage Amplifier

Lecture 16 - General Purpose Operational Amplifier-747

Lecture 17 - Transconductance Operational Amplifier

Lecture 18 - Audio Power Amplifier and Norton's Amplifier

Lecture 19 - Analog Multipliers

Lecture 20 - Analog Multipliers

Lecture 21 - Voltage Controlled Oscillator

Lecture 22 - Voltage Controlled Oscillator

Lecture 23 - Self Tuned Filter

Lecture 24 - Phase Locked Loop24 Phase Locked Loop

Lecture 25 - Phase Locked Loop

Lecture 26 - Phase Locked Loop

Lecture 27 - Phase Locked Loop

Lecture 28 - Current Mode ICs

NPTEL : Digital Integrated Circuits (Electrical Engineering)

Co-ordinators : Prof. Amitava Dasgupta

Lecture 1 - Semiconductors

Lecture 2 - Modelling of PN Junction Diodes

Lecture 3 - Modelling of BJTs

Lecture 4 - Diode and BJT Model Parameter Extraction

Lecture 5 - BJT Inverters DC and Switching Characteristics

Lecture 6 - Schottky Transistor

Lecture 7 - Specifications of Logic Circuits

Lecture 8 - Qualitative discussion on TTL Circuits

Lecture 9 - Standard TTL Circuits

Lecture 10 - Schottky (74s..) and Low power Schottky (74ls)

Lecture 11 - Advanced TTL Circuits

Lecture 12 - I2 L Technology

Lecture 13 - Edge triggered D-F/F

Lecture 14 - I2 L - Condition for Proper Operation

Lecture 15 - I2 L - Propagation delay Self aligned

Lecture 16 - Schottky Transistor Logic

Lecture 17 - Stacked I2 L

Lecture 18 - ECL Basic Operation

Lecture 19 - Quantitative analysis of ECL 10k Series gates

Lecture 20 - ECL 100k series; Stacked ECL gates; D-F/F

Lecture 21 - Emitter Function Logic;Low Power ECL

Lecture 22 - Polyemitter Bipolar Transistor In ECL;Propagation

Lecture 23 - Heterojunction Bipolar Transistor Based ECL;ECL

Lecture 24 - nMOS Logic Circuits

Lecture 25 - nMOS Logic Circuits(contd); CMOS :Introduction

Lecture 26 - CMOS Inverter

Lecture 27 - CMOS NAND,NOR and Other Gates: Clocked CMOS

Lecture 28 - Dynamic CMOS ;Transmission Gates;Realization Of MUX,decoder, D-F/F

Lecture 29 - BiCMOS Gates

Lecture 30 - BiCMOS Driver;BiCMOS 32-bit Adder

Lecture 31 - Digital Integrated Circuits

Lecture 32 - Digital Integrated Circuits

Lecture 33 - CMOS SRAM

Lecture 34 - BiCMOS SRAM

Lecture 35 - DRAM-CMOS and BiCMOS

Lecture 36 - ROM-EPROM,EEPROM and Flash EPROM

Lecture 37 - GaAs MESFET Characteristics and Equivalent Circuits

Lecture 38 - Direct Coupled FET Logic; Superbuffer FET Logic

Lecture 39 - Buffered FET Logic; Schottky Diode FET Logic

Lecture 40 - Transmission Line Effects

NPTEL : Electromagnetic Fields (Electrical Engineering)

Co-ordinators : Prof. Harishankar Ramachandran

Lecture 1 - Introduction To Vector

Lecture 2 - Introduction To Vector (Continued...)

Lecture 3 - Coulomb's Law

Lecture 4 - Electric Field

Lecture 5 - Electro Static Potential

Lecture 6 - The Gradient

Lecture 7 - Gauss's Law

Lecture 8 - Poisson's Equation

Lecture 9 - Energy In The Field

Lecture 10 - Sample Problems In Electrostatics

Lecture 11 - Fields In Materials

Lecture 12 - Fields In Material Bodies

Lecture 13 - Displacement Vectors

Lecture 14 - Capacitors

Lecture 15 - Method Of Images

Lecture 16 - Poisson's Equation 2 Dimensions

Lecture 17 - Field Near Sharp Edges And Points

Lecture 18 - Magnetic Field 1

Lecture 19 - Magnetic Field 2

Lecture 20 - Stokes Theorems

Lecture 21 - The curl

Lecture 22 - Field due to current loop

Lecture 23 - Ampere's law

Lecture 24 - Examples of Ampere's law

Lecture 25 - Inductance

Lecture 26 - Mutual Inductance

Lecture 27 - Faraday's law

Lecture 28 - Magnetic Energy

Lecture 29 - Magnetic Energy (Continued...)

Lecture 30 - Magnetic Energy (Continued...)

Lecture 31 - Generalised Ampere's Law

Lecture 32 - The Wave Equation

Lecture 33 - The Wave Equation

Lecture 34 - Poynting Theorem

Lecture 35 - Skin Effect

Lecture 36 - Skin Effect (Continued...)

Lecture 37 - Radiation And Circuits

Lecture 38 - Phasor Form Of Poynting Theorem

Lecture 39 - Reflection At Dielectric Boundaries

Lecture 40 - Reflection At Dielectric Boundaries (Continued...)

Lecture 41 - Transmission Lines

Lecture 42 - Transmission Lines (Continued...) and Conclusion

NPTEL : Networks and Systems (Electrical Engineering)

Co-ordinators : Prof. V.G.K. Murti

Lecture 1 - Introductory Concepts - 1

Lecture 2 - Introductory Concepts - 2

Lecture 3 - Introductory Concepts - 3

Lecture 4 - Introductory Concepts - 4

Lecture 5 - Introductory Concepts - 5

Lecture 6 - Introductory Concepts - 6

Lecture 7 - Fourier Series - 1

Lecture 8 - Fourier Series - 2

Lecture 9 - Fourier Series - 3

Lecture 10 - Fourier Series - 4

Lecture 11 - Fourier Series - 5

Lecture 12 - Fourier Series - 6

Lecture 13 - Fourier Transforms - 1

Lecture 14 - Fourier Transforms - 2

Lecture 15 - Fourier Transforms - 3

Lecture 16 - Fourier Transforms - 4

Lecture 17 - Fourier Transforms - 5

Lecture 18 - Fourier Transforms - 6

Lecture 19 - Fourier Transforms - 7

Lecture 20 - Laplace Transforms - 1

Lecture 21 - Laplace Transforms - 2

Lecture 22 - Laplace Transforms - 3

Lecture 23 - Laplace Transforms - 4

Lecture 24 - Laplace Transforms - 5

Lecture 25 - Laplace Transforms - 6

Lecture 26 - Application of Laplace Transforms - 1

Lecture 27 - Application of Laplace Transforms - 2

Lecture 28 - Application of Laplace Transforms - 3

Lecture 29 - Application of Laplace Transforms - 4

Lecture 30 - Network Functions - 1

Lecture 31 - Network Functions - 2

Lecture 32 - Network Functions - 3

Lecture 33 - Network Functions - 4

Lecture 34 - Network Theorems - 1

Lecture 35 - Network Theorems - 2

Lecture 36 - Network Theorems - 3

Lecture 37 - Network Theorems - 4

Lecture 38 - Discrete - Time Systems - 1

Lecture 39 - Discrete - Time Systems - 2

Lecture 40 - Discrete - Time Systems - 3

Lecture 41 - Discrete - Time Systems - 4

Lecture 42 - Discrete - Time Systems - 5

Lecture 43 - Discrete - Time Systems - 6

Lecture 44 - Discrete - Time Systems - 7

Lecture 45 - State-Variable Methods - 1

Lecture 46 - State-Variable Methods - 2

Lecture 47 - State Variable Methods - 3

Lecture 48 - State Variable Methods - 4

Lecture 49 - State Variable Methods - 5

Lecture 50 - State Variable Methods - 6

NPTEL : Probability Foundation for Electrical Engineers (Electrical Engineering)

Co-ordinators : Dr. Krishna Jagannathan

Lecture 1 - Introduction

Lecture 2 - Cardinality

Lecture 3 - Countability

Lecture 4 - Uncountable sets - 1

Lecture 5 - Uncountable sets - 2

Lecture 6 - Probability spaces - Introduction

Lecture 7 - Probability spaces - Algebra

Lecture 8 - Probability spaces - Ïƒ-algebra

Lecture 9 - Probability spaces - Measurable space

Lecture 10 - Properties of probability measures

Lecture 11 - Continuity of probability measure

Lecture 12 - Discrete probability space - finite and countably infinite sample space

Lecture 13 - Discrete probability space - Uncountable sample space

Lecture 14 - Generated Ïƒ-algebra, Borel Sets

Lecture 15 - Borel sets

Lecture 16 - Uniform probability measure on Borel sets-Lebesgue measure

Lecture 17 - CarathÃ©odoryâ€™s extension theorem

Lecture 18 - Lebesgue measure (Continued...)

Lecture 19 - Infinite coin toss model

Lecture 20 - Infinite coin toss model (Continued...)

Lecture 21 - Conditional probability

Lecture 22 - Properties of conditional probability

Lecture 23 - Independence of events

Lecture 24 - Independence of Ïƒ-algebras

Lecture 25 - Borel-Cantelli Lemma - 1

Lecture 26 - Borel-Cantelli Lemma - 2

Lecture 27 - Random Variables

Lecture 28 - Random Variables (Continued...)

Lecture 29 - Cumulative Distribution Function

Lecture 30 - Properties of CDF

Lecture 31 - Types of Random Variables

Lecture 32 - Examples of Random Variables

Lecture 33 - Continuous Random Variables - 1

Lecture 34 - Examples of Continuous Random Variables - 1

Lecture 35 - Continuous Random Variables - 2, Examples of Continuous RandomVariables - 2

Lecture 36 - Singular Random Variables

Lecture 37 - Several Random Variables - 1

Lecture 38 - Several Random Variables - 2

Lecture 39 - Independent Random Variables - 1

Lecture 40 - Independent Random Variables - 2

Lecture 41 - Conditional PMF, Jointly Continuous Random Variables - 1

Lecture 42 - Jointly Continuous Random Variables - 2

Lecture 43 - Jointly Continuous Random Variables - 3

Lecture 44 - Conditional CDF

Lecture 45 - Transformation of Random Variables - 1

Lecture 46 - Transformation of Random Variables - 2; Independent Random Variables

Lecture 47 - Sums of Discrete Random Variables

Lecture 48 - Sums of Jointly Continuous Random Variables

Lecture 49 - Sums of Random Number of Random Variables

Lecture 50 - General Transformations of Random Variables

Lecture 51 - Jacobian Formula

Lecture 52 - Examples Illustrating the use of Jacobian Formula

Lecture 53 - Introduction Integral and Expectation

Lecture 54 - Definition of the Abstract Integral

Lecture 55 - Simple Functions

Lecture 56 - Computing Expectation using Simple Functions, Properties of Integrals

Lecture 57 - Properties of Integrals (Continued....)

Lecture 58 - Inclusion Exclusion Formula using Indicator RVs and Expectation

Lecture 59 - Monotone Convergence Theorem - 1

Lecture 60 - Monotone Convergence Theorem - 2

Lecture 61 - Expectation of a Discrete Random Variable

Lecture 62 - Examples of Expectation of Discrete Random Variables

Lecture 63 - Expectation of Function of Random Variable

Lecture 64 - Some Examples of Computing Expectation

Lecture 65 - Fatouâ€™s Lemma

Lecture 66 - Dominated Convergence Theorem

Lecture 67 - Variance

Lecture 68 - Covariance

Lecture 69 - Covariance Correlation Coefficient - 1

Lecture 70 - Covariance Correlation Coefficient - 2

Lecture 71 - Conditional Expectation

Lecture 72 - Properties of Conditional Expectation

Lecture 73 - MMSE Estimator

Lecture 74 - Transforms

Lecture 75 - Moment Generating Function - 1

Lecture 76 - Moment Generating Function - 2

Lecture 77 - Characteristic Function - 1

Lecture 78 - Characteristic Function - 2

Lecture 79 - Characteristic Function - 3

Lecture 80 - Characteristic Function - 4

Lecture 81 - Concentration Inequalities - 1

Lecture 82 - Concentration Inequalities - 2

Lecture 83 - Convergence of Random Variables - 1

Lecture 84 - Convergence of Random Variables - 2

Lecture 85 - Convergence of Random Variables - 3

Lecture 86 - Convergence of Random Variables - 4

Lecture 87 - Convergence of Random Variables - 5

Lecture 88 - Convergence of Random Variables - 6

Lecture 89 - Convergence Of Characteristic Functions

Lecture 90 - Limit Theorems

Lecture 91 - The Law of Large Numbers - 1

Lecture 92 - The Law of Large Numbers - 2

Lecture 93 - The Central Limit Theorem - 1

Lecture 94 - The Central Limit Theorem - 2

Lecture 95 - A Brief Overview of Multivariate Gaussians - 1

Lecture 96 - A Brief Overview of Multivariate Gaussians - 2

NPTEL : NOC:Analog Circuits (Electrical Engineering)

Co-ordinators : Dr. Nagendra Krishnapura

Lecture 1 - Introduction to the course

Lecture 2 - Obtaining power gain

Lecture 3 - Obtaining power gain using a linear two port?

Lecture 4 - One port (two terminal) nonlinear element

Lecture 5 - Nonlinear circuit analysis

Lecture 6 - Small signal incremental analysis - graphical view

Lecture 7 - Small signal incremental analysis

Lecture 8 - Incremental equivalent circuit

Lecture 9 - Large signal characteristics of a diode

Lecture 10 - Analysis of diode circuits

Lecture 11 - Small signal model of a diode

Lecture 12 - Two port nonlinearity

Lecture 13 - Small signal equivalent of a two port network

Lecture 14 - Small signal equivalent circuit of a two port network

Lecture 15 - Gain of a two port network

Lecture 16 - Constraints on small signal parameters to maximize the gain

Lecture 17 - Constraints on large signal characteristics to maximize the gain

Lecture 18 - Implications of constraints in terms of the circuit equivalent

Lecture 19 - MOS transistor-description

Lecture 20 - MOS transistor large signal characteristics

Lecture 21 - MOS transistor large signal characteristics - graphical view

Lecture 22 - MOS transistor small signal characteristics

Lecture 23 - Linear (Triode) region of the MOS transistor

Lecture 24 - Small signal amplifier using the MOS transistor

Lecture 25 - Basic amplifier structure

Lecture 26 - Problems with the basic structure

Lecture 27 - Adding bias and signal-ac coupling

Lecture 28 - Common source amplifier with biasing

Lecture 29 - Common source amplifier: Small signal equivalent circuit

Lecture 30 - Common source amplifier analysis: Effect of biasing components

Lecture 31 - Constraint on the input coupling capacitor

Lecture 32 - Constraint on the output coupling capacitor

Lecture 33 - Dependence of ID on VDS

Lecture 34 - Small signal output conductance of a MOS transistor

Lecture 35 - Effect of gds on a common source amplifier; Inherent gain limit of a transistor

Lecture 36 - Variation gm with transistor parameters

Lecture 37 - Variation of gm with constant VGS and constant drain current bias

Lecture 38 - Negative feedback control for constant drain current bias

Lecture 39 - Types of feedback for constant drain current bias

Lecture 40 - Sense at the drain and feedback to the gate-Drain feedback

Lecture 41 - Intuitive explanation of low sensitivity with drain feedback

Lecture 42 - Common source amplifier with drain feedback bias

Lecture 43 - Constraint on the gate bias resistor

Lecture 44 - Constraint on the input coupling capacitor

Lecture 45 - Constraint on the output coupling capacitor

Lecture 46 - Input and output resistances of the common source amplifier with constant VGS bias

Lecture 47 - Current mirror

Lecture 48 - Common souce amplifier with current mirror bias

Lecture 49 - Constraint on coupling capacitors and bias resistance

Lecture 50 - Diode connected transistor

Lecture 51 - Source feedback biasing

Lecture 52 - Common source amplifier with source feedback bias

Lecture 53 - Constraints on capacitor values

Lecture 54 - Sensing at the drain and feeding back to the source

Lecture 55 - Sensing at the source and feeding back to the gate

Lecture 56 - Ensuring that transistor is in saturation

Lecture 57 - Using a resistor instead of current source for biasing

Lecture 58 - Controlled sources using a MOS transistor-Introduction

Lecture 59 - Voltage controlled voltage source

Lecture 60 - VCVS using a MOS transistor

Lecture 61 - VCVS using a MOS transistor - Small signal picture

Lecture 62 - VCVS using a MOS transistor - Complete circuit

Lecture 63 - Source follower: Effect of output conductance; Constraints on coupling capacitors

Lecture 64 - VCCS using a MOS transistor

Lecture 65 - VCCS using a MOS transistor: Small signal picture

Lecture 66 - VCCS using a MOS transistor: Complete circuit

Lecture 67 - VCCS using a MOS transistor: AC coupling the output

Lecture 68 - Source degenrated CS amplifier

Lecture 69 - CCCS using a MOS transistor

Lecture 70 - CCCS using a MOS transistor: Small signal picture

Lecture 71 - CCCS using a MOS transistor: Complete circuit

Lecture 72 - CCVS using a MOS transistor

Lecture 73 - CCVS using a MOS transistor: Gain

Lecture 74 - CCVS using a MOS transistor: Input and output resistances

Lecture 75 - CCVS using a MOS transistor: Complete circuit

Lecture 76 - VCVS using an opamp

Lecture 77 - CCVS using an opamp

Lecture 78 - Negative feedback and virtual short in an opamp

Lecture 79 - Negative feedback and virtual short in a transistor

Lecture 80 - Constraints on controlled sources using opamps and transistors

Lecture 81 - Quick tour of amplifying devices

Lecture 82 - Signal swing limits in amplifiers

Lecture 83 - Swing limit due to transistor entering triode region

Lecture 84 - Swing limit due to transistor entering cutoff region

Lecture 85 - Swing limit calculation example

Lecture 86 - Swing limits-more calculations

Lecture 87 - pMOS transistor

Lecture 88 - Small signal model of the pMOS transistor

Lecture 89 - Common source amplifier using the pMOS transistor

Lecture 90 - Swing limits of the pMOS common source amplifier

Lecture 91 - Biasing a pMOS transistor at a constant current; pMOS current mirror

Lecture 92 - Converting nMOS transistor circuits to pMOS

Lecture 93 - Bias current generation

Lecture 94 - Examples of more than one transistor in feedback

Lecture 95 - Gain limitation in a common source amplifier with resistive load

Lecture 96 - nMOS active load for pMOS common source amplifier

Lecture 97 - CMOS inverter

Lecture 98 - Large signal characteristics of pMOS CS amplifier with nMOS active load

Lecture 99 - Large signal characteristics of nMOS CS amplifier with pMOS active load

Lecture 100 - Large signal characteristics of a CMOS inverter

Lecture 101 - Active load amplifiers as digital gates

Lecture 102 - Sensitivity of output bias to input bias in a CMOS inverter

Lecture 103 - Self biasing a CMOS inverter

Lecture 104 - An application of self biased inverters

Lecture 105 - Current consumption of a self-biased inverter; Current biasing

Lecture 106 - Amplifying a difference signal; Differential pair

Lecture 107 - Differential pair-small signal basics

Lecture 108 - Biasing a differential pair

Lecture 109 - Differential pair with differential excitation

Lecture 110 - Differential pair with a current mirror load

Lecture 111 - Differential pair with a current mirror load - operating point

Lecture 112 - Differential pair with a current mirror load - Norton equivalent current

Lecture 113 - Differential pair with a current mirror load - Norton equivalent resistance

Lecture 114 - Common mode gain

Lecture 115 - Single stage opamp

Lecture 116 - Single stage opamp: Input common mode swing limits

Lecture 117 - Single stage opamp: Output swing limits

Lecture 118 - Which transistor type to use for the second stage?

Lecture 119 - Small signal gain

Lecture 120 - DC negative feedback biasing of all stages

Lecture 121 - DC negative feedback biasing of all stages (Continued...)

Lecture 122 - Small signal model

Lecture 123 - Swing limits

Lecture 124 - Systematic offset; How to eliminate it

Lecture 125 - Bipolar junction transistor(BJT): Large signal model

Lecture 126 - BJT model for calculating operating points

Lecture 127 - BJT small signal model

Lecture 128 - Biasing a BJT

Lecture 129 - Biasing a BJT, (Continued...)

Lecture 130 - Amplifiers using BJTs

Lecture 131 - PNP transistor

NPTEL : NOC:Introduction to Non Linear Dynamics (Electrical Engineering)

Co-ordinators : Prof. Gaurav Raina

Lecture 1 - A brief introduction to modelling

Lecture 2 - Dynamics and Nonlinear systems: getting started

Lecture 3 - 1-Dimensional Flows, Flows on the Line, Lecture 1

Lecture 4 - 1-Dimensional Flows, Flows on the Line, Lecture 2

Lecture 5 - 1-Dimensional Flows, Flows on the Line, Lecture 3

Lecture 6 - 1-Dimensional Flows, Flows on the Line, Lecture 4

Lecture 7 - 1-Dimensional Flows, Flows on the Line, Lecture 5

Lecture 8 - 1-Dimensional Flows, Flows on the Line, Lecture 6

Lecture 9 - 1-Dimensional Flows, Bifurcations, Lecture 1

Lecture 10 - 1-Dimensional Flows, Bifurcations, Lecture 2

Lecture 11 - 1-Dimensional Flows, Bifurcations, Lecture 3

Lecture 12 - 1-Dimensional Flows, Bifurcations, Lecture 4

Lecture 13 - 1-Dimensional Flows, Bifurcations, Lecture 5

Lecture 14 - 1-Dimensional Flows, Bifurcations, Lecture 6

Lecture 15 - 1-Dimensional Flows, Flows on the Circle, Lecture 1

Lecture 16 - 1-Dimensional Flows, Flows on the Circle, Lecture 2

Lecture 17 - 2-Dimensional Flows, Linear Systems, Lecture 1

Lecture 18 - 2-Dimensional Flows, Linear Systems, Lecture 2

Lecture 19 - 2-Dimensional Flows, Linear Systems, Lecture 3

Lecture 20 - 2-Dimensional Flows, Linear Systems, Lecture 4

Lecture 21 - 2-Dimensional Flows, Phase Plane, Lecture 1

Lecture 22 - 2-Dimensional Flows, Phase Plane, Lecture 2

Lecture 23 - 2-Dimensional Flows, Phase Plane, Lecture 3

Lecture 24 - 2-Dimensional Flows, Limit Cycles, Lecture 1

Lecture 25 - 2-Dimensional Flows, Limit Cycles, Lecture 2

Lecture 26 - 2-Dimensional Flows, Limit Cycles, Lecture 3

Lecture 27 - 2-Dimensional Flows, Bifurcations, Lecture 1

Lecture 28 - 2-Dimensional Flows, Bifurcations, Lecture 2

Lecture 29 - 2-Dimensional Flows, Bifurcations, Lecture 3

NPTEL : NOC:Control Engineering (Electrical Engineering)

Co-ordinators : Prof. Ramkrishna.P

Lecture 1 - Introduction to Systems and Control

Lecture 2 - Modelling of Systems

Lecture 3 - Elements of Modelling

Lecture 4 - Examples of Modelling

Lecture 5 - Solving Problems in Modelling of Systems

Lecture 6 - Laplace Transforms

Lecture 7 - Inverse Laplace Transforms

Lecture 8 - Transfer Function of Modelling Block Diagram Representation

Lecture 9 - Solving Problems on Laplace Transforms and Transfer Functions

Lecture 10 - Block Diagram Reduction, Signal Flow Graphs

Lecture 11 - Solving Problems on Block Diagram Reduction, Signal Flow Graphs

Lecture 12 - Time Response Analyzsis of systems

Lecture 13 - Time Response specifications

Lecture 14 - Solving Problems on Time Response Analyzsis ans specifications

Lecture 15 - Stability

Lecture 16 - Routh Hurwitz Criterion

Lecture 17 - Routh Hurwitz Criterion T 1

Lecture 18 - Closed loop System and Stability

Lecture 19 - Root Locus Technique

Lecture 20 - Root Locus Plots

Lecture 21 - Root Locus Plots (Continued...)

Lecture 22 - Root Locus Plots (Continued...)

Lecture 23 - Root Locus Plots (Continued...)

Lecture 24 - Introduction to Frequency Response

Lecture 25 - Frequency Response Plots

Lecture 26 - Relative Stability

Lecture 27 - Bode plots

Lecture 28 - Basics of Control design Proportional, Integral and Derivative Actions

Lecture 29 - Basics of Control design Proportional, Integral and Derivative Actions

Lecture 30 - Problems on PID Controllers

Lecture 31 - Basics of Control design Proportional, Integral and Derivative Actions

Lecture 32 - Control design in time domain and discusses the lead compensator

Lecture 33 - Improvement of the Transient Response using lead compensation

Lecture 34 - Design of control using lag compensators

Lecture 35 - The design of Lead-Lag compensators using root locus

Lecture 36 - Introduction design of control in frequency domain

Lecture 37 - Design of Lead Compensator using Bode Plots

Lecture 38 - Design of Lag Compensators using Bode Plots

Lecture 39 - Design of Lead-Lag Compensators using Bode plots

Lecture 40 - Experimental Determination of Transfer Function

Lecture 41 - Effect of Zeros on System Response

Lecture 42 - Navigation - Stories and Some Basics

Lecture 43 - Navigation - Dead Reckoning and Reference Frames

Lecture 44 - Inertial Sensors and Their Characteristics

Lecture 45 - Filter Design to Attentuate Inertial Sensor Noise

Lecture 46 - Complementary Filter

Lecture 47 - Complementary Filter - 1

Lecture 48 - Introduction to State Space Systems

Lecture 49 - Linearization of State Space Dynamics

Lecture 50 - Linearization of State Space Dynamics - 1

Lecture 51 - Controllability and Observability

Lecture 52 - State Space Canonical Forms

Lecture 53 - State Space Solution and Matrix Exponential

Lecture 54 - Controllability and Pole Placement

Lecture 55 - Controllable Decomposition and Observability

NPTEL : NOC:Analog IC Design (Electrical Engineering)

Co-ordinators : Prof. S. Aniruddhan

Lecture 1 - Introduction to MOSFETs

Lecture 2 - Simple MOSFET Circuits

Lecture 3 - MOSFET Current Mirrors

Lecture 4 - Cascode Amplifiers

Lecture 5 - MOSFET in Integrated Circuits

Lecture 6 - MOSFET Capacitances

Lecture 7 - Noise

Lecture 8 - Noise of Simple Circuits

Lecture 9 - Systematic Mismatch

Lecture 10 - Random Mismatch

Lecture 11 - Differential Amplifiers

Lecture 12 - Negative Feedback

Lecture 13 - Stability of Negative Feedback Systems

Lecture 14 - Dominant Pole Compensation

Lecture 15 - Active Load

Lecture 16 - One Stage OpAmps - 1

Lecture 17 - One Stage OpAmps - 2

Lecture 18 - One Stage OpAmps - 3

Lecture 19 - Differential Amplifiers Offset

Lecture 20 - One Stage OpAmps - Noise and Offset

Lecture 21 - One Stage OpAmps - Slew Rate

Lecture 22 - One Stage OpAmps - Datasheet

Lecture 23 - One Stage OpAmps - Example 1

Lecture 24 - One Stage OpAmps - Example 2

Lecture 25 - Telescopic OpAmp - 1

Lecture 26 - Telescopic OpAmp - 2

Lecture 27 - Telescopic OpAmp - 3

Lecture 28 - Telescopic OpAmp - 4

Lecture 29 - Telescopic OpAmp - 5

Lecture 30 - Telescopic OpAmp - Datasheet

Lecture 31 - Telescopic OpAmp - Design Example

Lecture 32 - Folded-Cascode OpAmp - 1

Lecture 33 - Folded-Cascode OpAmp - 2

Lecture 34 - Folded-Cascode OpAmp - 3

Lecture 35 - Folded-Cascode OpAmp - 4

Lecture 36 - Folded-Cascode OpAmp - 5

Lecture 37 - Negative feedback amplifier

Lecture 38 - Step response, sinusoidal steady state response

Lecture 39 - Loop gain and unity loop gain frequency; Opamp

Lecture 40 - Opamp realization using controlled sources; Delay in the loop

Lecture 41 - Negative feedback amplifier with ideal delay-small delays

Lecture 42 - Negative feedback amplifier with ideal delay-large delays

Lecture 43 - Negative feedback amplifier with parasitic poles and zeros

Lecture 44 - Negative feedback amplifier with parasitic poles and zeros; Nyquist criterion

Lecture 45 - Nyquist criterion; Phase margin

Lecture 46 - Phase margin

Lecture 47 - Single stage opamp realization

Lecture 48 - Two stage miller compensated opamp

Lecture 49 - Two stage miller compensated opamp.

Lecture 50 - Two and three stage miller compensated opamps; Feedforward compensated opamp

Lecture 51 - Two Stage Opamp

Lecture 52 - Two Stage Opamp ; Three Stage and Triple Cascade Opamps

Lecture 53 - Common Mode Rejection Ratio ; Example

Lecture 54 - Fully differential single stage opamp

Lecture 55 - Common mode feedback

Lecture 56 - Fully differential single stage opamp-2

Lecture 57 - Fully differential two stage opamp; Fully differential versus pseudo-differential

NPTEL : NOC:Probability Foundations for Electrical Engineers (Electrical Engineering)

Co-ordinators : Prof. R.Aravind, Dr. Andrew Thangaraj

Lecture 1 - Experiments, Outcomes and Events

Lecture 2 - Examples: Experiments and sample spaces

Lecture 3 - Operations on Events

Lecture 4 - Examples: Sample spaces and events

Lecture 5 - Sigma Fields and Probability

Lecture 6 - Discrete Sample Spaces

Lecture 7 - Union and Partition

Lecture 8 - Examples: Probability Calculation for Equally likely Outcomes

Lecture 9 - Definition and Basic Properties

Lecture 10 - Bayes' Rule for Partitions

Lecture 11 - Examples: Conditional probability

Lecture 12 - Example of Detection

Lecture 13 - Example: Coloured Cards from a Box

Lecture 14 - Independence of Events

Lecture 15 - Examples: Independence

Lecture 16 - Combining Independent Experiments

Lecture 17 - Conditional Independence

Lecture 18 - Examples and Computations with Conditional Independence

Lecture 19 - Binomial and Geometric Models

Lecture 20 - Examples: Binomial and Geometric Model

Lecture 21 - Definition and Discrete Setting

Lecture 22 - RandomVariables and Events

Lecture 23 - Examples: Discrete random variables

Lecture 24 - Important distributions

Lecture 25 - Examples: Discrete PMFs

Lecture 26 - Real-life modeling example

Lecture 27 - More Distributions

Lecture 28 - Conditional PMFs, Conditioning on an event, Indicator random variables

Lecture 29 - Example: Conditioning on an event, Indicator random variables

Lecture 30 - Multiple random variables and joint distribution

Lecture 31 - Example: Two random variables

Lecture 32 - Marginal PMF

Lecture 33 - Trinomial joint PMF

Lecture 34 - Events and Conditioning with Two Random Variables

Lecture 35 - Example: compute marginal and conditional PMFs, probability of events

Lecture 36 - Independent random variables

Lecture 37 - More on independence

Lecture 38 - Example: IID Repetitions

Lecture 39 - Addition of Random Variables

Lecture 40 - Sum, Difference and Max of Two Random Variables

Lecture 41 - More Computations: Min of Two Random Variables

Lecture 42 - Example: X+Y, X-Y, min(X,Y), max(X,Y)

Lecture 43 - Real line as sample space

Lecture 44 - Probability density function (pdf)

Lecture 45 - Cumulative distribution function (CDF)

Lecture 46 - Continuous random variables

Lecture 47 - pdf and CDF of continuous random variables

Lecture 48 - Spinning pointer example

Lecture 49 - Important continuous distributions

Lecture 50 - More continuous distributions

Lecture 51 - Two-dimensional real sample space

Lecture 52 - Joint pdf and joint CDF

Lecture 53 - More on assigning probability to regions of x-y plain

Lecture 54 - Darts example and marginal pdfs

Lecture 55 - Independence to two continuous random variables

Lecture 56 - Examples: two independent continuous random variables

Lecture 57 - Prob[X > Y]: computation of probability of a non-rectangular region

Lecture 58 - Transformations of random variables

Lecture 59 - CDF method

Lecture 60 - pdf method

Lecture 61 - Examples

Lecture 62 - One-to-one transformations

Lecture 63 - Expected Value or Mean of a Random Variable

Lecture 64 - Properties of Expectation

Lecture 65 - Expectation Computations for Important Distributions

Lecture 66 - Variance

Lecture 67 - Examples of Variance

Lecture 68 - Expectations with Two Random Variables

Lecture 69 - Correlation and Covariance

Lecture 70 - Examples: Continuous Distributions

Lecture 71 - Examples: Symmetry

Lecture 72 - Examples: Discrete Distributions

Lecture 73 - Live Session

NPTEL : NOC:Introduction to Photonics (Electrical Engineering)

Co-ordinators : Prof. Balaji Srinivasan

Lecture 1 - Introduction to Photonics

Lecture 2 - Diffraction and Interference

Lecture 3 - Tutorial on Ray Optics and Wave Optics

Lecture 4 - Lab Demonstration : Diffractions and Interference

Lecture 5 - Interferometers

Lecture 6 - Coherence

Lecture 7 - Spatial and Temporal Coherence

Lecture 8 - Tutorial on Wave Optics

Lecture 9 - Lab Demonstration: Michelson Interferometer

Lecture 10 - Electromagnetic Optics

Lecture 11 - Fiber Optics

Lecture 12 - Photon Properties

Lecture 13 - Lab Demonstration: Fiber modes, NA and MFD

Lecture 14 - Photon Optics

Lecture 15 - Tutorial on Photon optics

Lecture 16 - Photon interaction - 1

Lecture 17 - Photon interaction - 2

Lecture 18 - Lab Demonstration: Interaction of light with matter

Lecture 19 - Optical Amplification

Lecture 20 - Three Level systems

Lecture 21 - Four Level Systems

Lecture 22 - EDFA Introduction

Lecture 23 - EDFA Tutorial

Lecture 24 - Lasers Part - 1

Lecture 25 - Lab Demonstration: EDFA Characterization

Lecture 26 - Lasers part- 2

Lecture 27 - Lasers part- 3

Lecture 28 - Lasers part- 4

Lecture 29 - Lab Demonstration: Fiber Laser

Lecture 30 - Semiconductor light Source and detector - Band structure

Lecture 31 - Semiconductor light Source and detector - Light emission

Lecture 32 - Semiconductor light Source and detector LED Characteristics

Lecture 33 - Lab Demonstration: Semiconductor Sources

Lecture 34 - Semiconductor light Source and detector Laser Characteristics

Lecture 35 - Semiconductor Detectors - 1

Lecture 36 - Semiconductor Detectors - 2

Lecture 37 - Semiconductor Detectors - 3

Lecture 38 - Lab Demonstration: Semiconductor Detectors

Lecture 39 - Semiconductor Detectors - 4

Lecture 40 - Light manipulation-Mallus' Law

Lecture 41 - Light manipulation-Birefringence

Lecture 42 - Light manipulation-Faraday Rotation

Lecture 43 - Lab Demonstration: Manipulation of Light Intensity and Polarization

Lecture 44 - Non-linear optics-Pockels effect

Lecture 45 - Non-linear optics-Kerr Effect

Lecture 46 - Lab Demonstration: Manipulation of Light Electro Optic Modulator (EOM)

Lecture 47 - Non-linear optics-stimulated Brillouin scattering

Lecture 48 - Non-linear optics-stimulated Raman scattering

NPTEL : NOC:Multirate DSP (Electrical Engineering)

Co-ordinators : Prof. David Kovil Pillai

Lecture 1 - Introduction to Multirate DSP - Part 1

Lecture 2 - Introduction to Multirate DSP - Part 2

Lecture 3 - Sampling and Nyquist criterion - Part 1

Lecture 4 - Sampling and Nyquist criterion - Part 2

Lecture 5 - Signal Reconstruction - Part 1

Lecture 6 - Signal Reconstruction - Part 2

Lecture 7 - Reconstruction filter - Part 1

Lecture 8 - Reconstruction filter - Part 2

Lecture 9 - Discrete time processing of continuous time signal - Part 1

Lecture 10 - Discrete time processing of continuous time signal - Part 2

Lecture 11 - DT processing of CT signal example

Lecture 12 - Time scaling- upsampler and downsampler - Part 1

Lecture 13 - Time scaling- upsampler and downsampler - Part 2

Lecture 14 - Upsampler and downsampler- continued - Part 1

Lecture 15 - Upsampler and downsampler- continued - Part 2

Lecture 16 - Decimator properties

Lecture 17 - Properties of Upsampler and Downsampler

Lecture 18 - Fractional sampling rate change - Part 1

Lecture 19 - Fractional sampling rate change - Part 2

Lecture 20 - Multiplexer/ demultiplexer interpretation

Lecture 21 - Noble identities and polyphase decomposition - Part 1

Lecture 22 - Noble identities and polyphase decomposition - Part 2

Lecture 23 - Polyphase decomposition continued - Part 1

Lecture 24 - Polyphase decomposition continued - Part 2

Lecture 25 - Introduction to Multirate Filter Banks

Lecture 26 - Applications of Multirate - Part 1

Lecture 27 - Applications of Multirate - Part 2

Lecture 28 - Spectral Analysis of Filter Bank - Part 1

Lecture 29 - Spectral Analysis of Filter Bank - Part 2

Lecture 30 - DFT and High Resolution Spectral Analysis - Part 1

Lecture 31 - DFT and High Resolution Spectral Analysis - Part 2

Lecture 32 - Transmultiplexer and Maximally Decimated Filterbanks - Part 1

Lecture 33 - Transmultiplexer and Maximally Decimated Filterbanks - Part 2

Lecture 34 - Maximally Decimated Filterbanks 2 - Part 1

Lecture 35 - Maximally Decimated Filterbanks 2 - Part 2

Lecture 36 - Study of Two-channel filter bank

Lecture 37 - Introduction to Quadrature Mirror Filters (QMF)

Lecture 38 - 2-channel QMF Filter Bank Design

Lecture 39 - Study of All-pass filters

Lecture 40 - Study of All-pass lattice

Lecture 41 - All-pass decomposition, the study of Mth band and Nyquist filters

Lecture 42 - Study of two-channel filter bank with perfect reconstruction

Lecture 43 - First part name : Perfect Reconstruction Final Overview. Second part name : Introduction to OFDM- Motivation - Part 1

Lecture 44 - First part name : Perfect Reconstruction Final Overview. Second part name : Introduction to OFDM- Motivation - Part 2

Lecture 45 - Capacity of wireless channels - CSIR - Part 1

Lecture 46 - Capacity of wireless channels - CSIT - Part 2

Lecture 47 - Capacity of wireless channels - Formulation of capacity calculation - Part 3

Lecture 48 - Capacity of wireless channels - Formulation of capacity calculation (Continued...) - Part 1

Lecture 49 - Capacity of wireless channels - Formulation of capacity calculation (Continued...) - Part 2

Lecture 50 - Capacity of wireless channels - Time-invariant Frequency selective channel - Part 3

Lecture 51 - Capacity of wireless channels - Time varying Frequency selective channels - Part 1

Lecture 52 - Multi-rate DSP framework for Multi-carrier Modulation - Part 2

Lecture 53 - MCM with overlapping spectra - Part 1

Lecture 54 - Recap of multirate DSP concepts for building OFDM - Part 2

Lecture 55 - Introduction to Redundancy and it's implementation in multi-rate framework - Part 3

Lecture 56 - M-channel multicarrier Transceiver - Part 1

Lecture 57 - M-channel multicarrier Transceiver - Part 2

Lecture 58 - M-channel multicarrier Transceiver - Part 3

Lecture 59 - Pseudo -circulant structure - Part 1

Lecture 60 - Pseudo -circulant structure - Part 2

Lecture 61 - MCM impairments and CP - Part 1

Lecture 62 - MCM impairments and CP - Part 2

Lecture 63 - Orthogonal Frequency Division Multiplexing - Part 1

Lecture 64 - Orthogonal Frequency Division Multiplexing - Part 2

Lecture 65 - Review of OFDM with CP

Lecture 66 - Review of Lec 1-28

Lecture 67 - OFDM applications - Quantization - Part 1

Lecture 68 - OFDM applications - Quantization - Part 2

Lecture 69 - Some more applications of MDSP

NPTEL : NOC:LDPC and Polar Codes in 5G Standard (Electrical Engineering)

Co-ordinators : Dr. Andrew Thangaraj

Lecture 1 - Additive White Gaussian Noise (AWGN) Channel and BPSK

Lecture 2 - Bit Error Rate (BER) and Signal to Noise Ratio (SNR)

Lecture 3 - Error Correction Coding in a Digital Communication System

Lecture 4 - Complementary Error Function

Lecture 5 - Simulation of Uncoded BPSK and BER v/s Eb/N0 plot Generation in MATLAB/Octave

Lecture 6 - n = 3 Repetition Code

Lecture 7 - Implementation of n = 3 Repetition Code in MATLAB

Lecture 8 - (7,4) Hamming Code

Lecture 9 - A Brief Introduction to Linear Block Codes

Lecture 10 - Simulation of (7,4) Hamming Code in MATLAB

Lecture 11 - Low Density Parity Check Codes: definition, properties and introduction to protograph construction

Lecture 12 - LDPC Codes in 5G: protograph, base matrix, expansion

Lecture 13 - Encoding LDPC codes in 5G

Lecture 14 - MATLAB programs for encoding LDPC codes

Lecture 15 - Log-Likelihood Ratio and Soft Input and Soft Output (SISO) Decoder for the Repetition Code

Lecture 16 - Soft Input and Soft Output (SISO) Decoder for the Single Parity Check (SPC) Code

Lecture 17 - Illustration of SISO decoder for (3,2) SPC code and min-sum approximation

Lecture 18 - SISO decoder for a general (n,n-1) SPC code

Lecture 19 - Soft-Input Soft-Output Iterative Message Passing Decoder for LDPC Codes

Lecture 20 - A Toy Example Illustration of the SISO MInsum Iterative Message Passing Decoder

Lecture 21 - Modifications to the Decoder: Layered Decoding and Offset

Lecture 22 - Implementation of SISO Layered Minsum Iterative Message Passing Decoder in MATLAB

Lecture 23 - Debugging and Improvements to the MATLAB Implementation

Lecture 24 - Rate Matching in LDPC Codes using Puncturing and Shortening

Lecture 25 - Implementation of Fixed Point Quantization and Offset Minsum in the Decoder

Lecture 26 - Introduction to Polar Codes: Polar Transform

Lecture 27 - Channel Polarization, Definition of (N,K) Polar Code and Encoding

Lecture 28 - MATLAB Implementation for Encoding Polar Codes

Lecture 29 - Successive Cancellation (SC) Decoder for Polar Codes: Illustration of its Building Blocks with N=2,4

Lecture 30 - Successive Cancellation (SC) Decoder for a General (N,K) Polar Code

Lecture 31 - MATLAB Implementation of Successive Cancellation Decoder - Part 1

Lecture 32 - MATLAB Implementation of Successive Cancellation Decoder - Part 2

Lecture 33 - Successive Cancellation List Decoding

Lecture 34 - Fixed Point Quantization for SC Decoder and LDPC Decoder

Lecture 35 - MATLAB Implementation of Successive Cancellation List Decoding

Lecture 36 - Rate Matching for LDPC codes

Lecture 37 - Performance Comparison of LDPC codes and Polar Codes in 5G

NPTEL : NOC:Electromagnetic Compatibility, EMC (Electrical Engineering)

Co-ordinators : Prof. Daniel Mansson, Prof. Rajeev Thottappillil

Lecture 1 - Introduction to EMC - Definitions

Lecture 2 - Introduction to EMC - Sources, units etc

Lecture 3 - Electromagnetic principles - Faraday's and Ampere's equations

Lecture 4 - Electromagnetic principles - Gauss's equation, boundary conditions

Lecture 5 - Electromagnetic principles - Uniform plane wave

Lecture 6 - Electromagnetic principles - Transmission lines

Lecture 7 - Electromagnetic principles - Dipoles

Lecture 8 - High-frequency behaviour of components - Conductors

Lecture 9 - High-frequency behaviour of components - Capacitors, inductors, resistors

Lecture 10 - High-frequency behaviour of components - Mechanical switches and transformers

Lecture 11 - Crosstalk or near-field coupling - Capacitive coupling, inductive coupling, common-impedance coupling

Lecture 12 - Crosstalk or near-field coupling - Crosstalk combinations

Lecture 13 - Crosstalk or near-field coupling - Coupling to shielded cables

Lecture 14 - Electromagnetic coupling in the far-field

Lecture 15 - Field Coupling - Exercises

Lecture 16 - Solutions to EMC problems - Lay out and control of interfaces

Lecture 17 - Solutions to EMC problems - Grounding or earthing

Lecture 18 - Solutions to EMC problems - Electromagnetic Shielding

Lecture 19 - Solutions to EMC problems - Electromagnetic Shielding (Continued...)

Lecture 20 - Solutions to EMC problems - Shielded cables

Lecture 21 - Solutions to EMC problems - Filters and Surge protectors

Lecture 22 - Lightning Protection - Introduction

Lecture 23 - Lightning protection - Currents, charges and fields

Lecture 24 - Lightning Protection - Buildings

Lecture 25 - Lightning Protection - Towers, Lightning safety

Lecture 26 - EMC Requirements and Standard, Testing and Difficulties - 1

Lecture 27 - EMC Requirements and Standard, Testing and Difficulties - 2

Lecture 28 - Intentional Electromagnetic Interference or IEMI - 1

Lecture 29 - Intentional Electromagnetic Interference or IEMI - 2

NPTEL : NOC:Mapping Signal Processing Algorithms to Architectures (Electrical Engineering)

Co-ordinators : Prof. Nitin Chandrachoodan

Lecture 1 - Introduction: Objectives and Pre-requisites

Lecture 2 - Review of digital logic

Lecture 3 - Timing and Power in digital circuits

Lecture 4 - Implementation Costs and Metrics

Lecture 5 - Example: Audio processing

Lecture 6 - Example: AlexNet

Lecture 7 - Architecture cost components

Lecture 8 - Examples of Architectures

Lecture 9 - Multi-objective Optimization

Lecture 10 - Number representation

Lecture 11 - Scientific notation and Floating point

Lecture 12 - Basic FIR filter

Lecture 13 - Serial FIR filter architectures

Lecture 14 - Simple programmable architecture

Lecture 15 - Block diagrams and SFGs

Lecture 16 - Dataflow Graphs

Lecture 17 - Iteration period

Lecture 18 - FIR filter iteration period

Lecture 19 - IIR filter iteration period

Lecture 20 - Computation Model

Lecture 21 - Constraint analysis for IPB computation

Lecture 22 - Motivational examples for IPB

Lecture 23 - General IPB computation

Lecture 24 - Sample period calculation

Lecture 25 - Parallel architecture

Lecture 26 - Odd-even register reuse

Lecture 27 - Power consumption

Lecture 28 - Pipelining

Lecture 29 - Time-invariant systems

Lecture 30 - Valid pipelining examples

Lecture 31 - Feedforward cutsets

Lecture 32 - Balanced pipeline

Lecture 33 - Retiming basic concept

Lecture 34 - Retiming basic concept

Lecture 35 - Example and uses of retiming

Lecture 36 - Resource sharing: adder example

Lecture 37 - Changing iteration period

Lecture 38 - Hardware assumptions and constraint analysis

Lecture 39 - Mathematical formulation

Lecture 40 - Examples with formulation

Lecture 41 - Example: Biquad filter

Lecture 42 - Hardware architecture

Lecture 43 - Review biquad folding sets

Lecture 44 - Complete biquad hardware

Lecture 45 - DEMO: FFT in Vivado HLS

Lecture 46 - DEMO: FFT synthesis

Lecture 47 - Obtaining a folding schedule

Lecture 48 - ASAP schedule

Lecture 49 - Utilization Efficiency

Lecture 50 - ALAP schedule

Lecture 51 - Iteration period bound and scheduling

Lecture 52 - Retiming for scheduling

Lecture 53 - Blocked schedules

Lecture 54 - Overlapped schedules

Lecture 55 - Improved blocked schedule

Lecture 56 - Allocation, Binding and Scheduling

Lecture 57 - DEMO: Analyze FFT implementation

Lecture 58 - DEMO: FFT interface

Lecture 59 - Scheduling: problem formulation

Lecture 60 - Example: differential equation solver

Lecture 61 - Heuristic approaches to scheduling

Lecture 62 - Mathematical formulation

Lecture 63 - ILP formulation

Lecture 64 - List scheduling

Lecture 65 - Hardware model

Lecture 66 - Force Directed Scheduling

Lecture 67 - DEMO: HLS on FFT

Lecture 68 - DEMO: FFT Simulation and Optimization

Lecture 69 - DEMO: CPU interfacing

Lecture 70 - Software Compilation

Lecture 71 - Optimization Examples

Lecture 72 - Loop optimizations - 1

Lecture 73 - Loop optimizations - 2

Lecture 74 - Loop optimizations - 3

Lecture 75 - Software pipelining - 1

Lecture 76 - Software pipelining - 2

Lecture 77 - FFT Optimization

Lecture 78 - Demo: Vivado setup

Lecture 79 - Background: CPUs and FPGAs

Lecture 80 - Demo: Vivado HLS FFT IP Export

Lecture 81 - Demo: Vivado ILA and VIO on hardware

Lecture 82 - Demo: FFT on FPGA board

Lecture 83 - Demo: Simulating SoC and SDK

Lecture 84 - Background: Understanding ELF files

Lecture 85 - On-chip communication basics

Lecture 86 - Many-to-Many communication

Lecture 87 - AXI bus handshaking

Lecture 88 - AXI bus (Continued...)

Lecture 89 - Demo: Microblaze processor on FPGA

Lecture 90 - Demo: Performance counter AXI peripheral

Lecture 91 - Demo: HW accelerator for FPGA

Lecture 92 - DMA and arbitration

Lecture 93 - Network-on-chip basics

Lecture 94 - NoC - Topologies and metrics

Lecture 95 - NoC - Routing

Lecture 96 - NoC - Switching and flow control

Lecture 97 - Systolic Arrays - Background

Lecture 98 - Systolic Arrays - Examples

Lecture 99 - CORDIC algorithm

Lecture 100 - Parallel implementation of FIR filters

Lecture 101 - Unfolding Transformation

Lecture 102 - Lookahead Transformation

Lecture 103 - Introduction to GPUs and Matrix multiplication

NPTEL : NOC:Linear System Theory (Electrical Engineering)

Co-ordinators : Prof. Ramakrishna Pasumarthi

Lecture 1 - Introduction to Linear Systems

Lecture 2 - System Models

Lecture 3 - System Models - Part 1

Lecture 4 - System Models - Part 2

Lecture 5 - General Representation

Lecture 6 - Sets, Functions and Fields

Lecture 7 - Linear Algebra - Vector Spaces and Metric Spaces

Lecture 8 - Linear Algebra - Span, Basis and Subspaces

Lecture 9 - Linear Algebra - Linear Maps and Matrices

Lecture 10 - Linear Algebra - Fundamental Subspaces and Rank-Nullity

Lecture 11 - Tutorial 1 on Linear Algebra

Lecture 12 - Linear Algebra - Change of Basis and Similarity Transformation

Lecture 13 - Linear Algebra - Invariant Subspaces, Eigen Values and Eigen Vectors

Lecture 14 - Linear Algebra - Diagonalization and Jordan Forms

Lecture 15 - Linear Algebra - Eigen Decomposition and Singular Value Decomposition

Lecture 16 - Tutorial 2 on Linear Algebra

Lecture 17 - Solutions to LTI Systems

Lecture 18 - State Transition Matrix for LTI systems

Lecture 19 - Forced Reponse of Continuous and Discrete LTI system

Lecture 20 - State Transition Matrix and Solutions to LTV systems

Lecture 21 - Equilibrium Points

Lecture 22 - Limit Cycles and Linearisation

Lecture 23 - Stability Analysis and Types of Stability

Lecture 24 - Lyapunov Stability

Lecture 25 - Stability of Discrete Time Systems

Lecture 27 - Controllability and Reachability

Lecture 28 - Controllability Matrix and Controllable Systems

Lecture 29 - Controllability Tests

Lecture 30 - Controllability of Discrete Time Systems

Lecture 31 - Controllable Decomposition

Lecture 32 - Stabilizability

Lecture 33 - Observability

Lecture 34 - Gramians and Duality

Lecture 35 - Observability for Discrete Time Systems and Observability Tests

Lecture 36 - Observable Decompositon and Detectability

Lecture 37 - Kalman Decomposition and Minimal Realisation

Lecture 38 - Canonical Forms and State Feedback Control

Lecture 39 - Control Design using Pole Placement

Lecture 40 - Tutorial for Modules 9 and 10

Lecture 41 - State Estimation and Output Feedback

Lecture 42 - Design of Observer and Observer based Controller

Lecture 43 - Optimal Control and Linear Quadratic Regulator (LQR)

Lecture 44 - Feedback Invariant and Algebraic Ricatti Equation

Lecture 45 - Tutorial for Module 11

Lecture 46 - Linear Matrix Inequalities

Lecture 47 - Properties of LMIs and Delay LMIs

NPTEL : NOC:Digital Signal Processing (Electrical Engineering)

Co-ordinators : C. S. Ramalingam

Lecture 1 - Signal Definition and Classification

Lecture 2 - Affine Transform

Lecture 3 - Recap of Affine Transform

Lecture 4 - Even and Odd Parts of a Signal

Lecture 5 - The Unit Step Sequence

Lecture 6 - The Unit Impulse

Lecture 7 - The Unit Impulse (Continued...)

Lecture 8 - Exponential Signals and Sinusoids

Lecture 9 - Sinusoids (Continued...)

Lecture 10 - When are two sinusoids independent?

Lecture 11 - Another Difference Between CT and DT Sinusoids

Lecture 12 - System definition and properties (linearity)

Lecture 13 - Time-invariance, memory, causality, and stability

Lecture 14 - LTI systems, impulse response, and convolution

Lecture 15 - Properties of convolution, system interconnections

Lecture 16 - Java applet demo of convolution

Lecture 17 - Systems governed by LCCDE

Lecture 18 - FIR and IIR systems

Lecture 19 - Karplus-Strong algorithm

Lecture 20 - Z-transform definition and RoC

Lecture 21 - Z-transform (Continued...)

Lecture 22 - Poles and zeros

Lecture 23 - Recursive implementation of FIR filters

Lecture 24 - Convergence criterion

Lecture 25 - Properties of the RoC

Lecture 26 - DTFT definition and absolute summability

Lecture 27 - Linearity

Lecture 28 - Delay

Lecture 29 - Exponential multiplication

Lecture 30 - Complex conjugation

Lecture 31 - Time reversal

Lecture 32 - Differentiation in the Z-domain

Lecture 33 - Convolution in the time domain

Lecture 34 - Relationship between x[n] and X(1)

Lecture 35 - Initial Value Theorem

Lecture 36 - Final Value Theorem

Lecture 37 - Multiplication in the time domain

Lecture 38 - Parseval's Theorem

Lecture 39 - Partial Fractions Method

Lecture 40 - Power series method

Lecture 41 - Contour Integral Method

Lecture 42 - Contour Integral Method (Continued...)

Lecture 43 - Inverse DTFT

Lecture 44 - DTFT of Sequences that are not absolutely summable

Lecture 45 - Response to cos(?_0 n+?)

Lecture 46 - Causality and Stability

Lecture 47 - Response to suddenly applied inputs

Lecture 48 - Introduction to frequency response

Lecture 49 - Magnitude response and its geometric interpretation

Lecture 50 - Magnitude Response (Continued...)

Lecture 51 - Response of a single complex zero/pole

Lecture 52 - Resonator and Improved Resonator

Lecture 53 - Notch filter

Lecture 54 - Moving Average Filter

Lecture 55 - Comb filter

Lecture 56 - Phase response of a single complex zero

Lecture 57 - Effect of crossing a unit circle zero, wrapped and unwrapped phase, resonator phase response

Lecture 58 - Allpass Filter

Lecture 59 - Group delay and its physical interpretation

Lecture 60 - Zero-phase filtering, effect on nonlinear phase on waveshape

Lecture 61 - Zero-Phase Filtering, Linear Phase - 1

Lecture 62 - Linear Phase - 2

Lecture 63 - Linear Phase - 3

Lecture 64 - Linear Phase - 3

Lecture 65 - Linear Phase - 3

Lecture 66 - Linear Phase - 4, Sampling - 1

Lecture 67 - Linear Phase - 4, Sampling - 1

Lecture 68 - Linear Phase - 4, Sampling - 1

Lecture 69 - Sampling - 2

Lecture 70 - Sampling - 3

Lecture 71 - Sampling - 4

Lecture 72 - Sampling - 4

Lecture 73 - Sampling - 4

Lecture 74 - The Discrete Fourier Transform - 1

Lecture 75 - The Discrete Fourier Transform - 1

Lecture 76 - The Discrete Fourier Transform - 2

Lecture 77 - The Discrete Fourier Transform - 3

Lecture 78 - The Discrete Fourier Transform - 3

Lecture 79 - The Discrete Fourier Transform - 3

Lecture 80 - The Discrete Fourier Transform - 4

Lecture 81 - The Discrete Fourier Transform - 4

Lecture 82 - The Discrete Fourier Transform - 4

NPTEL : NOC:Computational Electromagnetics (Electrical Engineering)

Co-ordinators : Prof. Uday Khankhoje

Lecture 1 - Chain rule of differentiation

Lecture 2 - Gradient, Divergence, and Curl operators

Lecture 3 - Common theorems in vector calculus

Lecture 4 - Corollaries of these theorems

Lecture 5 - Mathematical History

Lecture 6 - Different regimes of Maxwell's equations

Lecture 7 - Different ways of solving them

Lecture 8 - Maxwell's Equations

Lecture 9 - Boundary Conditions

Lecture 10 - Uniqueness Theorem

Lecture 11 - Equivalence Theorem

Lecture 12 - Simple Numerical Integration

Lecture 13 - Interpolating a Function

Lecture 14 - Gauss Quadrature

Lecture 15 - Line Charge Problem

Lecture 16 - Solving the Integral Equation

Lecture 17 - Basis Functions

Lecture 18 - Helmholtz Equation

Lecture 19 - Solving Helmholtz Equation

Lecture 20 - Huygen's principle and the Extinction theorem

Lecture 21 - Formulating the integral equations

Lecture 22 - Conclusions of surface integral equations

Lecture 23 - Motivations for Green's functions

Lecture 24 - A one-dimensional example

Lecture 25 - 1-D example: alternate representation

Lecture 26 - 2-D wave example : finding solution

Lecture 27 - 2-D wave example : boundary conds

Lecture 28 - 2-D example : Evaluating Constants - Part 1

Lecture 29 - 2-D example : Evaluating Constants - Part 2

Lecture 30 - 3-D example

Lecture 31 - Motivation for MoM

Lecture 32 - Linear Vector Spaces

Lecture 33 - Formulating Method of Moments

Lecture 34 - Surface Integral Equations: Recap

Lecture 35 - Surface Integral Equations: Evaluating the Integrals - Part 1

Lecture 36 - Surface Integral Equations: Evaluating the Integrals - Part 2

Lecture 37 - Surface Integral Equations: Conclusion

Lecture 38 - Volume Integral Equations:Setting Up

Lecture 39 - Volume Integral Equations:Solving - Part 1

Lecture 40 - Volume Integral Equations:Solving - Part 2

Lecture 41 - Volume Integral Equations:Summary

Lecture 42 - Surface integral equations for PEC

Lecture 43 - Surface v/s volume integral equations

Lecture 44 - Definition of radar cross-section

Lecture 45 - Computational Considerations

Lecture 46 - History and Overview of the FEM

Lecture 47 - Basic framework of FEM

Lecture 48 - 1D Basis Functions

Lecture 49 - 2D Basis Functions

Lecture 50 - Weak form of 1D-FEM - Part 1

Lecture 51 - Weak form of 1D-FEM - Part 2

Lecture 52 - Generating System of Equations for 1D FEM

Lecture 53 - 1D wave equation: Formulation

Lecture 54 - 1D Wave Equation: Boundary Conditions

Lecture 55 - 1D Wave Equation: Basis and testing functions

Lecture 56 - 1D Wave Equation: Matrix assembly

Lecture 57 - 2D FEM Shape Functions

Lecture 58 - Converting to Weak Form (2D FEM)

Lecture 59 - Radiation Boundary Condition

Lecture 60 - Total field formulation

Lecture 61 - Scattered field formulation

Lecture 62 - Comparing total and scattered field formulation

Lecture 63 - Matrix assembly - Part 1

Lecture 64 - Matrix assembly - Part 2

Lecture 65 - Computing Far Field

Lecture 66 - Numerical Aspects of 2D FEM

Lecture 67 - Summary of FEM Procedure

Lecture 68 - Introduction to FDTD

Lecture 69 - 2D FDTD Formulation : Stencil

Lecture 70 - 2D FDTD Formulation : Time Stepping

Lecture 71 - 2D FDTD Formulation : Divergence Conditions

Lecture 72 - Stability Criteria - Part 1

Lecture 73 - Stability Criteria - Part 2

Lecture 74 - Stability Criteria - Higher Dimensions

Lecture 75 - Accuracy Considerations - 1D

Lecture 76 - Accuracy Considerations - Higher Dimensions

Lecture 77 - Dealing with non-dispersive dielectric media

Lecture 78 - Dealing with dispersive dielectric media

Lecture 79 - Debye Model - Part 1

Lecture 80 - Debye Model - Part 2

Lecture 81 - Absorbing Boundary Conditions - 1D

Lecture 82 - Absorbing Boundary Conditions - 2D

Lecture 83 - Implementing ABC in FDTD

Lecture 84 - Failure of ABC

Lecture 85 - Perfectly Matched Layers (PML) - Introduction

Lecture 86 - Implementing PML using Coordinate Stretching

Lecture 87 - PML - Phase Matching

Lecture 88 - PML - Tangential Boundary Conditions

Lecture 89 - Perfectly Matched Interface

Lecture 90 - PML theory - Summary

Lecture 91 - Implementing PML into FDTD - Part 1

Lecture 92 - Implementing PML into FDTD - Part 2

Lecture 93 - Sources in FDTD - Currents

Lecture 94 - Sources in FDTD - Part 2

Lecture 95 - Summary of FDTD

Lecture 96 - MEEP : FDTD in action

Lecture 97 - Inverse Problems - Introduction

Lecture 98 - Inverse Problems - Mathematical Formulation

Lecture 99 - Inverse Problems - Challenges

Lecture 100 - Inverse Problems - Non-Linearity

Lecture 101 - Inverse Problems - Summary

Lecture 102 - Antennas - Potential formulation

Lecture 103 - Antennas - Hertz Dipole - Part 1

Lecture 104 - Antennas - Hertz Dipole - Part 2

Lecture 105 - Antennas - Radiation Patterns

Lecture 106 - Antennas - Motivation for CEM

Lecture 107 - Antennas - Pocklingtonâ€™s Integral Equation - Part 1

Lecture 108 - Antennas - Pocklingtonâ€™s Integral Equation - Part 2

Lecture 109 - Antennas - Source Modeling

Lecture 110 - Antennas - Circuit Model

Lecture 111 - Antennas - MoM details

Lecture 112 - Antennas - Mutual Coupling - Part 1

Lecture 113 - Antennas - Mutual Coupling - Part 2

Lecture 114 - Hybrid Methods - Motivation

Lecture 115 - Finite Element-Boundary Integral - Part 1

Lecture 116 - Finite Element-Boundary Integral - Part 2

Lecture 117 - Finite Element-Boundary Integral - Part 3

NPTEL : NOC:Transmission Lines and Electromagnetic Waves (Electrical Engineering)

Co-ordinators : Dr. Ananth Krishnan

Lecture 1 - Transmission lines

Lecture 2 - LosslessTransmission lines: Wave Equations

Lecture 3 - Introduction to finite difference method

Lecture 4 - Octave simulation of wave equation

Lecture 5 - Octave simulation of Telegrapher's equation

Lecture 6 - Reflections and reflection coefficient

Lecture 7 - AC signals in loss-less transmission lines

Lecture 8 - Transmission lines with losses

Lecture 9 - Octave simulation of Transmission lines with losses

Lecture 10 - Voltage reflection coefficient and standing wave ratio

Lecture 11 - Graphical representation of reflection coefficient

Lecture 12 - Impedance matching using Smith chart

Lecture 13 - Demonstration of Impedance matching using VNA

Lecture 14 - Transmission Line Limitations and Maxwell's Equation

Lecture 15 - Maxwell's Curl Equation

Lecture 16 - Octave simulation of an Electromagnetic Wave Equation

Lecture 17 - Polarisation of an Electromagnetic Wave

Lecture 18 - Octave Simulation of different types of Polarisation

Lecture 19 - Electromagnetic Waves in a conductive Medium

Lecture 20 - Plane Waves

Lecture 21 - Plane Waves at normal incidence

Lecture 22 - Plane waves at Oblique Incidence - I

Lecture 23 - Plane waves at Oblique Incidence - II

Lecture 24 - Plane waves at Oblique Incidence - III

Lecture 25 - Octave simulation of perpendicular polarisation

Lecture 26 - Octave simulation of perpendicular polarisation (Continued...)

Lecture 27 - Dielectric-ideal conductor interface

Lecture 28 - Parallel plate waveguide

Lecture 29 - Rectangular Waveguide

Lecture 30 - Octave simulation of modes of a Rectangular Waveguide

Lecture 31 - Phase Velocity and Group velocity

Lecture 32 - Octave simulation of Field pattern of a parellel plate waveguide

Lecture 33 - Cavity resonatorand Real life applications of waveguides and cavity

NPTEL : NOC:Digital IC Design (Electrical Engineering)

Co-ordinators : Prof. Janakiraman

Lecture 1 - Introduction - Digital IC Design

Lecture 2 - PN Junction

Lecture 3 - MOS Capacitor Threshold Voltage

Lecture 4 - MOS Transistor Current Expression

Lecture 5 - Body Effect and I-V Plots

Lecture 6 - Short Channel Transistors - Channel Length Modulation

Lecture 7 - Velocity Saturation and Level-1 SPICE Model

Lecture 8 - Drain Induced Barrier Lowering

Lecture 9 - Sub-Threshold Leakage

Lecture 10 - Substrate and Gate Leakage

Lecture 11 - The PMOS Transistor

Lecture 12 - Transistor Capacitance - 1

Lecture 13 - Transistor Capacitance - 2

Lecture 14 - CMOS Inverter Construction

Lecture 15 - Voltage Transfer Characteristics

Lecture 16 - Load Line Analysis

Lecture 17 - Trip Point for Short Channel Device Inverter

Lecture 18 - Trip Point for Long Channel Device Inverter

Lecture 19 - Noise Margin Analysis - 1

Lecture 20 - Noise Margin Analysis - 2

Lecture 21 - Noise Margin Analysis - 3

Lecture 22 - Noise Margin Analysis-Long Channel Device Inverter - 1

Lecture 23 - Noise Margin Analysis-Long Channel Device Inverter - 2

Lecture 24 - Pass Transistors

Lecture 25 - NMOS Transistor ON Resistance and Fall Delay

Lecture 26 - Elmore Delay Model

Lecture 27 - Inverter: Transient Response

Lecture 28 - Inverter: Dynamic Power

Lecture 29 - Inverter: Short Circuit Power

Lecture 30 - Inverter: Leakage Power and Transistor Stacks

Lecture 31 - Stacking Effect and Sleep Transistors

Lecture 32 - Ring Oscillators and Process Variations

Lecture 33 - Implementing Any Boolean Logic Function

Lecture 34 - Implementing Any Boolean Logic Function: Examples. Gate sizing

Lecture 35 - Gate Sizing

Lecture 36 - Logic Gate Capacitance

Lecture 37 - Gate Delay

Lecture 38 - Parasitic Delay

Lecture 39 - Gate Delay with a Load Capacitance

Lecture 40 - Logical Effort

Lecture 41 - Gate Delay

Lecture 42 - Path Delay Calculation and Optimization Formulation

Lecture 43 - Path Delay Optimization: Intuition

Lecture 44 - Path Delay Optimization: Example

Lecture 45 - Buffer Insertion

Lecture 46 - Input Ordering and Asymmetric Gates

Lecture 47 - Skewed Gates

Lecture 48 - Special Functions

Lecture 49 - Pseudo NMOS Logic

Lecture 50 - Pseudo NMOS Inverter

Lecture 51 - Pseudo NMOS Logical Effort and CVSL

Lecture 52 - Dynamic Circuits and Input Monotonicity

Lecture 53 - Domino Logic and Weak Keepers

Lecture 54 - Transmission Gate Logic

Lecture 55 - Gate Sizing for Large Circuits

Lecture 56 - Ripple Adder Introduction

Lecture 57 - Full Adder Circuit Implementation

Lecture 58 - Full Adder Optimization

Lecture 59 - Carry Skip Adder

Lecture 60 - Carry Select Adder

Lecture 61 - Linear and Square Root Carry Select Adder

Lecture 62 - Two's Complement Arithmetic

Lecture 63 - Two's Complement Sign Extension

Lecture 64 - Array Multiplier

Lecture 65 - Array Multiplier - Timing Analysis

Lecture 66 - Carry Save Multiplier

Lecture 67 - Carry Save Multiplier - Signed Multiplication

Lecture 68 - Introduction to Pipelining

Lecture 69 - Time Borrowing

Lecture 70 - Master Slave Flip Flop

Lecture 71 - Flop Timing Parameters

Lecture 72 - Alternate Circuit Implementations

Lecture 73 - Clock Overlap

Lecture 74 - C2MOS Flop

Lecture 75 - Flop Characterization

Lecture 76 - Max and Min Delay of Flop Based Systems

Lecture 77 - Flop Min Delay Constraint

Lecture 78 - Latch - Max and Min Delay Constraints

Lecture 79 - Latch - Timing Analysis with Skew

Lecture 80 - Time Borrowing

NPTEL : NOC:Power Management Integrated Circuits (Electrical Engineering)

Co-ordinators : Prof. Qadeer Ahmad Khan

Lecture 1 - Introduction to PMIC - Part 1

Lecture 2 - Introduction to PMIC - Part 2

Lecture 3 - Linear versus Switching Regulators

Lecture 4 - Performance Parameters of Regulators

Lecture 5 - Local vs Remote Feedback, Point of Load Regulators

Lecture 6 - Kelvin Sensing, Droop Compensation

Lecture 7 - Current Regulator Applications, Introduction to Bandgap Voltage References, PTAT and CTAT voltage

Lecture 8 - Adding PTAT and CTAT Voltages

Lecture 9 - Bandgap Voltage Reference Circuit, Brokaw Bandgap Circuit

Lecture 10 - Sub-1-volt Bandgap Circuit

Lecture 11 - Generating Multiple Reference Voltages; Applications of Linear Regulators

Lecture 12 - Designing a Linear Regulator, Negative and Positive Feedback

Lecture 13 - First-Order Systems, Phase Margin

Lecture 14 - Closed-Loop Response of Second-Order Systems

Lecture 15 - Relationship between Damping Factor and Phase Margin, Frequency Compensation, MOS Parasitic Capacitances

Lecture 16 - Finding the Poles of the Error Amplifier - Part 1

Lecture 17 - Finding the Poles of the Error Amplifier - Part 2

Lecture 18 - Dominant Pole Frequency Compensation

Lecture 19 - Dominant Pole Compensation at No-Load

Lecture 20 - Dominant Pole Compensation using Miller Effect, RHP zero due to Miller Capacitor

Lecture 21 - Intuitive Method of Finding the Poles, Pole Splitting after Miller Compensation

Lecture 22 - Effect of RHP zero on Stability, Mitigating the Effect of RHP zero, LDO with NMOS Pass Element

Lecture 23 - Output Impedance of PMOS LDO

Lecture 24 - Line Regulation and PSRR of PMOS LDO

Lecture 25 - PSRR of PMOS versus PSRR of NMOS LDO

Lecture 26 - Sources of Error in Linear and Switching Regulators

Lecture 27 - Offset in Amplifiers; Real Life Analogy; Static Offset Cancellation

Lecture 28 - Dynamic Offset Cancellation Techniques (Chopping, Auto-zeroing)

Lecture 29 - Digital LDO, Technique to Avoid Limit Cycle Oscillations in Digital LDO

Lecture 30 - Hybrid LDO, Short-Circuit Protection

Lecture 31 - Hiccup Mode and Foldback Current Limit

Lecture 32 - Introduction to Switching Regulators

Lecture 33 - volt-second Balance, Non-Idealities in the Power Stage of a Buck Converter

Lecture 34 - Transformer Model of a Buck Converter, Conduction Efficiency, Efficiency of an LDO versus Efficiency of a Switching Regulator

Lecture 35 - Synchronous versus Non-Synchronous Switching Regulators, PWM Control Techniques

Lecture 36 - Losses in Switching Regulators (Conduction Loss, Gate-Driver Switching Loss)

Lecture 37 - Dead-Time Switching Loss in DC-DC Converters

Lecture 38 - Hard Switching Loss in DC DC Converters

Lecture 39 - Magnetic Loss in DC-DC Converters, Relative Significance of Losses as a Function of the Load Current

Lecture 40 - Output Voltage Ripple of a Buck Converter

Lecture 41 - Choosing the Inductor and Capacitor for a Buck Converter

Lecture 42 - CCM Vs DCM Operation in DC DC Converters

Lecture 43 - CCM DCM Boundary Condition, Voltage Conversion Ratio in DCM

Lecture 44 - Concept of Pulse Frequency Modulation PFM

Lecture 45 - Classification of Pulse Width Modulators

Lecture 46 - DC - DC Converter Control Techniques, Stability Analysis of Voltage Mode Buck Converter - Part 1

Lecture 47 - Stability Analysis of Voltage Mode Buck Converter - Part 2

Lecture 48 - Stability Analysis of Voltage Mode Buck Converter - Part 3

Lecture 49 - Dominant Pole Compensation (Type-I with Gm-C Architecture)

Lecture 50 - Dominant Pole Compensation (Type-I with Op Amp-RC Architecture)

Lecture 51 - Introduction to Type-II Compensation

Lecture 52 - Type-II Compensator using Gm-C Architecture - Part 1

Lecture 53 - Type-II Compensator using Gm-C Architecture - Part 2

Lecture 54 - Type-II Compensator using Gm-C Architecture - Part 3

Lecture 55 - Type-II Compensator using Op Amp-RC Architecture

Lecture 56 - Introduction to Type-III Compensator

Lecture 57 - Type-III Compensator using Op Amp-RC Architecture

Lecture 58 - Simulation of DC-DC Converter with Type-III Compensator

Lecture 59 - Type-III Compensator using Gm-C Architecture

Lecture 60 - Feed-Forward Line Compensation, Loop Gain Compensation by Modulating Gm

Lecture 61 - Designing a Buck Converter, Power Loss Budgeting

Lecture 62 - Sizing Power MOSFETs

Lecture 63 - Estimating Switching Losses and Choosing the Switching Frequency

Lecture 64 - Choosing Inductance and Capacitance Values

Lecture 65 - Choosing 'C' Depending on Factors that Limit the Load Transient Response

Lecture 66 - Inductor and Capacitor Characteristics, Reducing the Effect of Capacitor ESL

Lecture 67 - Gate Buffer and Non-Overlap Clock Generator in Gate-Driver Circuit

Lecture 68 - Pulse-Width Modulator- Trailing Edge, Leading Edge and Dual Edge; Triangle Wave Generator

Lecture 69 - Average Ramp Voltage of Single-Edge PW Modulator,Design Considerations of EA

Lecture 70 - Delays Associated with PW Modulator, PFM and PSM Operation, DCM Operation using NMOS

Lecture 71 - Designing a Zero-Cross Comparator, Inverter-Based Auto-Zeroed Comparator, Simulation Demo

Lecture 72 - Current Mode Control- Peak, Valley, Emulated; VMC versus CMC; Sub-Harmonic Oscillation

Lecture 73 - Ramp-Adaptive Slope Compensation to Avoid Current Loop Instability

Lecture 74 - Non-Linear Control of DC-DC Converters, Phase-Shift between i_L and v_C

Lecture 75 - Stabilising a Voltage-Mode Hysteretic Converter using R_esr, Relation between F_sw and the Hysteresis Window

Lecture 76 - Hysteretic Converter - Simulation Demo

Lecture 77 - Current-Mode Hysteretic Converter, Using R-C as Ripple Generator

Lecture 78 - Controlling the Switching Frequency of a Hysteretic Converter, Delay in the Hysteretic Comparator

Lecture 79 - Frequency and Voltage Regulation Loops in a Fixed-Frequency Hysteretic Converter

Lecture 80 - Resetting the Capacitor Voltage in a Hysteretic Converter, Constant ON-Time Control

Lecture 81 - Introduction to Boost Converter, RHP Zero in a Boost Converter

Lecture 82 - Introduction to Buck-Boost Converter

Lecture 83 - Tri-Mode Buck-Boost Converter (Buck, Buck-Boost and Boost)

Lecture 84 - Boundary Conditions for Mode Transition in a Tri-Mode Buck-Boost Converter

Lecture 85 - Generating Buck and Boost Duty Cycles in a Tri-Mode Buck-Boost Converter

Lecture 86 - Introduction to Switched-Capacitor DC-DC Converters,Switched-Capacitor DC-DC Converter with V_o = 2*V_DD

Lecture 87 - Applications of Switched-Capacitor DC-DC Converters in Open-Loop, Regulating the Output using Feedback Control

Lecture 88 - H-Bridge Switched-Capacitor DC-DC Converter,SC DC-DC converter with Multiple Gain Settings

Lecture 89 - Current Sensing Techniques in DC-DC Converters

Lecture 90 - Analog Layout Techniques - Part 1

Lecture 91 - Analog Layout Techniques - Part 2

Lecture 92 - Digital Control of DC-DC Converters, ADC Architectures

Lecture 93 - Digital Pulse-Width Modulator Architectures, Adaptive Compensation

Lecture 94 - Limitations of Analog and Digital Controllers, Time-Based Controller for Buck Converter

Lecture 95 - Time-Based Controller for Buck Converter and for LDO, Issues with Time-Based Control

Lecture 96 - Multi-Phase DC-DC Converters

Lecture 97 - Dynamic Voltage and Frequency Scaling, Single Inductor Multiple Output (SIMO) DC-DC Converter

Lecture 98 - LCD/AMOLED Display Drivers - Part 1

Lecture 99 - LCD/AMOLED Display Drivers - Part 2

Lecture 100 - LCD/AMOLED Display Drivers - Part 3

Lecture 101 - LED Drivers for Camera Flash

Lecture 102 - Li-Ion Battery and its Charging Phases

Lecture 103 - Battery Charger IC

NPTEL : NOC:DC Power Transmission Systems (Electrical Engineering)

Co-ordinators : Prof. Krishna S

Lecture 1 - Course contents

Lecture 2 - Introduction

Lecture 3 - Historical developments

Lecture 4 - Power semiconductor devices

Lecture 5 - General converter configuration

Lecture 6 - Choice of converter configuration: Valve utilization factor

Lecture 7 - Choice of converter configuration: Transformer utilization factor

Lecture 8 - Converter configuration for pulse number equal to 6

Lecture 9 - Analysis of 6 pulse LCC neglecting inductance

Lecture 10 - Analysis of 6 pulse LCC neglecting inductance: Jumps in voltage across a valve

Lecture 11 - Analysis of 6 pulse LCC neglecting inductance: Average DC side voltage

Lecture 12 - Fourier series - Part 1

Lecture 13 - Fourier series - Part 2

Lecture 14 - Analysis of 6 pulse LCC neglecting inductance: DC side voltage harmonics

Lecture 15 - Analysis of 6 pulse LCC neglecting inductance: Fundamental and harmonic components of AC side current

Lecture 16 - Definitions: Delay angle, angle of advance, commutation margin angle

Lecture 17 - Commutation margin angle in a 6 pulse LCC neglecting inductance - Part 1

Lecture 18 - Commutation margin angle in a 6 pulse LCC neglecting inductance - Part 2

Lecture 19 - Instantaneous power on AC and DC sides in a 6 pulse LCC neglecting inductance

Lecture 20 - Average power on AC and DC sides in a 6 pulse LCC neglecting inductance

Lecture 21 - 6 pulse LCC with inductance

Lecture 22 - 2 and 3 valve conduction mode of 6 pulse LCC

Lecture 23 - 2 and 3 valve conduction mode of 6 pulse LCC: DC side voltage harmonics

Lecture 24 - 2 and 3 valve conduction mode of 6 pulse LCC: DC side voltage and voltage across a valve

Lecture 25 - 2 and 3 valve conduction mode of 6 pulse LCC: Fundamental and harmonic components of AC side current

Lecture 26 - Extinction angle

Lecture 27 - Extinction angle: Commutation margin angle for normal inverter operation of 6 pulse LCC

Lecture 28 - 3 and 4 valve conduction mode of 6 pulse LCC

Lecture 29 - Analysis of 3 and 4 valve conduction mode of 6 pulse LCC - Part 1

Lecture 30 - Analysis of 3 and 4 valve conduction mode of 6 pulse LCC - Part 2

Lecture 31 - Analysis of 3 and 4 valve conduction mode of 6 pulse LCC - Part 3

Lecture 32 - 3 valve conduction mode of 6 pulse LCC

Lecture 33 - Commutation margin angle

Lecture 34 - Normalization

Lecture 35 - Characteristics of 6 pulse LCC - Part 1

Lecture 36 - Characteristics of 6 pulse LCC - Part 2

Lecture 37 - Steady state analysis of a general LCC - Part 1

Lecture 38 - Steady state analysis of a general LCC - Part 2

Lecture 39 - Steady state analysis of a general LCC - Application to 6 pulse LCC

Lecture 40 - 6 pulse LCC with resistance included on the AC side

Lecture 41 - 6 pulse LCC with resistance, inductance and voltage source on the DC side - Part 1

Lecture 42 - 6 pulse LCC with resistance, inductance and voltage source on the DC side - Part 2

Lecture 43 - Power factor

Lecture 44 - Capacitor commutated converter - Part 1

Lecture 45 - Capacitor commutated converter - Part 2

Lecture 46 - 12 pulse LCC - Part 1

Lecture 47 - 12 pulse LCC - Part 2

Lecture 48 - Modes of operation of 12 pulse LCC

Lecture 49 - Purposes of transformer

Lecture 50 - Applications of DC transmission

Lecture 51 - Types of DC link: Monopolar

Lecture 52 - Types of DC link: Bipolar and homopolar

Lecture 53 - DC link control

Lecture 54 - DC link control: Control variables

Lecture 55 - Considerations that influence selection of control

Lecture 56 - Converter control characteristics

Lecture 57 - MTDC systens: Applications

Lecture 58 - Types of MTDC systems

Lecture 59 - Non-characteristic harmonics

Lecture 60 - Effect of firing angle errors

Lecture 61 - Problems with harmonics

Lecture 62 - Single tuned filter

Lecture 63 - Design of single tuned filter - Part 1

Lecture 64 - Design of single tuned filter - Part 2

Lecture 65 - Double tuned and damped filters

Lecture 66 - Reactive power requirement

Lecture 67 - Comparison of AC and DC transmission

NPTEL : NOC:Optical Engineering (Electrical Engineering)

Co-ordinators : Prof. Shanti Bhattacharya

Lecture 1 - Introduction to Optical Engineering

Lecture 2 - Geometric Optics Basics

Lecture 3 - Refraction at a single surface

Lecture 4 - Lab 1 Introduction to OSLO

Lecture 5 - Stops and Rays

Lecture 6 - Aperture stop - Part 1

Lecture 7 - Aperture stop - Part 2

Lecture 8 - Lab 2 OSLO

Lecture 9 - Imaging equation for thick lens using ABCD matrix

Lecture 10 - Ray Tracing Matrix - Part 1

Lecture 11 - Ray Tracing Matrix - Part 2

Lecture 12 - Principal Planes

Lecture 13 - Lab 3 OSLO

Lecture 14 - Tracing rays through optical pupils - Part 1

Lecture 15 - Tracing rays through optical pupils - Part 2

Lecture 16 - Aberrations

Lecture 17 - Monochromatic Aberrations - Part 1

Lecture 18 - Monochromatic Aberrations - Part 2

Lecture 19 - Lab 4 - OSLO

Lecture 20 - Chromatic Aberrations and Aberration correction

Lecture 21 - Aberration correction

Lecture 22 - Revisiting Ray intercept curves

Lecture 23 - Lab 5 - OSLO

Lecture 24 - Interesting Geometric phenomena and applications

Lecture 25 - Gaussian beams introduction

Lecture 26 - Gaussian beams

Lecture 27 - Lab 6 - OSLO

Lecture 28 - ransformation of a Gaussian beam

Lecture 29 - Transformation of a Gaussian beam due to a lens and a mirror

Lecture 30 - Application of Gaussian beam equations

Lecture 31 - Interferometry basics

Lecture 32 - Interferometry basics - Part 1

Lecture 33 - Introduction to Python

Lecture 34 - Python - Part 2

Lecture 35 - Introduction to Matlab

Lecture 36 - Interferometry basics - Part 2

Lecture 37 - Python - Part 3

Lecture 38 - Matlab tutorial on interference

Lecture 39 - Applications of interference - Part 1

Lecture 40 - Holography

Lecture 41 - Applications of interference

Lecture 42 - Applications of Optical Engineering

Lecture 43 - Diffractive Optics

Lecture 44 - Diffraction Grating

NPTEL : NOC:Nonlinear System Analysis (Electrical Engineering)

Co-ordinators : Dr. Arun D. Mahindrakar, Prof. Ramkrishna Pasumarthy

Lecture 1 - Examples of Nonlinear Physical Systems

Lecture 2 - Math Preliminaries - Part 1

Lecture 3 - Math Preliminaries - Part 2

Lecture 4 - Math Preliminaries - Part 3

Lecture 5 - Lipschitz Continuity and Contraction Mapping Theorem - Part 1

Lecture 6 - Lipschitz Continuity and Contraction Mapping Theorem - Part 2

Lecture 7 - Lipschitz Continuity and Contraction Mapping Theorem - Part 3

Lecture 8 - Existence and Uniqueness Theorem of ODE - Part 1

Lecture 9 - Existence and Uniqueness Theorem of ODE - Part 2

Lecture 10 - Existence and Uniqueness Theorem of ODE - Part 3

Lecture 11 - Existence and Uniqueness Theorem of ODE - Part 4

Lecture 12 - Equilibrium Points

Lecture 13 - Phase Portrait - Part 1

Lecture 14 - Phase Portrait - Part 2

Lecture 15 - Phase Portrait - Part 3

Lecture 16 - Phase portrait of Nonlinear Systems: Examples

Lecture 17 - Limit Cycles

Lecture 18 - Limit Cycles - Examples - Part 1

Lecture 19 - Limit Cycles - Examples - Part 2

Lecture 20 - Introduction to Bifurcation Theory - 1

Lecture 21 - Introduction to Bifurcation Theory - 2

Lecture 22 - Necessary and Sufficient Conditions for Local Bifurcation

Lecture 23 - Problems on Bifurcation Theory.

Lecture 24 - Stability Notions: Lyapunov and LaSalle's theorem - Part 1

Lecture 25 - Stability Notions: Lyapunov and LaSalle's theorem - Part 2

Lecture 26 - Stability Notions: Lyapunov and LaSalle's theorem - Part 3

Lecture 27 - Stability Notions: Lyapunov and LaSalle's theorem - Part 4

Lecture 28 - Stability Analysis and types of stability

Lecture 29 - Lypaunov Stability

Lecture 30 - Supplementary lecture: Comparison Lemma and Lyapunov Stability

Lecture 31 - Center Manifold Theorem

Lecture 32 - Interconnection between non linearity and a linear system - Sector Nonlinearities And Aizermannâ€™s conjecture

Lecture 33 - Counter example for Aizermannâ€™s conjecture

Lecture 34 - Passivity inspiration - passive circuits - dissipation equality

Lecture 35 - Dissipative Equality for circuit (Continued...)

Lecture 36 - PR condition for passivity of SISO system

Lecture 37 - Examples of PR transfer functions

Lecture 38 - Relation between storage function and Lyapunov function - PR Lemma

Lecture 39 - Proof of PR Lemma

Lecture 40 - Proof (Continued...) using spectral factorization theorem

Lecture 41 - PR definition for MIMO case

Lecture 42 - PSD Storage function in PR Lemma and how to make it PD (strictly PR)

Lecture 43 - KYP Theorem

Lecture 44 - Passivity preservation under interconnection

Lecture 45 - Aizermannâ€™s conjecture under passivity assumption is true

Lecture 46 - Sector Nonlinearities and need for generlaizing KYP Lemma

Lecture 47 - Need for Loop transformations

Lecture 48 - Loop Transformations - Part 1

Lecture 49 - Loop Transformations - Part 2

Lecture 50 - Circle criterion for PR

Lecture 51 - Examples based on circle criterion and stability under circle transformations

NPTEL : NOC:Signals and Systems (Electrical Engineering)

Co-ordinators : Prof. Kushal K. Shah

Lecture 1 - Real and Complex Number

Lecture 2 - Sinusoid and Phasor

Lecture 3 - Limits and Continuity

Lecture 4 - Differentiation and Integration

Lecture 5 - Lâ€™Hospitalâ€™s Rule

Lecture 6 - LTI System Examples; Impedance

Lecture 7 - Dirac Delta function; Impulse

Lecture 8 - Continuous and Discrete Time Systems

Lecture 9 - Even Signal; Odd Signal

Lecture 10 - Orthogonality of Signals

Lecture 11 - Shifting and Scaling in Continuous Time - I

Lecture 12 - Shifting and Scaling in Continuous Time - II

Lecture 13 - Shifting and Scaling in Discrete Time

Lecture 14 - Signal and Noise

Lecture 15 - Signals in the Physical World

Lecture 16 - Signals and Sensory Perception

Lecture 17 - Frequency Domain Representation

Lecture 18 - Definition of Fourier Transform

Lecture 19 - Fourier Transform : Examples I

Lecture 20 - Dirichlet Conditions

Lecture 21 - Inverse Fourier Transform

Lecture 22 - Fourier Transform : Examples II

Lecture 23 - Frequency-Time Uncertainty Relation

Lecture 24 - Fourier Transform : Linearity, Time Shifting and Time Scaling

Lecture 25 - Fourier Transform : Derivative Property

Lecture 26 - Fourier Transform : Multiplication and Convolution Property

Lecture 27 - Fourier Transform : Integral Property

Lecture 28 - Fourier Transform : Example III

Lecture 29 - Fourier Transform : Example IV

Lecture 30 - Fourier Transform of Noise

Lecture 31 - Types of Noise

Lecture 32 - Overview of Systems and General Properties

Lecture 33 - Linearity and Time Invariance

Lecture 34 - LTI System Examples

Lecture 35 - Frequency Response of RLC circuits - I

Lecture 36 - Frequency Response of RLC circuits - II

Lecture 37 - LCCDE Representation of Continuous-Time LTI Systems

Lecture 38 - Frequency Domain Representation of LCCDE Systems

Lecture 39 - Time Domain Representation of LTI Systems

Lecture 40 - Continuous-Time Convolution Integral

Lecture 41 - Continuous-Time Convolution : Example I

Lecture 42 - Continuous-Time Convolution : Example II

Lecture 43 - Continuous-Time Convolution : Example III

Lecture 44 - LTI Systems : Commutative, Distributive and Associative

Lecture 45 - LTI Systems : Memorylessness and Invertibility

Lecture 46 - LTI Systems : Causality and Stability

Lecture 47 - Fourier Transform in Complex Frequency Domain

Lecture 48 - Laplace Transform : Poles and Zeros

Lecture 49 - Laplace Transform : Region of Convergence [ROC]

Lecture 50 - Laplace Transform : Examples I

Lecture 51 - Laplace Transform : Examples II

Lecture 52 - Laplace Analysis of LTI Systems

Lecture 53 - Laplace Analysis of RLC Circuits - I

Lecture 54 - Laplace Transform : Linearity, Shifting and Scaling

Lecture 55 - Laplace Transform : Derivative and Integral

Lecture 56 - Laplace Transform : Causality and Stability

Lecture 57 - Laplace Analysis of LTI Systems : Example I

Lecture 58 - Laplace Analysis of LTI Systems : Example II

Lecture 59 - Laplace Analysis of First Order RLC Circuits

Lecture 60 - Laplace Analysis of Second Order RLC Circuits

Lecture 61 - Fourier Transform of Periodic Signals

Lecture 62 - Fourier Series Representation in Continuous-Time

Lecture 63 - Fourier Series Properties - I

Lecture 64 - Fourier Series Properties - II

Lecture 65 - LTI System Response for Periodic Input Signal

Lecture 66 - Fourier Series in Continuous-Time : Examples I

Lecture 67 - Fourier Series in Continuous-Time : Examples II

Lecture 68 - Discrete-Time Convolution Sum

Lecture 69 - Discrete-Time Convolution Sum Examples and Properties

Lecture 70 - LCCDE Representation of Discrete-Time LTI Systems

Lecture 71 - Impulse Train Sampling

Lecture 72 - Reconstruction of Continuous-Time Signal

Lecture 73 - Nyquist Sampling Theorem and Aliasing

Lecture 74 - Fourier Transform of Sampled Signals

Lecture 75 - DTFT : Examples I

Lecture 76 - DTFT Properties I: Periodicity, Linearity, Time/Frequency shifting, and Conjugation

Lecture 77 - DTFT Properties II: Differencing and Accumulation in Time Domain, Differentiation in Frequency Domain

Lecture 78 - DTFT Properties III: Time Reversal, Time Expansion, Convolution and Parsevaalâ€™s Relation

Lecture 79 - DTFT : Examples II

Lecture 80 - DTFT in Complex Frequency Domain

Lecture 81 - Z-Transform : Properties of ROC

Lecture 82 - Z-Transform Properties I: Linearity, Time-Shifting, Time-Expansion, Time-Reversal, and Z-Scaling

Lecture 83 - Z-Transform Properties II: Conjugation and Convolution

Lecture 84 - Z-Transform Properties III: Causality and Stability

Lecture 85 - Z-Transform : Examples I

Lecture 86 - Z-Transform : Examples II

Lecture 87 - Block Diagram Representation

NPTEL : NOC:Linear Dynamical Systems (Electrical Engineering)

Co-ordinators : Prof. Tushar Jain

Lecture 1 - Response and state-space solution of Linear systems

Lecture 2 - Solution of LTV systems

Lecture 3 - Solution of LTI systems

Lecture 4 - Equivalent State Equations

Lecture 5 - Realization of LTI and LTV Systems

Lecture 6 - Tutorial - 1

Lecture 7 - Introduction to Stability Analysis

Lecture 8 - Lyapunov Stability - Part I

Lecture 9 - Lyapunov Stability - Part II

Lecture 10 - Proof of lyapunov stability theorem

Lecture 11 - BIBO vs Lyapunov Stability

Lecture 12 - BIBO vs Lyapunov Stability

Lecture 13 - Tutorial - 2

Lecture 14 - Introduction to Controllability

Lecture 15 - Reachability and Controllability Gramians

Lecture 16 - Controllability Matrix

Lecture 17 - Discrete-time Reachability and Controllability Gramians

Lecture 18 - Tests for controllability - I

Lecture 19 - Tests for controllability - II

Lecture 20 - Tutorial - 3

Lecture 21 - Tests for controllability - III

Lecture 22 - Tests for controllability - IV

Lecture 23 - Controllable Decomposition - I

Lecture 24 - Stabilizable Systems

Lecture 25 - Tests for Stabilizability

Lecture 26 - Tutorial - 4

Lecture 27 - State Feeback - I

Lecture 28 - State Feeback - II

Lecture 29 - Lyapunov Method of State Feedback Design

Lecture 30 - Regulation and Tracking

Lecture 31 - Tutorial - 5

Lecture 32 - Robust Tracking and Disturbance Rejection

Lecture 33 - State Feedback design for Multi-input systems

Lecture 34 - Linear Quadratic Regulator

Lecture 35 - Tutorial - 6

Lecture 36 - Output feedback and observability

Lecture 37 - Duality and Observability tests

Lecture 38 - Decompostions and Detectability

Lecture 39 - Minimal Realisations

Lecture 40 - Observer Design and Output Feedback

Lecture 41 - Observer Design and Output Feedback

Lecture 42 - UIO

Lecture 43 - Tutorial - 7 and 8 (combined)

NPTEL : NOC:A brief Introduction of Micro-Sensors (Electrical Engineering)

Co-ordinators : Prof. Santanu Talukder

Lecture 1 - Introduction to Microscale Sensors or MEMS

Lecture 2 - Scaling effect

Lecture 3 - Some Simple Mechanics

Lecture 4 - Basic Mechanics - Part 1

Lecture 5 - Basic Mechanics - Part 2

Lecture 6 - Basic Mechanics - Part 3

Lecture 7 - Electrostatics

Lecture 8 - Electrostatic force

Lecture 9 - Coupled electromechanics

Lecture 10 - Stiction

Lecture 11 - Si crystal structure

Lecture 12 - Si etching

Lecture 13 - KOH etching

Lecture 14 - TMAH etching

Lecture 15 - Deposition and Lithography

Lecture 16 - Lithography

Lecture 17 - Pressure sensor types, membrane, Piezoelectric sensing, capacitive sensing

Lecture 18 - Pressure Sensor - II

Lecture 19 - Pressure Sensor - III

Lecture 20 - Accelerometer - I

Lecture 21 - Accelerometer - II

Lecture 22 - Assignment 1

Lecture 23 - Assignment 2

NPTEL : NOC:Fiber Optic Communication Technology (Electrical Engineering)

Co-ordinators : Prof. Deepa Venkitesh

Lecture 1 - Introduction to FOCT: Prerequisites, Course Content and Learning Outcomes

Lecture 2 - Communication through the ages

Lecture 3 - Communication: Basics - 1

Lecture 4 - Communication: Basics - 2

Lecture 5 - Digital Communication for Optical Communication

Lecture 6 - Digital modulation: Basics - 2

Lecture 7 - Digital modulation: Basics - 3

Lecture 8 - Optical communication system

Lecture 9 - Assignment Discussion - Week 1

Lecture 10 - Optical Sources

Lecture 11 - Semiconductor gain media- structure, spectrum

Lecture 12 - Optical sources: LED

Lecture 13 - External Quantum Efficiency

Lecture 14 - Modulation Bandwidth of LED

Lecture 15 - Optical and Electrical Bandwidth of LED

Lecture 16 - Emission Pattern of LED

Lecture 17 - Optical Sources: Laser Diodes over LEDs

Lecture 18 - Laser Diodes: Resonator Concepts 1a

Lecture 19 - Laser Diodes: Resonator Concepts 1b

Lecture 20 - Laser Diodes: Resonator Concepts 1c

Lecture 21 - Assignment Discussion - Week 2

Lecture 22 - Laser Diodes: Gain Coefficient

Lecture 23 - Laser Diodes: Photon life time

Lecture 24 - Laser rate equation: Steady State solution1

Lecture 25 - Laser rate equation: LI Chara

Lecture 26 - Laser power derivation

Lecture 27 - Modulation Response of Laser - 1

Lecture 28 - Modulation Response of Laser - 2

Lecture 29 - Modulation Response of Laser - 3

Lecture 30 - Setbacks of direct modulation of laser: Modulation Chirp

Lecture 31 - Setbacks of direct modulation of laser: Transcient Chirp

Lecture 32 - Assignment Discussion - Week 3

Lecture 33 - Recap of direction modulation consequences

Lecture 34 - Noise in Lasers

Lecture 35 - Relative Intensity Noise

Lecture 36 - Laser Phase Noise - 1

Lecture 37 - Laser Phase Noise - 2

Lecture 38 - Effect of Laser Phase Noise: A case study

Lecture 39 - Electro-optic phase modulation

Lecture 40 - Electro-optic intensity modulator

Lecture 41 - Biasing of MZM: BPSK Generation

Lecture 42 - Biasing of MZM: QPSK and 16 QAM Generation

Lecture 43 - Line coding schemes and their bandwidth requirements

Lecture 44 - Assignment Discussion - Week 4

Lecture 45 - Introduction to optical Fiber

Lecture 46 - Attenuation in optical fibers

Lecture 47 - Fiber Modes

Lecture 48 - Modes of a step index fiber - 1

Lecture 49 - Modes of a step index fiber - 2

Lecture 50 - Modes of a step index fiber - 3

Lecture 51 - Modes of a step index fiber - 4

Lecture 52 - Modes of a step index fiber - 5

Lecture 53 - Modes and Cut-off conditions

Lecture 54 - Universal b-V curves

Lecture 55 - Modal Profiles in step index fiber

Lecture 56 - Mode Field Diameter

Lecture 57 - Dispersion- Intermodal dispersion derivation

Lecture 58 - Dispersion-Bit rate distance Product

Lecture 59 - Phase Velocity and Group Velocity - 1

Lecture 60 - Phase Velocity and Group Velocity - 2

Lecture 61 - Material dispersion

Lecture 62 - Waveguide dispersion

Lecture 63 - Total Dispersion in optical fiber

Lecture 64 - Polarization mode dispersion

Lecture 65 - Photodetectors concepts

Lecture 66 - p-n and p-i-n Photodetectors

Lecture 67 - Avalance Photodetector

Lecture 68 - Direct detection receiver and sources of noise

Lecture 69 - Quantifying noises in direct detection receivers

Lecture 70 - SNR and Operation Regimes

Lecture 71 - Noise Equivalent power and SNR in APDs

Lecture 72 - Coherent Receivers

Lecture 73 - SNR analysis of coherent receivers

Lecture 74 - Performance Evaluation - 1

Lecture 75 - Performance Evaluation - 2

Lecture 76 - Performance Metrics: BER,Q, and Receiver Sensitivity

Lecture 77 - Performance Metrics:Q and SNR

Lecture 78 - Quantum limit of photodetection

Lecture 79 - Optical Amplifier

Lecture 80 - Erbium doped fiber amplifier - 1

Lecture 81 - Erbium doped fiber amplifier - 2

Lecture 82 - Erbium doped fiber amplifier - 3

Lecture 83 - Erbium doped fiber amplifier - 4

Lecture 84 - Link Design - Rise Time Budget

Lecture 85 - Link Design - Case Study

Lecture 86 - Link Design - Passive Optical Network and long haul link

Lecture 87 - Dispersion - Recap

Lecture 88 - Dispersion Compensation - Pulse Propagation with disperison

Lecture 89 - Pulse propagation - 2

Lecture 90 - Dispersion Compensation - Dispersion Transfer Function

Lecture 91 - Dispersion Compensation - Case Study

Lecture 92 - Dispersion COmpensation - WDM and DSP

Lecture 93 - Nonlinear Effects- Nonlinear refractive Index

Lecture 94 - Self Phase Modulation

Lecture 95 - Cross Phase Modulation

Lecture 96 - Scattering Processes in optical fibers

Lecture 97 - Stimulated Brillouin Scattering

Lecture 98 - Stimulated Raman Scattering

Lecture 99 - Components - Directional Couplers

Lecture 100 - Components - VOA, Polariser, Polarisation Controllers

Lecture 101 - Components - Isolator

Lecture 102 - Components - Circulator, Definitions

Lecture 103 - Components - Wavelength filters

Lecture 104 - Components - Arrayed Waveguide Gratings, WSS

Lecture 105 - Balanced Detection

Lecture 106 - Polarisation Diverse Coherent Receiver

Lecture 107 - Phase and Polarisation Diverse Coherent Reciever

Lecture 108 - Overview of impairments in coherent optical communication

Lecture 109 - Transceiver impairments - Generation and Compensation

Lecture 110 - Channel Impairments - Generation and Compensation

Lecture 111 - Demo video

Lecture 112 - Introduction to Optical Networks

Lecture 113 - Layers of Optical Network

Lecture 114 - SDH/SONET Layering, Frame Structure

Lecture 115 - Physical Networks Topologies

Lecture 116 - Topology specific Link Design

Lecture 117 - Network Protection

Lecture 118 - Access Networks- PON

Lecture 119 - Optical Interconnects, Data Centers

Lecture 120 - Optical communication for Wireless Fronthauling

NPTEL : NOC:Image Signal Processing (Electrical Engineering)

Co-ordinators : Prof. A. N. Rajagopalan

Lecture 1 - Course Introduction

Lecture 2 - Applications of Image processing

Lecture 3 - Applications of Image processing (Continued...)

Lecture 4 - Basics of Images

Lecture 5 - Shot Noise

Lecture 6 - Geometric Transformations

Lecture 7 - Geometric Transformations (Continued...)

Lecture 8 - Bilinear Interpolation

Lecture 9 - Geometric Transformations (Continued...)

Lecture 10 - Projective Transformation

Lecture 11 - Homography

Lecture 12 - Homography - Special cases

Lecture 13 - Computing Homography

Lecture 14 - RANSAC

Lecture 15 - Rotational Homography

Lecture 16 - Research Challenges

Lecture 17 - Real Aperture Camera

Lecture 18 - Real aperture camera - Introduction

Lecture 19 - Cricle of confusion

Lecture 20 - Depth of field, Linearity

Lecture 21 - Space-Invariance

Lecture 22 - 2D Convolution

Lecture 23 - 2D Convolution

Lecture 24 - Blur Models

Lecture 25 - Space-variant Blurring

Lecture 26 - Shape from X - Introduction

Lecture 27 - 2-View Stereo

Lecture 28 - Introduction to Shape from Focus

Lecture 29 - SFF Principle

Lecture 30 - Shape from focus - Gaussian fitting

Lecture 31 - Shape from focus - Focus operators

Lecture 32 - Shape from Focus - Examples

Lecture 33 - Shape from Focus - Tensor Voting

Lecture 34 - DFD Principle

Lecture 35 - Motion Blur

Lecture 36 - Image Transforms - Introduction

Lecture 37 - Image Transforms - Motivation

Lecture 38 - 1D Unitary Transforms - Introduction

Lecture 39 - Extending 1D Unitary Transform to 2D - Motivation

Lecture 40 - Extending 1D Unitary Transform to 2D - Example

Lecture 41 - Alternative Forms of 2D

Lecture 42 - Kronecker Product

Lecture 43 - Kronecker Product - (Example Revisited)

Lecture 44 - Extending 1D Unitary Transform to 2D - Summary

Lecture 45 - 1D DFT to 2D DFT

Lecture 46 - 2D DFT Visualization

Lecture 47 - 2D DFT - Computation

Lecture 48 - 1D DCT - Definition, Motivation

Lecture 49 - Relation to DFT

Lecture 50 - 2D DCT and Walsh-Haddamard Transform

Lecture 51 - Data Dependent Transforms, Karhunen Loeve Transform

Lecture 52 - Karhunen-Loeve Transform (KLT) - Concept

Lecture 53 - Karhunen-Loeve Transform (KLT) - Applications

Lecture 54 - Karhunen-Loeve Transform (KLT) - Applications

Lecture 55 - Singular Value Decomposition (SVD)

Lecture 56 - Applications of SVD

Lecture 57 - Change detection

Lecture 58 - Image Thresholding

Lecture 59 - Adaptive Local thresholding - Motivation

Lecture 60 - Chow-Kaneko Local thresholding

Lecture 61 - K-Means Method

Lecture 62 - ISODATA Method

Lecture 63 - Theory of Histogram Equalization and Modification

Lecture 64 - Histogram Equalization example

Lecture 65 - Image sequence and Single image filtering in Gaussian noise

Lecture 66 - Non-local Means Method

Lecture 67 - Non-local Means Filtering (Examples)

Lecture 68 - Impulse Noise Generator

Lecture 69 - Impulse noise filtering

Lecture 70 - Transform Domain Filtering

Lecture 71 - Illumination Handling

Lecture 72 - Applications of Restoration, and Image Deblurring

Lecture 73 - Haddamard's conditions and Least squares solution

Lecture 74 - Min-norm solution and Norm of Linear operator

Lecture 75 - Numerical stability analysis

Lecture 76 - Image Deblurring

Lecture 77 - Tikhonov-Miller Regularization

Lecture 78 - Conditional Mean as an Estimator

Lecture 79 - Linear Estimator

Lecture 80 - Wiener Filter

Lecture 81 - Fourier Wiener Filter

Lecture 82 - 1D Superresolution

Lecture 83 - Superresolution Examples

NPTEL : NOC:Fundamentals of Electric Vehicles: Technology and Economics (Electrical Engineering)

Co-ordinators : Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan

Lecture 1 - Overview of Electric Vehicles in India

Lecture 2 - Can India Drive its EV program Innovatively and Differently and scale? - Part 1

Lecture 3 - Can India Drive its EV program Innovatively and Differently and scale? - Part 2

Lecture 4 - A bit about batteries

Lecture 5 - Charging and Swapping Infrastructure

Lecture 6 - Where will we get Lithium for batteries?

Lecture 7 - EV Subsystems

Lecture 8 - Forces acting when a vehicle move

Lecture 9 - Aerodynamic drag, Rolling Resistance and Uphill Resistance

Lecture 10 - Power and Torque to accelerate

Lecture 11 - Putting it all together - 1

Lecture 12 - Putting it all together - 2

Lecture 13 - Concept of Drive Cycle - 1

Lecture 14 - Concept of Drive Cycle - 2

Lecture 15 - Drive Cycles and Energy used per km - Part 1

Lecture 16 - Drive Cycles and Energy used per km - Part 2

Lecture 17 - EV Subsystem: Design of EV Drive Train - Part 1

Lecture 18 - EV Subsystem: Design of EV Drive Train - Part 2

Lecture 19 - Introduction to Battery Parameters - Part 1

Lecture 20 - Introduction to Battery Parameters - Part 2

Lecture 21 - Why Lithium Ion Battery? - Part 1

Lecture 22 - Why Lithium Ion Battery? - Part 2

Lecture 23 - Batteries in Future

Lecture 24 - Li-Ion Battery Cells

Lecture 25 - SoH and SoC estimation and Self Discharge - Part 1

Lecture 26 - SoH and SoC estimation and Self Discharge - Part 2

Lecture 27 - Battery Pack Development - Part 1

Lecture 28 - Battery Pack Development - Part 2

Lecture 29 - Computation of Effective cost of battery - Part 1

Lecture 30 - Computation of Effective cost of battery - Part 2

Lecture 31 - Charging Batteries

Lecture 32 - Fundamentals of Battery Pack Design

Lecture 33 - Mechanical Design - Part 1

Lecture 34 - Mechanical Design - Part 2

Lecture 35 - Mechanical Design - Part 3

Lecture 36 - Mechanical Design - Part 4

Lecture 37 - Thermal Design - Part 1

Lecture 38 - Thermal Design - Part 2

Lecture 39 - Thermal Design - Part 3

Lecture 40 - Thermal Design - Part 4

Lecture 41 - Electrical Design - Part 1

Lecture 42 - Electrical Design - Part 2

Lecture 43 - Electrical Design - Part 3

Lecture 44 - BMS Design of Electic Vehicle - Part 1

Lecture 45 - BMS Design of Electic Vehicle - Part 2

Lecture 46 - BMS Design of Electic Vehicle - Part 3

Lecture 47 - EV Motors and Controllers - Understanding Flow - Part 1

Lecture 48 - EV Motors and Controllers - Understanding Flow - Part 2

Lecture 49 - Power and Efficiency

Lecture 50 - Torque Production - Part 1

Lecture 51 - Torque Production - Part 2

Lecture 52 - Torque Production - Part 3

Lecture 53 - Speed and Back EMF

Lecture 54 - The d-q Equivalent circuit - Part 1

Lecture 55 - The d-q Equivalent circuit - Part 2

Lecture 56 - Field-oriented Control

Lecture 57 - Three phase AC - Part 1

Lecture 58 - Three phase AC - Part 2

Lecture 59 - Thermal Design - Part 1

Lecture 60 - Thermal Design - Part 2

Lecture 61 - Engineering Considerations - Part 1

Lecture 62 - Engineering Considerations - Part 2

Lecture 63 - Future Frontiers

Lecture 64 - EV Chargers: Introduction

Lecture 65 - EV Chargers: Slow or Fast - Part 1

Lecture 66 - EV Chargers: Slow or Fast - Part 2

Lecture 67 - Battery Swapping

Lecture 68 - Standardization and On board Chargers

Lecture 69 - Public Chargers - Part 1

Lecture 70 - Public Chargers - Part 2

Lecture 71 - Bulk Chargers/Swap Stations - Part 1

Lecture 72 - Bulk Chargers/Swap Stations - Part 2

Lecture 73 - Economics of Public Chargers in context

Lecture 74 - Analytics - Part 1

Lecture 75 - Analytics - Part 2

Lecture 76 - Course Summary

NPTEL : NOC:Applied Linear Algebra (Electrical Engineering)

Co-ordinators : Prof. Andrew Thangaraj

Lecture 1 - Introduction to the Course

Lecture 2 - Vector Spaces: Introduction

Lecture 3 - Linear Combinations and Span

Lecture 4 - Subspaces, Linear Dependence and Independence

Lecture 5 - Basis and Dimension

Lecture 6 - Sums, Direct Sums and Gaussian Elimination

Lecture 7 - Linear Maps and Matrices

Lecture 8 - Null space, Range, Fundamental theorem of linear maps

Lecture 9 - Column space, null space and rank of a matrix

Lecture 10 - Algebraic operations on linear maps

Lecture 11 - Invertible maps, Isomorphism, Operators

Lecture 12 - Solving Linear Equations

Lecture 13 - Elementary Row Operations

Lecture 14 - Translates of a subspace, Quotient Spaces

Lecture 15 - Row space and rank of a matrix

Lecture 16 - Determinants

Lecture 17 - Coordinates and linear maps under a change of basis

Lecture 18 - Simplifying matrices of linear maps by choice of basis

Lecture 19 - Polynomials and Roots

Lecture 20 - Invariant subspaces, Eigenvalues, Eigenvectors

Lecture 21 - More on Eigenvalues, Eigenvectors, Diagonalization

Lecture 22 - Eigenvalues, Eigenvectors and Upper Triangularization

Lecture 23 - Properties of Eigenvalues

Lecture 24 - Linear state space equations and system stability

Lecture 25 - Discrete-time Linear Systems and Discrete Fourier Transforms

Lecture 26 - Sequences and counting paths in graphs

Lecture 27 - PageRank Algorithm

Lecture 28 - Dot product and length in Cn, Inner product and norm in V over F

Lecture 29 - Orthonormal basis and Gram-Schmidt orthogonalisation

Lecture 30 - Linear Functionals, Orthogonal Complements

Lecture 31 - Orthogonal Projection

Lecture 32 - Projection and distance from a subspace

Lecture 33 - Linear equations, Least squares solutions and Linear regression

Lecture 34 - Minimum Mean Squared Error Estimation

Lecture 35 - Adjoint of a linear map

Lecture 36 - Properties of Adjoint of a Linear Map

Lecture 37 - Adjoint of an Operator and Operator-Adjoint Product

Lecture 38 - Self-adjoint Operator

Lecture 39 - Normal Operators

Lecture 40 - Complex Spectral Theorem

Lecture 41 - Real Spectral Theorem

Lecture 42 - Positive Operators

Lecture 43 - Quadratic Forms, Matrix Norms and Optimization

Lecture 44 - Isometries

Lecture 45 - Classification of Operators

Lecture 46 - Singular Values and Vectors of a Linear Map

Lecture 47 - Singular Value Decomposition

Lecture 48 - Polar decomposition and some applications of SVD

NPTEL : NOC:Basic Electrical Circuits (Electrical Engineering)

Co-ordinators : Dr. Nagendra Krishnapura

Lecture 1 - Preliminaries

Lecture 2 - Current

Lecture 3 - Voltage

Lecture 4 - Electrical elements and circuits

Lecture 5 - Kirchhoff's current law (KCL)

Lecture 6 - Kirchhoff's voltage law (KVL)

Lecture 7 - Voltage source

Lecture 8 - Current source

Lecture 9 - Resistor

Lecture 10 - Capacitor

Lecture 11 - Inductor

Lecture 12 - Mutual inductor

Lecture 13 - Linearity of elements

Lecture 14 - Series connection-Voltage sources in series

Lecture 15 - Series connection of R, L, C, current source

Lecture 16 - Elements in parallel

Lecture 17 - Current source in series with an element; Voltage source in parallel with an element

Lecture 18 - Extreme cases: Open and short circuits

Lecture 19 - Summary

Lecture 20 - Voltage controlled voltage source (VCVS)

Lecture 21 - Voltage controlled current source (VCCS)

Lecture 22 - Current controlled voltage source (CCVS)

Lecture 23 - Current controlled current source (CCCS)

Lecture 24 - Realizing a resistance using a VCCS or CCCS

Lecture 25 - Scaling an element's value using controlled sources

Lecture 26 - Example calculation

Lecture 27 - Power and energy absorbed by electrical elements

Lecture 28 - Power and energy in a resistor

Lecture 29 - Power and energy in a capacitor

Lecture 30 - Power and energy in an inductor

Lecture 31 - Power and energy in a voltage source

Lecture 32 - Power and energy in a current source

Lecture 33 - Goals of circuit analysis

Lecture 34 - Number of independent KCL equations

Lecture 35 - Number of independent KVL equations and branch relationships

Lecture 36 - Analysis of circuits with a single independent source

Lecture 37 - Analysis of circuits with multiple independent sources using superposition

Lecture 38 - Superposition: Example

Lecture 39 - What is nodal analysis

Lecture 40 - Setting up nodal analysis equations

Lecture 41 - Structure of the conductance matrix

Lecture 42 - How do elements circuit appear in the nodal analysis formulation

Lecture 43 - Completely solving the circuit starting from nodal analysis

Lecture 44 - Nodal analysis example

Lecture 45 - Matrix inversion basics

Lecture 46 - Nodal analysis with independent voltage sources

Lecture 47 - Supernode for nodal analysis with independent voltage sources

Lecture 48 - Nodal analysis with VCCS

Lecture 49 - Nodal analysis with VCVS

Lecture 50 - Nodal analysis with CCVS

Lecture 51 - Nodal analysis with CCCS

Lecture 52 - Nodal analysis summary

Lecture 53 - Planar circuits

Lecture 54 - Mesh currents and their relationship to branch currents

Lecture 55 - Mesh analysis

Lecture 56 - Mesh analysis with independent current sources-Supermesh

Lecture 57 - Mesh analysis with current controlled voltage sources

Lecture 58 - Mesh analysis with current controlled current sources

Lecture 59 - Mesh analysis using voltage controlled sources

Lecture 60 - Nodal analysis versus Mesh analysis

Lecture 61 - Superposition theorem

Lecture 62 - Pushing a voltage source through a node

Lecture 63 - Splitting a current source

Lecture 64 - Substitution theorem: Current source

Lecture 65 - Substitution theorem: Voltage source

Lecture 66 - Substituting a voltage or current source with a resistor

Lecture 67 - Extensions to Superposition and Substitution theorem

Lecture 68 - Thevenin's theorem

Lecture 69 - Worked out example: Thevenin's theorem

Lecture 70 - Norton's theorem

Lecture 71 - Worked out example: Norton's theorem

Lecture 72 - Maximum power transfer theorem

Lecture 73 - Preliminaries

Lecture 74 - Two port parameters

Lecture 75 - y parameters

Lecture 76 - y parameters: Examples

Lecture 77 - z parameters

Lecture 78 - z parameters: Examples

Lecture 79 - h parameters

Lecture 80 - h parameters: Examples

Lecture 81 - g parameters

Lecture 82 - g parameters: Examples

Lecture 83 - Calculations with a two-port element

Lecture 84 - Calculations with a two-port element

Lecture 85 - Degenerate cases

Lecture 86 - Relationships between different two-port parameters

Lecture 87 - Equivalent circuit representation of two-ports

Lecture 88 - Reciprocity

Lecture 89 - Proof of reciprocity of resistive two-ports

Lecture 90 - Proof for 4-terminal two-ports

Lecture 91 - Reciprocity in terms of different two-port parameters

Lecture 92 - Reciprocity in circuits containing controlled sources

Lecture 93 - Examples

Lecture 94 - Feedback amplifier using an opamp

Lecture 95 - Ideal opamp

Lecture 96 - Negative feedback around the opamp

Lecture 97 - Finding opamp sign for negative feedback

Lecture 98 - Example: Determining opamp sign for negative feedback

Lecture 99 - Analysis of circuits with opamps

Lecture 100 - More on opamps: Example circuits and additional topics

Lecture 101 - Inverting amplifier

Lecture 102 - Summing amplifier

Lecture 103 - Instrumentation amplifier

Lecture 104 - Negative resistance

Lecture 105 - Finding opamp signs for negative feedback-circuits with multiple opamps

Lecture 106 - Opamp supply voltages and saturation

Lecture 107 - KCL with an opamp and supply currents

Lecture 108 - Circuits with storage elements (capacitors and inductors)

Lecture 109 - First order circuit with zero input-natural response

Lecture 110 - First order RC circuit with zero input-Example

Lecture 111 - First order circuit with a constant input

Lecture 112 - General form of the first order circuit response

Lecture 113 - First order RC circuit with a constant input-Example

Lecture 114 - First order circuit with piecewise constant input

Lecture 115 - First order circuit with piecewise constant input-Example

Lecture 116 - First order circuit-Response of arbitrary circuit variables

Lecture 117 - Summary: Computing first order circuit response

Lecture 118 - Does a capacitor block DC?

Lecture 119 - Finding the order of a circuit

Lecture 120 - First order RC circuits with discontinuous capacitor voltages

Lecture 121 - Summary: Computing first order circuit response with discontinuities

Lecture 122 - First order RL circuits

Lecture 123 - First order RL circuit with discontinuous inductor current-Example

Lecture 124 - First order RC circuit with an exponential input

Lecture 125 - First order RC response to its own natural response

Lecture 126 - First order RC response to a sinusoidal input

Lecture 127 - First order RC response to a sinusoidal input-via the complex exponential

Lecture 128 - Summary: Linear circuit response to sinusoidal input via the complex exponential

Lecture 129 - Three methods of calculating the sinusoidal steady state response

Lecture 130 - Calculating the total response including initial conditions

Lecture 131 - Why are sinusoids used in measurement?

Lecture 132 - Second order system natural response

Lecture 133 - Second order system as a cascade of two first order systems

Lecture 134 - Second order system natural response-critically damped and underdamped

Lecture 135 - Generalized form of a second order system

Lecture 136 - Numerical example

Lecture 137 - Series and parallel RLC circuits

Lecture 138 - Forced response of a second order system

Lecture 139 - Steady state response calculation and Phasors

Lecture 140 - Phasors (Continued...)

Lecture 141 - Magnitude and Phase plots

Lecture 142 - Magnitude and phase plotes of a second order system

Lecture 143 - Maximum power transfer and Conjugate matching

NPTEL : NOC:Optical Fiber Sensors (Electrical Engineering)

Co-ordinators : Prof. Balaji Srinivasan

Lecture 1 - Introduction to optical sensors

Lecture 2 - Different types of optical sensors

Lecture 3 - Overview of distributed sensors

Lecture 4 - Optical sensors system

Lecture 5 - Optical sources

Lecture 6 - Optical receivers - 1

Lecture 7 - Optical receivers - 2

Lecture 8 - Optical receivers - 3

Lecture 9 - Optical receiver design

Lecture 10 - Noise Analysis

Lecture 11 - Sensor Performance characteristics

Lecture 12 - Noise Mitigation Techniques

Lecture 13 - Lock in detection

Lecture 14 - Amplitude modulated sensors - 1

Lecture 15 - Gas absoprtion spectroscopy

Lecture 16 - Amplitude modulated sensors - 2

Lecture 17 - Amplitude modulated sensors - 3

Lecture 18 - Amplitude modulated sensors - 4

Lecture 19 - Problem Discussion

Lecture 20 - Pulse-oximeter

Lecture 21 - Phase modulated sensors - 1

Lecture 22 - Phase modulated sensors - 2

Lecture 23 - Phase modulated Sensors - 3

Lecture 24 - Phase modulated sensors - 4

Lecture 25 - Phase modulated sensors - 5

Lecture 26 - Phase modulated sensors - 6

Lecture 27 - Phase modulated sensors - 7

Lecture 28 - Phase modulated sensors - 8

Lecture 29 - Phase modulated sensors - 9

Lecture 30 - Phase modulated sensors - 10

Lecture 31 - Phase modulated Sensors - 11

Lecture 32 - Wavelength modulated sensors - 1

Lecture 33 - Wavelength modulated sensors - 2

Lecture 34 - Wavelength modulated sensors - 3

Lecture 35 - Wavelength modulated sensors - 4

Lecture 36 - Wavelength modulated sensors - 5

Lecture 37 - Wavelength modulated sensors - 6

Lecture 38 - Wavelength modulated sensors - 7

Lecture 39 - Wavelength modulated sensors - 8

Lecture 40 - Polarization modulated sensors - 1

Lecture 41 - Polarization modulated sensors - 2

Lecture 42 - Polarization modulated sensors - 3

NPTEL : NOC:Introduction to Time - Varying Electrical Networks (Electrical Engineering)

Co-ordinators : Prof. Shanthi Pavan

Lecture 1 - Course Introduction and Motivation

Lecture 2 - Kirchoff's Current and Voltage Laws, and the Incidence Matrix

Lecture 3 - Power Conservation and Tellegen's Theorem

Lecture 4 - Intuition behind Tellegen's Theorem

Lecture 5 - Tellegen's Theorem and reciprocity in linear resistive networks

Lecture 6 - Why is reciprocity useful in practice?

Lecture 7 - Inter-reciprocity in linear time-invariant networks

Lecture 8 - Inter-reciprocity in linear time-invariant networks (Continued...)

Lecture 9 - Inter-reciprocity in networks with ideal operational amplifiers

Lecture 10 - Review of Modified Nodal Analysis (MNA) of linear networks

Lecture 11 - MNA stamps of controlled sources - the VCCS and VCVS

Lecture 12 - MNA stamps of controlled sources - the CCCS and CCVS

Lecture 13 - Inter-reciprocity in linear networks - using the MNA stamp approach

Lecture 14 - The Adjoint Network

Lecture 15 - MNA stamp of an ideal opamp

Lecture 16 - Properties of circuits with multiple ideal opamps

Lecture 17 - Introduction to noise in electrical networks

Lecture 18 - Noise processed by a linear time-invariant system

Lecture 19 - kT/C noise in a sample-and-hold circuit

Lecture 20 - Noise in RLC networks

Lecture 21 - Total integrated noise in RLC Networks

Lecture 22 - Bode's Noise Theorem - Frequency domain

Lecture 23 - Input referred noise in electrical networks - Part 1

Lecture 24 - Input referred noise in electrical networks - Part 2

Lecture 25 - Input referred noise and the noise factor

Lecture 26 - Noise Factor Examples

Lecture 27 - Motivation to learn about time-varying circuits and systems - Part 1

Lecture 28 - Motivation to learn about time-varying circuits and systems - Part 2

Lecture 29 - Convolution integral for LTV systems

Lecture 30 - Frequency response of an LTV system

Lecture 31 - LTV system example : Time-varying RC filter

Lecture 32 - Linear Periodically Time-Varying Systems (LPTV)

Lecture 33 - Response of an LPTV system to a complex exponential input

Lecture 34 - Harmonic Transfer Functions

Lecture 35 - Zadeh expansion of an LPTV system

Lecture 36 - MNA analysis of LPTV networks

Lecture 37 - MNA stamp of a periodically time varying conductance

Lecture 38 - MNA stamp of a capacitor and a voltage source in an LPTV network

Lecture 39 - Analysis of an example LPTV network - Part 1

Lecture 40 - Analysis of an example LPTV network - Part 2

Lecture 41 - LPTV network analysis, RC filter, time-varying

Lecture 42 - Impedance and admittance in LTI and LPTV networks

Lecture 43 - Thevenin and Norton's Theorems for LPTV networks

Lecture 44 - The N-path principle

Lecture 45 - N-path example

Lecture 46 - Time-domain intuition of the N-path principle

Lecture 47 - N-path example: Time-Interleaved ADCs

Lecture 48 - Dc-dc converter as an LPTV system

Lecture 49 - N-path principle: Multiphase dc-dc converter

Lecture 50 - The N-path filter

Lecture 51 - Computing H_0(j2\pi f_s) for a 4-path filter

Lecture 52 - Input impedance of the 4-path filter at f_s

Lecture 53 - Computing H_0(j2\pi 2 f_s) for a 4-path filter

Lecture 54 - Determining H_0 for input frequency deviations from f_s

Lecture 55 - Reciprocity and Inter-reciprocity in LPTV networks : Part 1

Lecture 56 - Reciprocity and Inter-reciprocity in LPTV networks : Part 2, the transfer-function theorem

Lecture 57 - Why is the transfer-function theorem important?

Lecture 58 - The frequency-reversal theorem for inter-reciprocal (adjoint) LPTV networks : introduction

Lecture 59 - The frequency-reversal theorem for inter-reciprocal (adjoint) LPTV networks : derivation

Lecture 60 - Why is the frequency-reversal theorem important?

Lecture 61 - Inter-reciprocity in signal-flow graphs

Lecture 62 - Applications of inter-reciprocity: analysis of chopped amplifiers

Lecture 63 - Applications of inter-reciprocity: analysis of chopped amplifiers (Continued...)

Lecture 64 - Applications of inter-reciprocity: chopping with square-wave modulation

Lecture 65 - Applications of inter-reciprocity: the switched-RC network

Lecture 66 - Time-domain implications of inter-reciprocity and the adjoint network

Lecture 67 - Time-domain implications of inter-reciprocity and the adjoint network : Example calculation

Lecture 68 - LPTV networks with sampled outputs: Switched capacitor circuits

Lecture 69 - LPTV networks with sampled outputs: A continuous-time delta-sigma data converter

Lecture 70 - LPTV networks with sampled outputs: The equivalent LTI filter

Lecture 71 - Finding the equivalent LTI filter of a sampled LPTV system : example

Lecture 72 - Equivalent LTI filter for a switched-RC network

Lecture 73 - Finding the equivalent LTI filter of a sampled LPTV system : example of a continuous-time delta-sigma modulator

Lecture 74 - Finding the equivalent LTI filter of a sampled LPTV system with offset sampling

Lecture 75 - LPTV networks driven by modulated inputs

Lecture 76 - Introduction to noise in LPTV Networks

Lecture 77 - Noise in LPTV networks with sampled outputs

Lecture 78 - Total integrated noise in networks with R,L,C and periodically operated switches

NPTEL : NOC:Digital System Design (Electrical Engineering)

Co-ordinators : Prof. Neeraj Goel

Lecture 1 - Introduction

Lecture 2 - Analog vs Digital

Lecture 3 - Binary number system - 1

Lecture 4 - Binary number system - 2

Lecture 5 - Negative number representation - 1

Lecture 6 - Negative number representation - 2

Lecture 7 - Other number systems

Lecture 8 - Floating point numbers - 1

Lecture 9 - Floating point numbers - 2

Lecture 10 - Floating point numbers - 3

Lecture 11 - Floating point numbers - 4

Lecture 12 - Floating point numbers - 5

Lecture 13 - Boolean functions

Lecture 14 - Boolean Algebra

Lecture 15 - SOP and POS Representation

Lecture 16 - Algebraic simplifications

Lecture 17 - Canonical form

Lecture 18 - Boolean minimization using K-Maps

Lecture 19 - More Logic gates

Lecture 20 - Hardware description language:Verilog

Lecture 21 - Verilog simulation demo

Lecture 22 - K-maps

Lecture 23 - QM-method

Lecture 24 - Area delay model

Lecture 25 - Multi-level logic

Lecture 26 - Multiplexer

Lecture 27 - Four state logic

Lecture 28 - Decoders - 1

Lecture 29 - Decoders - 2

Lecture 30 - Encoders

Lecture 31 - Programmable hardware

Lecture 32 - Ripple carry adder

Lecture 33 - Carry look ahead adder

Lecture 34 - Modeling BUS in Verilog

Lecture 35 - Fast adder:Carry select adder

Lecture 36 - Multiple operand adder

Lecture 37 - Multiplication

Lecture 38 - Iterative circuits - 1

Lecture 39 - Iterative circuits - 2

Lecture 40 - Introduction to sequential circuits

Lecture 41 - Latches

Lecture 42 - D-Flip-flops

Lecture 43 - More Flip-flops

Lecture 44 - Counters

Lecture 45 - Verilog-Behavior model - 1

Lecture 46 - Verilog-Behavior model - 2

Lecture 47 - Registers - 1

Lecture 48 - Registers - 2

Lecture 49 - Memory

Lecture 50 - Sequential circuit analysis

Lecture 51 - Derivation state graph

Lecture 52 - Sequence detector: Example 1

Lecture 53 - Sequence detector: Example 2

Lecture 54 - State machine reduction

Lecture 55 - State encoding

Lecture 56 - Multi-cycle adder design

Lecture 57 - Pipelined adder design

Lecture 58 - Multiplication design

Lecture 59 - Division hardware design

Lecture 60 - Interacting state machines

Lecture 61 - Register Transfer Level design

Lecture 62 - GCD computer at RTL Level

Lecture 63 - RTL Design - Bubble sort

Lecture 64 - RTL Design - Traffic light controller

Lecture 65 - FPGA

Lecture 66 - Xilinx CLB

Lecture 67 - FPGA - Design flow

Lecture 68 - FPGA design demo

Lecture 69 - Introduction to ASIC design flow - Part 1

Lecture 70 - Introduction to ASIC design flow - Part 2

Lecture 71 - Future directions

NPTEL : NOC:Stochastic Modeling and the Theory of Queues (Electrical Engineering)

Co-ordinators : Prof. Krishna Jagannathan

Lecture 1 - Review of Probability Theory: Random Variable

Lecture 2 - Sequence of Random Variables

Lecture 3 - Laws of Large Numbers and Central Limit Theorem

Lecture 4 - What is a stochastic process?

Lecture 5 - Counting Process

Lecture 6 - Poisson Process - Introduction

Lecture 7 - Poisson Process - Memorylessness

Lecture 8 - Poisson Process - Increment properties

Lecture 9 - Distribution of arrival epoch Sn and N(t) for a Poisson Process

Lecture 10 - Alternate definitions of a Poisson Process

Lecture 11 - Merging of Poisson Processes - Part 1

Lecture 12 - Merging of Poisson Processes - Part 2

Lecture 13 - Splitting of Poisson Process - Part 1

Lecture 14 - Splitting of Poisson Process - Part 2

Lecture 15 - Example: Poisson Splitting

Lecture 16 - Conditional arrival density and order statistics - Part 1

Lecture 17 - Conditional arrival density and order statistics - Part 2

Lecture 18 - Non Homogeneous Poisson Process

Lecture 19 - Introduction to Queueing (with examples)

Lecture 20 - Examples: Non homogeneous Poisson process

Lecture 21 - Examples: Competing Poisson processes

Lecture 22 - Introduction to Renewal Processes

Lecture 23 - Strong law for renewal processes

Lecture 24 - Strong law for renewal processes - Proof

Lecture 25 - Residual life, age and duration (Time average) - Part 1

Lecture 26 - Residual life, age and duration (Time average) - Part 2

Lecture 27 - Renewal Reward Theorem (Time average) - Part 1

Lecture 28 - Renewal Reward Theorem (Time average) - Part 2

Lecture 29 - Stopping time

Lecture 30 - Wald's Equality

Lecture 31 - Wald's Equality (Continued...)

Lecture 32 - Elementary Renewal Theorem

Lecture 33 - The Renewal Equation

Lecture 34 - The Renewal Equation (Continued...)

Lecture 35 - G/G/1 Queue and Little's theorem

Lecture 36 - Little's theorem

Lecture 37 - M/G/1 Queue

Lecture 38 - M/G/1 Queue and PK Formula

Lecture 39 - M/G/1 Queue and PK Formula (Continued...)

Lecture 40 - Ensemble rewards - Age and Duration

Lecture 41 - Ensemble rewards - Age and Duration (Continued...)

Lecture 42 - Key Renewal Theorem and Ensemble rewards

Lecture 43 - Introduction to finite state Discrete Time Markov Chains

Lecture 44 - Class and Types of Classes in a DTMC

Lecture 45 - Periodicity in a DTMC

Lecture 46 - Matrix Representation of a DTMC

Lecture 47 - The long term behaviour of a DTMC

Lecture 48 - Stationary Distribution and Long term behaviour of a DTMC - Part 1

Lecture 49 - Stationary Distribution and Long term behaviour of a DTMC - Part 2

Lecture 50 - Stationary Distribution and Long term behaviour of a DTMC - Part 3

Lecture 51 - Spectral Properties of Stochastic Matrices - Part 1

Lecture 52 - Spectral Properties of Stochastic Matrices - Part 2

Lecture 53 - The Short-term Behaviour of a DTMC

Lecture 54 - Introduction to Countable-state DTMC

Lecture 55 - Introduction to Countable-state DTMC (Continued...)

Lecture 56 - The Strong Markov Property

Lecture 57 - Renewal Theory applied to DTMC's

Lecture 58 - Stationary Distribution of a Countable State Space DTMC and Renewal Theory

Lecture 59 - Stationary Distribution of a Countable State Space DTMC and Renewal Theory (Continued...)

Lecture 60 - Stationary Distribution and The Steady State Behaviour of a Countable-state DTMC - Part 1

Lecture 61 - Stationary Distribution and The Steady State Behaviour of a Countable-state DTMC - Part 2

Lecture 62 - Convergence to Steady State of a Coutable-state DTMC (Stochastic Coupling)

Lecture 63 - The Birth-Death Markov Chains

Lecture 64 - The Reversibility Markov Chains

Lecture 65 - The Reversibility Markov Chains (Continued...)

Lecture 66 - Time Sampled M/M/1 Queue and The Burke's Theorem

Lecture 67 - Introduction to Continuous Time Markov Chains

Lecture 68 - Introduction to CTMC (Continued...)

Lecture 69 - The Steady State Behaviour of CTMC - Part 1

Lecture 70 - The Steady State Behaviour of CTMC - Part 2

Lecture 71 - The Steady State Behaviour of CTMC - Part 3

Lecture 72 - The Steady State Behaviour of CTMC - Part 4

Lecture 73 - The chapman-kolmogrov equations for CTMC's

Lecture 74 - The Birth-Death Continuous time Markov Chains

Lecture 75 - The Reversibility of Continuous time Markov Chains

Lecture 76 - Burke's Theorem and the Tandem Queues - Part 1

Lecture 77 - Burke's Theorem and the Tandem Queues - Part 2

Lecture 78 - The Jackson Networks - Part 1

Lecture 79 - The Jackson Networks - Part 2

Lecture 80 - Semi Markov Processes - Part 1

Lecture 81 - Semi Markov Processes - Part 2

NPTEL : NOC:Integrated Photonics Devices and Circuits (Electrical Engineering)

Co-ordinators : Prof. Bijoy Krishna Das

Lecture 1 - Course Background and Learning Outcome

Lecture 2 - Moore's Law and Interconnect Bottleneck

Lecture 3 - Progress in Optical Interconnect Technology and Beyond

Lecture 4 - Evolution of Silicon Photonics Platform

Lecture 5 - Fundamentals of Lightwaves: EM Waves: Maxwell Equations and Plane Wave Solutions

Lecture 6 - Fundamentals of Lightwaves: EM Waves: Wave Propagation in Lossy Dielectric Medium

Lecture 7 - Fundamentals of Lightwaves: EM Waves in Metals and Semiconductors

Lecture 8 - Fundamentals of Lightwaves: EM Waves: Plasma Dispersion

Lecture 9 - Fundamentals of Lightwaves: EM Waves Principle of Optical Waveguiding

Lecture 10 - Fundamentals of Lightwaves: 1-D Optical Waveguide: Ray Optics Model

Lecture 11 - Optical Waveguides: Theory and Design: TIR Based Eigen Mode Solutions for Slab Waveguides

Lecture 12 - Optical Waveguides: Theory and Design: TIR Based Design Solutions for Slab Waveguides

Lecture 13 - Optical Waveguides: Theory and Design: Guided ModeSolutions for Slab Waveguides

Lecture 14 - Optical Waveguides: Theory and Design: Guided ModeSolutions for Slab Waveguides cont

Lecture 15 - Optical Waveguides: Theory and Design: Guided Mode Dispersionand Power in Slab Waveguides

Lecture 16 - Optical Waveguides: Theory and Design: Optical Waveguide with 2D confinement

Lecture 17 - Optical Waveguides: Theory and Design: Dispersion and Polarization of Guided Modes

Lecture 18 - Optical Waveguides: Theory and Design: Orthogonalityof Guided Modes

Lecture 19 - Optical Waveguides: Theory and Design: Coupled Mode Theoryof Guided Modes

Lecture 20 - Optical Waveguides: Theory and Design: Coupled Mode Theory (Continued...)

Lecture 21 - Optical Waveguides: Theory and Design: Coupled Mode Theory (Continued...)

Lecture 22 - Integrated Optical Components: Y-Junction Power Splitter/Combiner and Mach-Zehnder Interferometer

Lecture 23 - Integrated Optical Components: Directional Coupler: Coupled Waveguides

Lecture 24 - Integrated Optical Components: Directional Coupler: Coupled Waveguides (Continued...)

Lecture 25 - Integrated Optical Components: Directional Coupler: Design and Modelling

Lecture 26 - Integrated Optical Components: DC based MZI and Microring Resonator (MRR)

Lecture 27 - Integrated Optical Components: Microring Resonator (MRR): Passive Characteristics

Lecture 28 - Integrated Optical Components: Distributed Bragg Reflector (DBR)

Lecture 29 - Integrated Optical Components: Distributed Bragg Reflector (DBR): Device Design - Part 1

Lecture 30 - Integrated Optical Components: Distributed Bragg Reflector (DBR): Device Design - Part 2

Lecture 31 - Tunable Devices and Reconfigurable Circuits: Phase Error Interference

Lecture 32 - Tunable Devices and Reconfigurable Circuits: Post Fabrication Phase Error Corrections

Lecture 33 - Tunable Devices and Reconfigurable Circuits: Thermo-Optic Switching and Tuning

Lecture 34 - Tunable Devices and Reconfigurable Circuits: Programmable Silicon Photonics

Lecture 35 - Electro-Optic Modulators for Integrated Photonics: Basic Design and Working Principle

Lecture 36 - Electro-Optic Modulators for Integrated Photonics: Various Physical Mechanisms

Lecture 37 - Electro-Optic Modulators for Integrated Photonics: FCCE Based Silicon Photonics Modulator

Lecture 38 - Light Sources and Photodetectors for Integrated Photonics: Integrated Photonic light Sources - Part 1

Lecture 39 - Light Sources and Photodetectors for Integrated Photonics: Integrated Photonic light Sources - Part 2

Lecture 40 - Light Sources and Photodetectors for Integrated Photonics: Photodetectors for Silicon Photonics

NPTEL : NOC:Introduction to Semiconductor Devices (Electrical Engineering)

Co-ordinators : Prof. Naresh Kumar Emani

Lecture 1 - Types of Semiconductors

Lecture 2 - Classical Vs Quantum Mechanics

Lecture 3 - Electrons in infinite and finite 1D potential well

Lecture 4 - 3D potential well model of atom and Bohr's model

Lecture 5 - Covalent bonds and inter-atomic interactions in Silicon

Lecture 6 - Energy band formation

Lecture 7 - Electron hole pair generation

Lecture 8 - Direct and Indirect bandgap semiconductors

Lecture 9 - Energy levels in infinite and finite potential wells (short demo)

Lecture 10 - Effective mass in Semiconductors

Lecture 11 - Intrinsic carrier density

Lecture 12 - Doping and extrinsic semiconductors

Lecture 13 - Fermi level in extrinsic semiconductors

Lecture 14 - Temperature dependence of Fermi level

Lecture 15 - Temperature dependence of Fermi level

Lecture 16 - Charge neutrality relationship

Lecture 17 - Drift current and energy band representation of kinetic energy of carriers

Lecture 18 - Semiconductor bands in a electric field

Lecture 19 - Diffusion current

Lecture 20 - Non-uniform doping

Lecture 21 - Equilibrium Vs Nonequilibrium carrier response

Lecture 22 - Minority carrier diffusion equation (MCDE) - Example problems

Lecture 23 - Quasi Fermi level in nonequilibrium conditions

Lecture 24 - Quasi Fermi level and minority carrier diffusion length

Lecture 25 - Semiconductor device fabrication

Lecture 26 - PN Junctions - An introduction

Lecture 27 - PN Junction electrostatics

Lecture 28 - Energy band diagram of PN junction

Lecture 29 - Depletion width and peak electric field

Lecture 30 - PN junction electrostatics - examples

Lecture 31 - Demo of PN Junction Lab on Nanohub

Lecture 32 - Forward and reverse biased PN junctions

Lecture 33 - Minority carrier injection in PN junctions

Lecture 34 - Current in forward biased PN junction

Lecture 35 - Current in reverse biased PN junction

Lecture 36 - Depletion capacitance in PN junction

Lecture 37 - Non-idealities in PN junction diode

Lecture 38 - Nanohub Demo - PN Junction with applied bias

Lecture 39 - Schottky barrier in metal-semiconductor junction

Lecture 40 - Current flow across a Schottky barrier

Lecture 41 - Ohmic vs rectifying contacts

Lecture 42 - An Ideal MOS Capacitor

Lecture 43 - Operating regimes of a MOSCAP

Lecture 44 - Simplified band diagrams of accumulation and depletion in MOSCAP

Lecture 45 - Inversion in a MOSCAP

Lecture 46 - NMOSCAP in accumulation mode

Lecture 47 - NMOSCAP in depletion mode

Lecture 48 - NMOSCAP in inversion mode

Lecture 49 - Exact solution vs delta-depletion approximation

Lecture 50 - Threshold voltage in a MOSCAP

Lecture 51 - Nanohub Demo - MOSCAP tool

Lecture 52 - Non-ideal MOS Capacitor

Lecture 53 - MOSCAP Capacitance-Voltage (CV) Characteristics

Lecture 54 - Example problems with MOSCAPs

Lecture 55 - Impact of doping, oxide thickness and temperature on CV

Lecture 56 - Nanohub Demo - MOS CV

Lecture 57 - Introduction to MOSFET

Lecture 58 - Operating modes of a MOSFET

Lecture 59 - IV Characteristics of a long channel MOSFET

Lecture 60 - Example problems with MOSFETs

Lecture 61 - MOSFET device metrics

Lecture 62 - CMOS Technology

Lecture 63 - MOSFET Scaling and technology nodes

Lecture 64 - Limits of scaling

Lecture 65 - Current characteristics of a short channel MOSFET

Lecture 66 - Threshold voltage characteristics of short channel MOSFET

Lecture 67 - MOSFETs in the 21st century

Lecture 68 - Optical absorption and bandgap

Lecture 69 - Introduction to solar cells

Lecture 70 - Efficiency of a solar cell

Lecture 71 - Types of photodetectors

Lecture 72 - PIN and avalanche Photodectectors

Lecture 73 - Photodetector metrics

Lecture 74 - Radiative absoption and emission processes

Lecture 75 - Materials for optoelectronic devices

Lecture 76 - Operation of a light emitting diode (LED)

Lecture 77 - LED emission spectrum

Lecture 78 - Stimulated emission and lasing

NPTEL : NOC:Electric Vehicles and Renewable Energy (Electrical Engineering)

Co-ordinators : Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan

Lecture 1 - Electric Vehicle Introduction

Lecture 2 - The drive Torque, Power, Speed and Energy

Lecture 3 - Energy Source

Lecture 4 - Vehicle Auxillary, Petrol pumps and Charging stations

Lecture 5 - Introduction to Electric Vehicles in India

Lecture 6 - Can India Drive its EV program Innovatively and Differently and scale

Lecture 7 - Battery Cost reduction strategy

Lecture 8 - A bit about Batteries, Charging and Swapping Infrastructure

Lecture 9 - Where will we get Lithium for batteries and EV Subsystems

Lecture 10 - Forces acting when a vehicle move

Lecture 11 - Aerodynamic drag, Rolling Resistance and Uphill Resistance

Lecture 12 - Power and torque to accelerate

Lecture 13 - Putting it all together - 1

Lecture 14 - Putting it all together - 2

Lecture 15 - Concept of drive cycle - 1

Lecture 16 - Concept of drive cycle - 2

Lecture 17 - Drive Cycles and Energy used per km - Part 1

Lecture 18 - Drive Cycles and Energy used per km - Part 2

Lecture 19 - EV Subsystem: Design of EV Drive Train - Part 1

Lecture 20 - EV Subsystem: Design of EV Drive Train - Part 2

Lecture 21 - Introduction to Battery Parameters - Part 1

Lecture 22 - Introduction to Battery Parameters - Part 2

Lecture 23 - Why Lithium Ion Battery? - Part 1

Lecture 24 - Why Lithium Ion Battery? - Part 2

Lecture 25 - Batteries in Future

Lecture 26 - Li-Ion Battery Cells

Lecture 27 - SoH and SoC estimation and Self Discharge - Part 1

Lecture 28 - SoH and SoC estimation and Self Discharge - Part 2

Lecture 29 - Battery Pack Development - Part 1

Lecture 30 - Battery Pack Development - Part 2

Lecture 31 - Computation of Effective cost of battery - Part 1

Lecture 32 - Computation of Effective cost of battery - Part 2

Lecture 33 - Charging Batteries

Lecture 34 - Fundamentals of Battery Pack Design

Lecture 35 - Electrical Design of Battery Pack - Part 1

Lecture 36 - Electrical Design of Battery Pack - Part 2

Lecture 37 - Electrical Design of Battery Pack - Part 3

Lecture 38 - Mechanical Design of Battery Pack - Part 1

Lecture 39 - Mechanical Design of Battery Pack - Part 2

Lecture 40 - Mechanical Design of Battery Pack - Part 3

Lecture 41 - Mechanical Design of Battery Pack - Part 4

Lecture 42 - Thermal Design of Battery Pack - Part 1

Lecture 43 - Thermal Design of Battery Pack - Part 2

Lecture 44 - Thermal Design of Battery Pack - Part 3

Lecture 45 - Thermal Design of Battery Pack - Part 4

Lecture 46 - BMS Design and Embedded System - Part 1

Lecture 47 - BMS Design and Embedded System - Part 2

Lecture 48 - BMS Design and Embedded System - Part 3

Lecture 49 - BMS Design and Embedded System - Part 4

Lecture 50 - BMS Design and Embedded System - Part 5

Lecture 51 - Cell Testing and Characterization - Part 1

Lecture 52 - Cell Testing and Characterization - Part 2

Lecture 53 - EV Motors and Controllers - Vehicle Dynamics - Part 1

Lecture 54 - EV Motors and Controllers - Vehicle Dynamics - Part 2

Lecture 55 - EV Motors and Controllers - Understanding Flow - Part 1

Lecture 56 - EV Motors and Controllers - Understanding Flow - Part 2

Lecture 57 - Power and Efficiency

Lecture 58 - Torque Production - Part 1

Lecture 59 - Torque Production - Part 2

Lecture 60 - Torque Production - Part 3

Lecture 61 - Speed and Back EMF

Lecture 62 - The d-q Equivalent circuit - Part 1

Lecture 63 - The d-q Equivalent circuit - Part 2

Lecture 64 - Field-oriented Control

Lecture 65 - Three phase AC - Part 1

Lecture 66 - Three phase AC - Part 2

Lecture 67 - Thermal Design - Part 1

Lecture 68 - Thermal Design - Part 2

Lecture 69 - Thermal Design - Part 3

Lecture 70 - Engineering Considerations - Part 1

Lecture 71 - Engineering Considerations - Part 2

Lecture 72 - Engineering Considerations - Part 3 and Future Frontiers

Lecture 73 - EV Charger Introduction

Lecture 74 - Charger Paramaters and Types

Lecture 75 - Slow Fast chargers and Swapping

Lecture 76 - Swapping

Lecture 77 - Standardization and on board chargers

Lecture 78 - Public chargers

Lecture 79 - Public charger economics in Indian Context

Lecture 80 - Bulk Chargers, Swapping stations and data analytics

Lecture 81 - Introduction to Energy Scenario in India - Part 1

Lecture 82 - Introduction to Energy Scenario in India - Part 2

Lecture 83 - A novel Approach towards 100% RE in India - Part 1

Lecture 84 - A novel Approach towards 100% RE in India - Part 2

Lecture 85 - Going Beyond solar, wind, Li Ion and chilled water storage

Lecture 86 - Solar Photovoltaic

Lecture 87 - Solar Cell and its Characteristics

Lecture 88 - Solar Cells to Modules

Lecture 89 - Wind Energy

Lecture 90 - The War of Currents

Lecture 91 - The Birth of Solar - DC

Lecture 92 - Storage Options for Energy - Part 1

Lecture 93 - Storage Options for Energy - Part 2

Lecture 94 - Storage Options for Energy - Part 3

Lecture 95 - Storage Options for Energy - Part 4

Lecture 96 - The EV Ecosystem - Part 1

Lecture 97 - The EV Ecosystem - Part 2

NPTEL : Phase-locked loops (Electrical Engineering)

Co-ordinators : Dr. Saurabh Saxena

Lecture 1 - Course Introduction and Motivation - Part I

Lecture 2 - Course Introduction and Motivation - Part II

Lecture 3 - Basic Operation of a Phase Locked Loop

Lecture 4 - Simple Implementation of a Phase Locked Loop

Lecture 5 - Input Output Characteristics of Basic PLL Blocks

Lecture 6 - Time Domain Analysis of a Simple PLL

Lecture 7 - Time Domain Versus Small Signal Analysis of a Simple PLL

Lecture 8 - Type and Order of PLL

Lecture 9 - Small Signal Analysis of Type-I/II/III PLLs for Phase Step, Frequency Step and Frequency Ramp

Lecture 10 - Frequency Acquisition Range for PLLs

Lecture 11 - Frequency Acquisition in Type-I PLLs

Lecture 12 - Frequency Acquisition Limits in Type-I PLLs

Lecture 13 - Frequency Acquisition in Type II PLLs

Lecture 14 - Frequency Acquisition Ranges in Type II PLLs with Ideal and Non Ideal Integrator

Lecture 15 - Frequency Domain Insight in Frequency Acquisition for Type II PLLs

Lecture 16 - Introduction to Clock Multipliers

Lecture 17 - Analog Phase Error Detectors - Part I

Lecture 18 - Analog Phase Error Detectors - Part II

Lecture 19 - Digital Phase Error Detectors - Part I

Lecture 20 - Digital Phase Error Detectors - Part II

Lecture 21 - Range Extension for Phase Error Detectors

Lecture 22 - Phase Frequency Detector

Lecture 23 - Digital Frequency Detector

Lecture 24 - Charge Pump PLL

Lecture 25 - Small Signal and Stability Analysis of Type II Order 2 Charge Pump PLL

Lecture 26 - Problems in Charge Pump PLL - Dead Zone in PFD

Lecture 27 - Problems in Charge Pump PLL - Reference Spur

Lecture 28 - Design Procedure for Type-II Order 3 Charge Pump PLL

Lecture 29 - Design Procedure for Charge Pump Clock Multiplier

Lecture 30 - Sources of Non-Linearities in CP-PLL - Part I

Lecture 31 - Sources of Non-Linearities in CP-PLL - Part II

Lecture 32 - Noise Analysis in CP-PLL - Part I

Lecture 33 - Noise Analysis in CP PLL - Part II

Lecture 34 - Noise Analysis in CP-PLL - Part III

Lecture 35 - Noise Simulations for CP-PLL Blocks

Lecture 36 - Introduction to Oscillators

Lecture 37 - Low Swing Ring Oscillator - Part I

Lecture 38 - Low-Swing Ring Oscillator - Part II

Lecture 39 - Large-Swing Ring Oscillator - Part I

Lecture 40 - Large-Swing Ring Oscillator - Part II

Lecture 41 - Large-Swing Ring Oscillator - Part III

Lecture 42 - Large-Swing Ring Oscillator - Part IV

Lecture 43 - Large-Swing Ring Oscillator - Part V

Lecture 44 - Supply Regulated VCO - Part I

Lecture 45 - Supply Regulated VCO - Part II

Lecture 46 - Supply Regulated VCO - Part III

Lecture 47 - Phase Noise in Ring Oscillators

Lecture 48 - Circuit level Design of PFD - Part I

Lecture 49 - Circuit level Design of PFD - Part II

Lecture 50 - Circuit level Design of PFD - Part III

Lecture 51 - Circuit level Design of Charge Pump - Part I

Lecture 52 - Circuit-level Design of Charge Pump - Part II

Lecture 53 - Circuit-level Design of Charge Pump - Part III

Lecture 54 - Circuit-level Design of Charge Pump - Part IV

Lecture 55 - Circuit-level Design of Charge Pump - Part V

Lecture 56 - Circuit-level Design of Charge Pump - Part VI

Lecture 57 - Circuit-level Design of Clock Frequency Divider

Lecture 58 - Techniques for Wide Frequency Range Clock Multiplier

Lecture 59 - Introduction to Digital PLL

Lecture 60 - Design of Time-to-Digital Converter

Lecture 61 - Small Signal Analysis of Digital PLL

Lecture 62 - Noise Analysis in Digital PLL

Lecture 63 - Analog/Digital Hybrid PLL - Part I

Lecture 64 - Analog/Digital Hybrid PLL - Part II

Lecture 65 - Course Summary

NPTEL : NOC:Fundamentals of Nano and Quantum Photonics (Electrical Engineering)

Co-ordinators : Prof. Naresh Kumar Emani

Lecture 1 - Review of Maxwell's Equations

Lecture 2 - Wave Equation

Lecture 3 - Dispersion Relation

Lecture 4 - Propagating and Evanescent Waves

Lecture 5 - Diffraction Limit and Spatial Frequencies

Lecture 6 - Plane Waves

Lecture 7 - Optical Response of Materials

Lecture 8 - Lorentz Model

Lecture 9 - Properties of Lorentz Oscillator Model

Lecture 10 - Drude-Lorentz Model for Metals

Lecture 11 - Kramers-Kronig Relation

Lecture 12 - Engineering Optical Response of Materials

Lecture 13 - Low dimensional systems

Lecture 14 - Absorption in Semiconductors

Lecture 15 - Optical gain in semiconductors

Lecture 16 - Absorption in low-dimensional semiconductors

Lecture 17 - Selection rules for optical processes

Lecture 18 - Scattering of EM radiation

Lecture 19 - LSPR: Quasi-static approximation

Lecture 20 - Size dependence of Plasmon Resonance

Lecture 21 - Tuning Plasmonic Resonances

Lecture 22 - Surface Plasmon Polariton(SPP)

Lecture 23 - Understanding SPP Dispersion Diagram

Lecture 24 - Exciting Surface Plasmon Polaritons

Lecture 25 - Analytical Calculation of Scattering Coefficients - IPython code overview

Lecture 26 - EM Waves in Multilayer Stack - T Matrix formulation

Lecture 27 - Photonic Bandgap in 1D

Lecture 28 - EM Waves in 1D Photonic Crystal

Lecture 29 - Diffracton Grating

Lecture 30 - Applications of Photonic Crystals

Lecture 31 - PhC in 1D - T-matrix examples

Lecture 32 - Introduction to Metamaterials

Lecture 33 - Metamaterials at GHz and THz frequecies

Lecture 34 - Negative index materials at optical frequencies

Lecture 35 - Plasmonic Metasurfaces

Lecture 36 - Dielectric Metasurfaces

Lecture 37 - Tunable and Active Metamaterials

Lecture 38 - Radiative Absorption and Emission

Lecture 39 - Miniaturization of Integrated Photonic Devices

Lecture 40 - Recent trends in nanoscale lasers

Lecture 41 - Non-Hermitian Systems

Lecture 42 - Resonant light-atom interactions

Lecture 43 - Experimental observation of Rabi oscillations

Lecture 44 - Atom-Cavity Interaction - Weak and strong coupling regimes

Lecture 45 - Experimental observation of weak and strong coupling

Lecture 46 - Fabrication of nanophotonic structures - 1

Lecture 47 - Fabrication of nanophotonic structures - 2

Lecture 48 - Measuring light quanta

Lecture 49 - Photon Statistics

Lecture 50 - Photodetection and shot noise limit

Lecture 51 - Second order correlation function

Lecture 52 - Hanbury Brown-Twiss Experiment with Photons

Lecture 53 - EM Waves as harmonic oscillator

Lecture 54 - Vacuum fluctuations

Lecture 55 - Coherent and squeezed states

Lecture 56 - Squeezed and photon number states

Lecture 57 - Application of squeezed states

Lecture 58 - Preliminaries for quantum theory of light

Lecture 59 - Quantum theory of light

Lecture 60 - Operator solution of quantum harmonic oscillator

Lecture 61 - Photon number states

Lecture 62 - Field quadratures and operators

Lecture 63 - Uncertainty relations for quantum light

Lecture 64 - Applications of quantum light - Quantum Key Distribution

NPTEL : NOC:Analog Electronic Circuits (IITM) (Electrical Engineering)

Co-ordinators : Prof. Shanthi Pavan

Lecture 1 - Introduction Linear and Nonlinear Network

Lecture 2 - Small Signal Analysis of Nonlinear Networks

Lecture 3 - Small Signal Analysis

Lecture 4 - Incremental Model for Common Two Terminal Element Passive Two Terminal Elements

Lecture 5 - Linear and Nonlinear Two Ports and the Incremental Y Matrix

Lecture 6 - Graphical Representation of the Y Matrix

Lecture 7 - Nonlinear Two Ports With Incremental Gain

Lecture 8 - IV Charateristic of a Nonlinear 2 port with Incremental Gain

Lecture 9 - The MOSFET and its Characterisitics

Lecture 10 - Deriving the Common V Source Amplifier - Part 1

Lecture 11 - The Common Source Amplifier

Lecture 12 - Large Signal Behaviour of the Common Source Amplifier

Lecture 13 - The Common Source Amplifier Swing Limits

Lecture 14 - Introduction to Robust Biasing

Lecture 15 - Robust Biasing Part 1 Common Source Amplifier with DC Drain Feedback

Lecture 16 - Robust Biasing with the Current Mirror and Drain Gate Resistor

Lecture 17 - Robust Baising With Source Feedback - Part 1

Lecture 18 - Robust Biasing with Source Feedback - Part 2

Lecture 19 - Robust Biasing with Source Degeneration

Lecture 20 - Introduction to Negative Feedback

Lecture 21 - The Ideal Operational Amplifier

Lecture 22 - Negative Feedback (Continued...)

Lecture 23 - Robust Baising with Drain Measurement and Source Feedback

Lecture 24 - Robust biasing with source measurement and gate feedback

Lecture 25 - The Incremental Voltage Controlled Voltage Source The Common drain Amplifier Incremental Picture

Lecture 26 - Baising of the Common Drain Amplifier and Signal Swings

Lecture 27 - The VCVS Continued, the Incremental

Lecture 28 - Introducing the Current Controlled Voltage Source

Lecture 29 - The Incremental Current Controlled Voltage Source Transimpedance Amplifier

Lecture 30 - The Transimpedance amplifier (Continued...)

Lecture 31 - The Incremental current controlled current source, the common gate amplifier

Lecture 32 - Summary of controlled Sources and finite output Impedance of the Transistor

Lecture 33 - Effect of Finite Output Resistance on the Basic Building Blocks - Part 1

Lecture 34 - Effect of Finite Output Resistance on the Basic Building Blocks - Part 2

Lecture 35 - Effect of Finite Output Resistance on the Basic Building Blocks - Part 3

Lecture 36 - Finite output Effect in current Mirrors the Cascode Current Mirror

Lecture 37 - Comparison of Current Mirrors The High Swing Cascode

Lecture 38 - Precision High Swing Cascode

Lecture 39 - The PMOS transistor

Lecture 40 - Small Signal Model and Bias Stabilization

Lecture 41 - Basic Building Blocks with PMOS Devices

Lecture 42 - Fixed Transconductance Bias Circuits from First Principles

Lecture 43 - Limitation of a Resistive Load

Lecture 44 - The Active Load

Lecture 45 - The Active Load (Continued...)

Lecture 46 - The CMOS Inverter

Lecture 47 - The CMOS Inverter (Continued...)

Lecture 48 - The Differential Amplifier

Lecture 49 - Half - Circuit Analysis

Lecture 50 - The Different Amplifier with Active Load - Part 1

Lecture 51 - The Different Amplifier with Active Load - Part 2

Lecture 52 - Large Signal Behaviour of the Different Pair

Lecture 53 - The two Stage Opamp and Single Supply Operation

Lecture 54 - The two Stage Opamp (Continued...)

Lecture 55 - The Two Stage Opamp (Continued...)

Lecture 56 - Swing Limits of the Two Stage OTA

Lecture 57 - The Two-Stage Opamp

Lecture 58 - The Bandgap Reference Principle

Lecture 59 - The Bandgap Reference - Part 1

Lecture 60 - The Bandgap Reference - Part 2

Lecture 61 - Memory Effects in MOS Transistors

Lecture 62 - The Common Source Amplifier with Parasitic Capacitances

Lecture 63 - The Common Source Amplifier with Parasitic Capacitances

Lecture 64 - Frequency Response of the Common Drain Amplifier

Lecture 65 - Frequency Response of the Common Gate Amplifier

Lecture 66 - Stability of Negative Feedback System The First Order Forward Amplifier

Lecture 67 - Stabilty of Second Order Feedback System

Lecture 68 - Stability of Third Order Negative Feedback System

Lecture 69 - Dominant Pole Compensation - Part 1

Lecture 70 - Dominant Pole Cpmpensation - Part 2

Lecture 71 - Phase Margin

Lecture 72 - Example Phase Margin Caculations

Lecture 73 - Dominant Pole Compensation Summary

Lecture 74 - Phase Margin Example

Lecture 75 - The 2 Stage Miller Compensated Amplifier

Lecture 76 - 2 Stage Operational Amplifier and Miller Compensation (Continued...)

Lecture 77 - Intuition Behind the Dominant and Second Poles in a Miller Compensated OTA

Lecture 78 - 2 Stage Operational Amplifier and Miller Compensation Cancelling the RHP Zero

Lecture 79 - Miller Compensation OTA Schematic

Lecture 80 - Bipolar Junction Transistor Circuits-Device Equations and Small Signal Model

Lecture 81 - BJT Biasing and Basic Building Blocks

Lecture 82 - Bipolar Junction Transistor Circuits Swing Limits and Two Stage Opamp

Lecture 83 - Input Stage of the 741 Opamp

Lecture 84 - Basic Analysis of the 741

NPTEL : NOC:Modern Computer Vision (Electrical Engineering)

Co-ordinators : Prof. A. N. Rajagopalan

Lecture 1 - Course introduction - 1

Lecture 2 - Course introduction - 2

Lecture 3 - Introduction to Deep Learning - 1

Lecture 4 - Introduction to Deep Learning - 2

Lecture 5 - Introduction to Deep Learning - 3

Lecture 6 - Introduction to Neuron - 1

Lecture 7 - Introduction to Neuron - 2

Lecture 8 - Introduction to Neuron - 3

Lecture 9 - Multilayer Perceptron

Lecture 10 - Regression and classification losses

Lecture 11 - Training a neural network

Lecture 12 - Gradient descent

Lecture 13 - Activation function

Lecture 14 - Backpropagation in MLP - 1

Lecture 15 - Backpropagation in MLP - 2

Lecture 16 - Optimization and Regularization - 1

Lecture 17 - Optimization and Regularization - 2

Lecture 18 - Regularization

Lecture 19 - Dropout

Lecture 20 - Pre-processing

Lecture 21 - Convolutional Neural Networks - 1

Lecture 22 - Convolutional Neural Networks - 2

Lecture 23 - Convolutional Neural Networks - 3

Lecture 24 - CNN Properties

Lecture 25 - Alexnet

Lecture 26 - CNN Architectures - 1

Lecture 27 - CNN Architectures - 2

Lecture 28 - CNN Architectures - 3

Lecture 29 - Introduction to RNN - 1

Lecture 30 - Introduction to RNN - 2

Lecture 31 - Encoder-Decoder models in RNN

Lecture 32 - LSTM

Lecture 33 - Low-level vision - 1

Lecture 34 - Low-level vision - 2

Lecture 35 - Low-level vision - 3

Lecture 36 - Spatial Domain Filtering

Lecture 37 - Frequency Domain Filtering

Lecture 38 - Edge Detection - 1

Lecture 39 - Edge Detection - 2

Lecture 40 - DeepNets for Edge Detection

Lecture 41 - Line detection

Lecture 42 - Feature detectors

Lecture 43 - Harris Corner Detector - 1

Lecture 44 - Harris Corner Detector - 2

Lecture 45 - Harris Corner Detector - 3

Lecture 46 - Blob detection - 1

Lecture 47 - Blob detection - 2

Lecture 48 - Blob detection - 3

Lecture 49 - SIFT - 1

Lecture 50 - SIFT - 2

Lecture 51 - Feature descriptors - 1

Lecture 52 - Feature descriptors - 2

Lecture 53 - SURF - 1

Lecture 54 - SURF - 2

Lecture 55 - Single-View Geometry - 1

Lecture 56 - Single-View Geometry - 2

Lecture 57 - 2D Geometric transformations - 1

Lecture 58 - 2D Geometric transformations - 2

Lecture 59 - Camera intrinsics and extrinsics - 1

Lecture 60 - Camera intrinsics and extrinsics - 2

Lecture 61 - Two-view stereo - 1

Lecture 62 - Two-view stereo - 2

Lecture 63 - Two-view stereo - 3

Lecture 64 - Algebraic representation of epipolar geometry - 1

Lecture 65 - Algebraic representation of epipolar geometry - 2

Lecture 66 - Fundamental matrix computation - 1

Lecture 67 - Fundamental matrix computation - 2

Lecture 68 - Structure from Motion - 1

Lecture 69 - Structure from Motion - 2

Lecture 70 - Structure from Motion - 3

Lecture 71 - Batch processing in SFM

Lecture 72 - Multi-view SFM

Lecture 73 - Factorization methods in SFM

Lecture 74 - Bundle adjustment

Lecture 75 - Dense 3D reconstruction

Lecture 76 - Some results in Stereo and SFM

Lecture 77 - Deepnets for stereo and SFM - 1

Lecture 78 - Deepnets for stereo and SFM - 2

Lecture 79 - Mid-level vision - 1

Lecture 80 - Mid-level vision - 2

Lecture 81 - Lucas-Kanade method for OF

Lecture 82 - Handling large motion in optical flow

Lecture 83 - Image segmentation

Lecture 84 - GMM for clustering

Lecture 85 - Deepnets for Segmentation and OF -1

Lecture 86 - Deepnets for Segmentation and OF -2

Lecture 87 - Deepnets for Segmentation and OF -3

Lecture 88 - Deepnets for Object Detection - 1

Lecture 89 - Deepnets for Object Detection - 2

Lecture 90 - Vision and Language

NPTEL : NOC:Optical Wireless Communications for Beyond 5G Networks and IoT (Electrical Engineering)

Co-ordinators : Prof. Anand Srivastava

Lecture 1 - Introduction to Optical Wireless Communications (OWC)

Lecture 2 - Basics of Lighting System

Lecture 3 - Optical Sources (LED)

Lecture 4 - Optical Sources (LASER)

Lecture 5 - Photodetecors

Lecture 6 - Photodetectors (Continued...)

Lecture 7 - SNR for PIN and APD

Lecture 8 - Indoor OWC channel modelling

Lecture 9 - Indoor OWC channel modelling (Continued...)

Lecture 10 - Channel model for single source

Lecture 11 - Channel model for multiple sources

Lecture 12 - MIMO channel

Lecture 13 - MIMO channel (Continued...)

Lecture 14 - Outdoor Optical Channel Modelling

Lecture 15 - Range equation of FSO link

Lecture 16 - Range equation of FSO link (Continued...)

Lecture 17 - Atmospheric Turbulence

Lecture 18 - Atmospheric Turbulence (Continued...)

Lecture 19 - Turbulence Mitigation techniques

Lecture 20 - Underwater OWC Channel Model

Lecture 21 - Underwater OWC Channel Model (Continued...)

Lecture 22 - Modulation Schemes for OWC, BER for OOK

Lecture 23 - BER of M-PPM, BER of L-PPM

Lecture 24 - Differential Pulse Interval Modulation (DPIM) and (DAPPM)

Lecture 25 - Variable Pulse Position Modulation (VPPM)

Lecture 26 - OFDM Basics

Lecture 27 - Cyclic Prefix (CP), OFDM with CP, BER of OFDM System

Lecture 28 - Frequency Offset in OFDM, PAPR in OFDM

Lecture 29 - OFDM in VLC, DCO-OFDM

Lecture 30 - ACO-OFDM

Lecture 31 - Color Shift Keying (CSK)

Lecture 32 - Higher order CSK

Lecture 33 - NOMA

Lecture 34 - NOMA VLC

Lecture 35 - MIMO

Lecture 36 - VLC based MIMO NOMA

Lecture 37 - Power allocation in VLC based MIMO NOMA

Lecture 38 - Hybrid Network LiFi and WiFi Coexistance

Lecture 39 - Vehicle to Vehicle communication using Visible light

Lecture 40 - Anand Singh Part - 1

Lecture 41 - Anand Singh Part - 2

Lecture 42 - Dilnasin lecture - 1

Lecture 43 - Saswati Paramita

Lecture 44 - Dilnashin Tutorial - 2

Lecture 45 - Guriendar Prof Anand 001

Lecture 46 - Rehana Prof Anand

NPTEL : NOC:VLSI Design Flow: RTL to GDS (Electrical Engineering)

Co-ordinators : Prof. Sneh Saurabh

Lecture 1 - Basic Concepts of Integrated Circuit - I

Lecture 2 - Basic Concepts of Integrated Circuit - II

Lecture 3 - Overview of VLSI Design Flow - I

Lecture 4 - Overview of VLSI Design Flow - II

Lecture 5 - Tutorial 1

Lecture 6 - Overview of VLSI Design Flow - III

Lecture 7 - Overview of VLSI Design Flow - IV

Lecture 8 - Overview of VLSI Design Flow - V

Lecture 9 - Overview of VLSI Design Flow - VI

Lecture 10 - Introduction to TCL

Lecture 11 - Hardware Modeling: Introduction to Verilog - I

Lecture 12 - Hardware Modeling: Introduction to Verilog - II

Lecture 13 - Functional Verification using Simulation

Lecture 14 - High-level synthesis using Bambu - Tutorial 3

Lecture 15 - RTL Synthesis - Part I

Lecture 16 - RTL Synthesis - Part II

Lecture 17 - Logic Optimization - Part I

Lecture 18 - Simulation-based Verification using Icarus

Lecture 19 - Logic Optimization - Part II

Lecture 20 - Logic Optimization - Part III

Lecture 21 - Formal Verification - I

Lecture 22 - Logic Synthesis using Yosys

Lecture 23 - Formal Verification - II

Lecture 24 - Formal Verification - III

Lecture 25 - Formal Verification - IV

Lecture 26 - Technology Library

Lecture 27 - Logic Optimization using Yosys

Lecture 28 - Static Timing Analysis - I

Lecture 29 - Static Timing Analysis - II

Lecture 30 - Static Timing Analysis - III

Lecture 31 - Static Timing Analysis using OpenSTA

Lecture 32 - Constraints - I

Lecture 33 - Constraints - II

Lecture 34 - Technology Mapping

Lecture 35 - Timing-driven Optimization

Lecture 36 - Technology Library and Constraints

Lecture 37 - Power Analysis

Lecture 38 - Power Optimization

Lecture 39 - Basic Concepts of DFT

Lecture 40 - Scan Design Flow

Lecture 41 - Power Analysis using OpenSTA

Lecture 42 - Automatic Test Pattern Generation (ATPG)

Lecture 43 - Built-in Self Test (BIST)

Lecture 44 - Basic Concepts for Physical Design - I

Lecture 45 - Basic Concepts for Physical Design - II

Lecture 46 - Installation of OpenRoad

Lecture 47 - Chip Planning - I

Lecture 48 - Chip Planning - II

Lecture 49 - Placement

Lecture 50 - Chip Planning and Placement

Lecture 51 - Clock Tree Synthesis (CTS)

Lecture 52 - Routing

Lecture 53 - Post-layout Verification and Signoff

Lecture 54 - Clock Tree Synthesis (CTS) and Routing

NPTEL : NOC:Fundamentals of Wireless Communication (Hindi) (Electrical Engineering)

Co-ordinators : Dr.Vivek Bohara

Lecture 1 - Introduction to the Course

Lecture 2 - Basics of Wireless Communication Systems

Lecture 3 - Path-Loss Models for a Wireless Channel

Lecture 4 - Log-Normal Shadowing

Lecture 5 - Small-Scale Fading

Lecture 6 - Statistical Multipath Channel Models

Lecture 7 - MATLAB programming for Path Loss Models

Lecture 8 - Statistical Multipath Channel Models - Part 1

Lecture 9 - Statistical Multipath Channel Models - Part 2

Lecture 10 - Digital Modulation and Detection (Binary Modulations) - Part 1

Lecture 11 - Digital Modulation and Detection (Binary Modulations) - Part 2

Lecture 12 - Digital Modulation and Detection (Binary Modulations) - Part 3

Lecture 13 - MATLAB programming for Wireless Fading Channels

Lecture 14 - Digital Modulation and Detection (Binary Modulations) - Part 1

Lecture 15 - Digital Modulation and Detection (Binary Modulations) - Part 2

Lecture 16 - Digital Modulation and Detection (M-ary Modulation) - Part 1

Lecture 17 - Digital Modulation and Detection (M-ary Modulation) - Part 2

Lecture 18 - Digital Modulation and Detection (M-ary Modulation) - Part 3

Lecture 19 - MATLAB programming for Modulation Schemes

Lecture 20 - Digital Modulation and Detection (GMSK)

Lecture 21 - Performance of Digital Modulation over Wireless Channels

Lecture 22 - Performance of Digital Modulation over Wireless Channels

Lecture 23 - MATLAB programaming: Error performance in AWGN channel

Lecture 24 - Receiver Diversity Techniques - Part 1

Lecture 25 - Receiver Diversity Techniques - Part 2

Lecture 26 - Receiver Diversity Techniques - Part 3

Lecture 27 - Error performance in Fading Channel Part 1

Lecture 28 - Error performance in Fading Channel Part 2

Lecture 29 - Multi-Carrier Modulation and OFDM - Part 1

Lecture 30 - Multi-Carrier Modulation and OFDM - Part 2

Lecture 31 - Multi-Carrier Modulation and OFDM - Part 3

Lecture 32 - Multi-Carrier Modulation and OFDM - Part 4

Lecture 33 - Numerical on OFDM

Lecture 34 - Programming for OFDM

Lecture 35 - OFDM System with Cyclic Prefix

Lecture 36 - OFDM Signal Transmission and OFDM System Design

Lecture 37 - Advantages and Drawbacks of OFDM System

Lecture 38 - OFDM Standards

Lecture 39 - Multiple Access Schemes

Lecture 40 - Technologies for Wireless Cellular Standards

NPTEL : NOC:Sensor Technologies: Physics, Fabrication, and Circuits (Electrical Engineering)

Co-ordinators : Prof.Mitradip Bhattacharjee

Lecture 1 - Sensors and Transducers - Basics

Lecture 2 - Introduction to Sensors

Lecture 3 - Materials for sensors

Lecture 4 - Multidisciplinary Aspects of Sensors

Lecture 5 - Introduction to Sensor Parameters

Lecture 6 - Sensor Parameters - II

Lecture 7 - Sensor Parameters - III

Lecture 8 - Sensor Parameters - IV

Lecture 9 - Sensor Parameters - V

Lecture 10 - Numerical Examples

Lecture 11 - Introduction: Physics of Sensors

Lecture 12 - Capacitive Sensor Architecture

Lecture 13 - Different Types of Capacitive Sensors

Lecture 14 - Thermal Sensors Basics

Lecture 15 - Dynamic Condition of Thermal Sensors

Lecture 16 - Classification of Thermal Sensors

Lecture 17 - Chemical Sensor Basics

Lecture 18 - Electrochemical Sensors

Lecture 19 - Impedimetric Sensors

Lecture 20 - Numerical Examples

Lecture 21 - Physics of Optical Sensors

Lecture 22 - Physics of Magnetic Sensors

Lecture 23 - Physics of Acoustic Sensors

Lecture 24 - Physics of Microfluidic Sensors

Lecture 25 - Various Sensor Geometries and Examples

Lecture 26 - Microfabrication Technologies

Lecture 27 - Deposition Techniques

Lecture 28 - Physical Vapor Deposition

Lecture 29 - Chemical Vapor Deposition

Lecture 30 - Patterning Techniques

Lecture 31 - Lithography Techniques

Lecture 32 - Basics of Etching Techniques

Lecture 33 - Dry Etching Techniques

Lecture 34 - Optical and Electron Microscopy

Lecture 35 - Other Microscopy Techniques

Lecture 36 - Sensor System: Basic Circuits

Lecture 37 - Amplifier Circuits

Lecture 38 - Instrumentation Amplifier

Lecture 39 - Filter Circuits

Lecture 40 - Sensor System: Experimental Demonstration

NPTEL : NOC:Advanced topics in Wireless Communication (Hindi) (Electrical Engineering)

Co-ordinators : Prof. Vivek Ashok Bohara

Lecture 1 - Overview of Advanced Topics in Wireless Communication System - Part A

Lecture 2 - Overview of Advanced Topics in Wireless Communication System - Part B

Lecture 3 - Revision of Wireless Fundamentals - Part A

Lecture 4 - Revision of Wireless Fundamentals - Part B

Lecture 5 - Revision of Wireless Fundamentals - Part C

Lecture 6 - Revision of Wireless Fundamentals - Part D

Lecture 7 - Revision of Wireless Fundamentals - Part E

Lecture 8 - Channel Capacity in AWGN channel

Lecture 9 - Channel Capacity in flat fading channel

Lecture 10 - Channel Capacity with Optimal Power Adaptation

Lecture 11 - Tutorial 1 - MATLAB Tutorial: Channel Capacity

Lecture 12 - Introduction to Channel Coding

Lecture 13 - Channel Coding: Uncoded and Coded Performnace

Lecture 14 - Introduction to Linear Block Codes

Lecture 15 - Tutorial 2 - MATLAB Tutorial: Linear Block Codes

Lecture 16 - Linear Block Codes: Error Detection

Lecture 17 - Linear Block Codes: Error Correction

Lecture 18 - Examples of Linear Block Codes

Lecture 19 - Introduction to Convolution Codes

Lecture 20 - Convolution Code: Decoder-Viterbi Algorithm

Lecture 21 - Tutorial 3 - MATLAB Tutorial: Syndrome Identification and Correction

Lecture 22 - Convolution Codes: State Diagram and Transfer Function

Lecture 23 - Turbo codes

Lecture 24 - Low Density Parity Check (LDPC) Codes: Encoding

Lecture 25 - Low Density Parity Check (LDPC) Codes: Decoding

Lecture 26 - Introduction to Polar Codes

Lecture 27 - Polar Codes: Encoding and Decoding

Lecture 28 - Introduciton to MIMO systems

Lecture 29 - Spatial Diversity Techniques

Lecture 30 - Introduction to Space Time Block Codes

Lecture 31 - Tutorial 4 - Convolution Codes: Hard and Soft Decoding

Lecture 32 - MIMO Zero-Forcing Receiver

Lecture 33 - MIMO MMSE Receiver

Lecture 34 - Introduction to MIMO SVD

Lecture 35 - Diagonalization of MIMO channel

Lecture 36 - Optimal Capacity of MIMO channel and MIMO Beamforming

Lecture 37 - Tutorial 5 - Random Access Technoques: ALOHA and CSMA

Lecture 38 - MIMO V-BLAST Receivers

Lecture 39 - Introduction to Adaptive Modulation and Coding

Lecture 40 - Modulation and Coding with Variable MQAM

Lecture 41 - Conventional Multiple Access Schemes

Lecture 42 - Next generation Multiple Access Schemes and Multi-User Channels

Lecture 43 - Overview of Cellular and Wi-Fi Standards

Lecture 44 - Evolution of Cellular and Wi-Fi Standards

Lecture 45 - Tutorial 6 - MIMO SVD Example

Lecture 46 - Tutorial 7 - Rate Splitting Multiple Access

NPTEL : NOC:State Space Approach to Control System Analysis and Design (Electrical Engineering)

Co-ordinators : Prof A P Tiwari

Lecture 1 - Introduction

Lecture 2 - Standard State-space Representation of Physical Systems

Lecture 3 - Mathematical Modeling from First Principles

Lecture 4 - Mathematical Modeling from First Principles

Lecture 5 - State-space Representation of Transfer Functions

Lecture 6 - State-space Representation of Transfer Functions (Continued...)

Lecture 7 - Equivalent Dynamical Equations

Lecture 8 - Transformation of State Equations into Canonical forms

Lecture 9 - Solution of State Equations

Lecture 10 - Solution of State Equations: Methods to determine the STM

Lecture 11 - Simulation: An Overview

Lecture 12 - Numerical Solution of State Equations

Lecture 13 - Controllability

Lecture 14 - Controllability

Lecture 15 - Controllability

Lecture 16 - Observability

Lecture 17 - Lypunov's Stability - 1

Lecture 18 - Lypunov's Stability - 2

Lecture 19 - Lypunov's Stability - 3

Lecture 20 - Pole Placement Design-I: Concept of State feedback

Lecture 21 - Pole Placement Design-II: Properties of State Feedback

Lecture 22 - Pole Placement Design-III: Pole placement formulae, Selection of Closed loop pole locations

Lecture 23 - Linear Quadratic Optimal Control - Part 1

Lecture 24 - Linear Quadratic Optimal Control - Part 2

Lecture 25 - Linear Observers-Full Order Observer

Lecture 26 - Linear Observers-Reduced Order Observer

Lecture 27 - Separation Principle

Lecture 28 - Multirate Sampling Controllers-Relationship between System state, multirate output samples and inputs

Lecture 29 - Multirate Output Controller (MROC)

Lecture 30 - Fast Output Sampling (FOS) Controller

Lecture 31 - Periodic Output Feedback (POF) Controller

Lecture 32 - Continuous-Time Kalman Filter

Lecture 33 - Discrete-Time Kalman Filter

Lecture 34 - Case Study of Nuclear Reactor: Nonlinear Model Development

Lecture 35 - Case Study of Nuclear Reactor: Model Linearization

Lecture 36 - Case Study of Nuclear Reactor: Output Feedback Control Design

Lecture 37 - Case Study of Nuclear Reactor: Periodic Output Feedback Design

Lecture 38 - Case Study of Nuclear Reactor: Fast Output Sampling based Control Design

Lecture 39 - Case Study of Nuclear Reactor: Application of Kalman Filtering to Response Improvement of Vanadium SPND

NPTEL : NOC:Optimal Control (Electrical Engineering)

Co-ordinators : Prof. Barjeev Tyagi

Lecture 1 - Introduction and Performance Index

Lecture 2 - Basic Concepts of Calculus of Variation

Lecture 3 - The Basic Variational Problem

Lecture 4 - Fixed End Point Problem

Lecture 5 - Free End Point Problem

Lecture 6 - Free End Point Problem (Continued...)

Lecture 7 - Free End Point Problem (Continued...)

Lecture 8 - Free End Point Problem (Continued...)

Lecture 9 - Optimum of Functions with Conditions

Lecture 10 - Optimum of Functions with Conditions (Lagrange Multiplier Method)

Lecture 11 - Optimum of Functional with Conditions

Lecture 12 - Variational Approach to Optimal Control Systems

Lecture 13 - Variational Approach to Optimal Control Systems (Continued...)

Lecture 14 - Linear Quadratic Optimal Control Systems

Lecture 15 - Linear Quadratic Optimal Control Systems (Continued...)

Lecture 16 - Linear Quadratic Optimal Control Systems (Continued...)

Lecture 17 - Linear Quadratic Optimal Control Systems (Continued...)

Lecture 18 - Linear Quadratic Optimal Control Systems (Continued...)

Lecture 19 - Linear Quadratic Optimal Control Systems (Optimal Value of Performance Index)

Lecture 20 - Infinite Horizon Regulator Problem

Lecture 21 - Infinite Horizon Regulator Problem (Continued...)

Lecture 22 - Analytical Solution of MDRE - State Transition Matrix Approach

Lecture 23 - Analytical Solution of MDRE - Similarity Transformation Approach

Lecture 24 - Analytical Solution of MDRE - Similarity Transformation Approach (Continued...)

Lecture 25 - Frequency Domain Interpretation of LQR - Linear Time Invariant System

Lecture 26 - Frequency Domain Interpretation of LQR - Linear Time Invariant System (Continued...)

Lecture 27 - LQR with a Specified Degree of Stability

Lecture 28 - Inverse Matrix Riccati Equation

Lecture 29 - Linear Quadratic Tracking System

Lecture 30 - Discrete-Time Optimal Control Systems

Lecture 31 - Discrete-Time Optimal Control Systems (Continued...)

Lecture 32 - Discrete-Time Optimal Control Systems (Continued...)

Lecture 33 - Matrix Discrete Riccati Equation

Lecture 34 - Analytical Solution of Matrix Difference Riccati Equation

Lecture 35 - Analytical Solution of Matrix Difference Riccati Equation (Continued...)

Lecture 36 - Optimal Control using Dynamic Programming

Lecture 37 - The Hamilton-Jacobi-Bellman (HJB) Equation

Lecture 38 - LQR System Using HJB Equation

Lecture 39 - Time Optimal Control System - Constrained Input

Lecture 40 - Time Optimal Control System (Continued...)

NPTEL : NOC:Basics of Software Defined Radios and Practical Applications (Electrical Engineering)

Co-ordinators : Dr. Meenakshi Rawat

Lecture 1 - Foundation for software defined radio

Lecture 2 - Components of a software defined radio

Lecture 3 - Software defined radio architectures - Part I

Lecture 4 - Software defined radio architectures - Part II

Lecture 5 - Software defined radio architectures - Part III

Lecture 6 - Software defined radio architectures - Part IV

Lecture 7 - Distortion Parameters - Part I

Lecture 8 - Distortion Parameters - Part II

Lecture 9 - Distortion Parameters: Nonlinear Distortion

Lecture 10 - Distortion Parameters: Nonlinearity Specifications

Lecture 11 - Power Amplifiers: Nonlinear Distortion in Transmitted Signals

Lecture 12 - Power Amplifiers: Useful Definitions

Lecture 13 - Case study-I: Power amplifier Line-up for achieving linearity and power requirement example

Lecture 14 - Case study-II: Power amplifier Line-up for linearity and power requirement: Need for linearization techniques

Lecture 15 - Behavioral models for representing nonlinear distortions

Lecture 16 - Linearization Techniques for nonlinear distortion

Lecture 17 - Predistortion Techniques for nonlinearity distortion in SDR

Lecture 18 - Basic Digital Predistortion Techniques for nonlinear distortion in SDR

Lecture 19 - State-of-the-art Digital Predistortion Techniques for Nonlinear Distortion in SDR

Lecture 20 - Digital Predistortion Techniques for Linear as well as Nonlinear Distortion in SDR

NPTEL : NOC:Electrical Distribution System Analysis (Electrical Engineering)

Co-ordinators : Prof. G. B. Kumbhar

Lecture 1 - Introduction to Electrical Distribution System

Lecture 2 - Components of Distribution System Substation and Busbar Layouts

Lecture 3 - Components of Distribution System and Feeder Configurations

Lecture 4 - Nature of Loads in a Distribution System

Lecture 5 - Load Allocation in a Distribution System

Lecture 6 - K Factors and Their Applications

Lecture 7 - Analysis of Uniformly Distributed

Lecture 8 - Lumping Loads in Geometric Configurations Rectangular

Lecture 9 - Lumping Loads in Geometric Configurations Triangular

Lecture 10 - Impedance of Distribution Lines and Feeders - Part I

Lecture 11 - Series Impedance of Distribution Lines and Feeders - Part II

Lecture 12 - Models of Distribution Lines and Cables

Lecture 13 - Modelling of Single-Phase and Three-Phase Transformers

Lecture 14 - Modelling of Three-Phase Transformers - Part I

Lecture 15 - Modelling of Three-Phase Transformers - Part II

Lecture 16 - Modelling of Three-Phase Transformers - Part III

Lecture 17 - Modelling of Three-Phase Transformers - Part IV

Lecture 18 - Modelling of Step Voltage Regulators - Part I

Lecture 19 - Modelling of Step Voltage Regulators - Part II

Lecture 20 - Modelling of Step Voltage Regulators - Part III

Lecture 21 - Modelling of Step Voltage Regulators - Part IV

Lecture 22 - Load Models in Distribution System - Part I

Lecture 23 - Load Models in Distribution System - Part II

Lecture 24 - Modelling of Distributed Generation

Lecture 25 - Applications and Modeling of Capacitor Banks

Lecture 26 - Summary of Modelling of Distribution System Components

Lecture 27 - Backward/Forward Sweep Load Flow Analysis - Part I

Lecture 28 - Backward/Forward Sweep Load Flow Analysis - Part II

Lecture 29 - Direct Approach Based Load Flow Analysis - Part I

Lecture 30 - Direct Approach Based Load Flow Analysis - Part II

Lecture 31 - Direct Approach Based Load Flow Analysis - Part III

Lecture 32 - Direct Approach Based Load Flow Analysis: Weakly Meshed System

Lecture 33 - Gauss Implicit Z-matrix Method

Lecture 34 - Sequence Component Based Short Circuit Analysis

Lecture 35 - Thevenin's Equivalent and Phase Variable Based Short Circuit Analysis

Lecture 36 - Direct Approach for Short-Circuit Analysis: Introduction and LG Fault

Lecture 37 - Direct Approach for Short-Circuit Analysis: LLG and LLLG Fault

Lecture 38 - Direct Approach for Short-Circuit Analysis: LL Fault and Examples

Lecture 39 - Direct Approach for Short-Circuit Analysis: Weakly Meshed System

Lecture 40 - Applications of Distribution System Analysis

NPTEL : NOC:Introduction to Smart Grid (Electrical Engineering)

Co-ordinators : Prof. Premalata Jena, Prof. N.P. Padhy

Lecture 1 - Introduction to Smart Grid - I

Lecture 2 - Introduction to Smart Grid - II

Lecture 3 - Architecture of smart grid system

Lecture 4 - Standards for smart grid system

Lecture 5 - Elements and Technologies of smart grid system - I

Lecture 6 - Elements and Technologies of smart grid system - II

Lecture 7 - Distributed Generation Resources - I

Lecture 8 - Distributed Generation Resources - II

Lecture 9 - Distributed Generation Resources - III

Lecture 10 - Distributed Generation Resources - IV

Lecture 11 - Wide Area Monitoring System - I

Lecture 12 - Wide Area Monitoring System - II

Lecture 13 - Phasor Estimation - I

Lecture 14 - Phasor Estimation - II

Lecture 15 - Digital Relays for Smart Grid Protection

Lecture 16 - Islanding Detection Techniques - I

Lecture 17 - Islanding Detection Techniques - II

Lecture 18 - Islanding Detection Techniques - III

Lecture 19 - Smart Grid Protection - I

Lecture 20 - Smart Grid Protection - II

Lecture 21 - Smart Grid Protection - III

Lecture 22 - Smart Grid Protection - IV

Lecture 23 - Modelling of Storage Devices

Lecture 24 - Modelling of DC Smart Grid Components

Lecture 25 - Operation and Control of AC Microgrid - I

Lecture 26 - Operation and Control of AC Microgrid - Il

Lecture 27 - Operation and Control of DC Microgrid - I

Lecture 28 - Operation and Control of DC Microgrid - II

Lecture 29 - Operation and Control of AC-DC hybrid Microgrid - I

Lecture 30 - Operation and Control of AC-DC hybrid Microgrid - II

Lecture 31 - Simulation and Case Study of AC Microgrid

Lecture 32 - Simulation and Case Study of DC Microgrid

Lecture 33 - Simulation and Case Study of AC-DC Hybrid Microgrid

Lecture 34 - Demand Side Management in Smart Grid

Lecture 35 - Demand Response Analysis of Smart Grid

Lecture 36 - Energy Management

Lecture 37 - Design of Smart Grid and Practical Smart Grid Case Study - I

Lecture 38 - Design of Smart Grid and Practical Smart Grid Case Study - II

Lecture 39 - System Analysis of AC/DC Smart Grid

Lecture 40 - Conclusions

NPTEL : NOC:Facts Devices (Electrical Engineering)

Co-ordinators : Prof. Avik Bhattacharya

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Switch Realization

Lecture 4 - PWM - I

Lecture 5 - PWM - II

Lecture 6 - Closed Loop Control

Lecture 7 - Multi Level Inverter - I

Lecture 8 - Multi Level Inverter - II

Lecture 9 - Multi Level Inverter - III

Lecture 10 - Shunt Compensator Analysis

Lecture 11 - Shunt Compensator TCR and TSC - I

Lecture 12 - Shunt Compensator TCR and TSC - II

Lecture 13 - Static Var Compensator - I

Lecture 14 - Static Var Compensator - II

Lecture 15 - STATCOM - I

Lecture 16 - STATCOM - II

Lecture 17 - STATCOM/SVC Comparisons

Lecture 18 - External Control Design of Static Var Compensator

Lecture 19 - DSTATCOM

Lecture 20 - Design of DSTATCOM

Lecture 21 - Series Compensator - I

Lecture 22 - Series Compensator - II

Lecture 23 - GCSC and SSSC

Lecture 24 - SSSC - II

Lecture 25 - SSSC - III and TSSC

Lecture 26 - TSSC - II and TCSC

Lecture 27 - TCSC Characteristics and Control

Lecture 28 - Voltage and Phase Angle Regulation

Lecture 29 - Voltage and Phase Angle Regulator Device - I

Lecture 30 - Voltage and Phase Angle Regulator Device - II

Lecture 31 - UPQC Introduction and Classification

Lecture 32 - UPQC Classification - I

Lecture 33 - Operation and Control of UPQC - II

Lecture 34 - Operation and Control of UPQC - III

Lecture 35 - UPFC

Lecture 36 - Control Structure of UPFC

Lecture 37 - Comparison of UPFC with PAR and Series Compensators

Lecture 38 - Interline Power Flow Controller (IPFC) - I

Lecture 39 - Interline Power Flow Controller (IPFC) - II

Lecture 40 - Practical Application and Conclusion

NPTEL : NOC:Advanced Linear Continuous Control Systems: Applications with MATLAB Programming and Simulink (Electrical Engineering)

Co-ordinators : Prof. Yogesh Vijay Hote

Lecture 1 - Introduction to State Space

Lecture 2 - State Space Representation

Lecture 3 - State Space Representation: Companion Form (Controllable Canonical Form)

Lecture 4 - State Space Representation: Extended Controllable Canonical Form

Lecture 5 - State Space Representation: Observable Canonical Form

Lecture 6 - State Space Representation: Diagonal Canonical Form - Part I

Lecture 7 - State Space Representation: Diagonal Canonical Form - Part II

Lecture 8 - State Space Representation: Jordan Canonical Form

Lecture 9 - State Space Representation: Numerical Examples on State space Modelling - Part I

Lecture 10 - State Space Representation: Numerical Examples on State space Modelling - Part II

Lecture 11 - Modelling of Mechanical Systems in State Space

Lecture 12 - Modelling of DC Servo Motor - Part I

Lecture 13 - Modelling of DC Servo Motor - Part II

Lecture 14 - Determination of Transfer Function from State Space Model - Part I

Lecture 15 - Determination of Transfer Function from State Space Model - Part II

Lecture 16 - Stability Analysis in State Space: Concept of Eigenvalues and Eigenvectors - Part I

Lecture 17 - Stability Analysis in State Space - Part II

Lecture 18 - Stability Analysis in State Space: Lyapunov Stability Analysis (Sylvesterâ€™s Criterion) - Part III

Lecture 19 - Stability Analysis in State Space: Lyapunov Stability Analysis (Stability Criterion) - PartIV

Lecture 20 - Stability Analysis in State Space: Lyapunov Stability Analysis (Direct Method) - Part V

Lecture 21 - Concept of Diagonalization

Lecture 22 - Solution of State Equation

Lecture 23 - Solution of State Equation (Forced System)

Lecture 24 - Steady State Error for State Space System

Lecture 25 - State Transition Matrix - Part I

Lecture 26 - State Transition Matrix - Part II

Lecture 27 - State Transition Matrix using Cayley-Hamilton Theorem - Part III

Lecture 28 - MATLAB Programming with State Space

Lecture 29 - Controllability in State Space - Part I

Lecture 30 - Controllability in State Space - Part II

Lecture 31 - Observability in State Space - Part I

Lecture 32 - Observability in State Space - Part II

Lecture 33 - Pole Placement by State Feedback - Part I

Lecture 34 - Pole Placement by State Feedback - Part II

Lecture 35 - Pole Placement by State Feedback - Part III

Lecture 36 - Tracking Problem in State Feedback Design - Part I

Lecture 37 - Tracking Problem in State Feedback Design - Part II

Lecture 38 - State Observer Design - Part I

Lecture 39 - State Observer Design - Part II

Lecture 40 - State Observer Design - Part III

NPTEL : NOC:Computer Aided Power System Analysis (Electrical Engineering)

Co-ordinators : Prof. Biswarup Das

Lecture 1 - Modeling of Power System Components

Lecture 2 - Modeling of Power System Components (Continued...)

Lecture 3 - Bus Admittance Matrix

Lecture 4 - Bus Admittance Matrix with Mutual Impedance

Lecture 5 - Bus Admittance Matrix with mutual impedance (Continued...)

Lecture 6 - Power flow equations and classification of buses

Lecture 7 - Basic Gauss - Seidel Numerical Method

Lecture 8 - Gauss - Seidel Load Flow (GSLF)

Lecture 9 - GSLF with Multiple Generators

Lecture 10 - Example of GSLF

Lecture 11 - Basics of Newton Raphson Numerical Method

Lecture 12 - Newton - Raphson Load Flow (NRLF) in Polar Co-Ordinate

Lecture 13 - NRLF in polar co-ordinate (Continued...)

Lecture 14 - NRLF in polar co-ordinate (Continued...)

Lecture 15 - NRLF (Polar) Algorithm and Example

Lecture 16 - NRLF in rectangular coordinate

Lecture 17 - NRLF in rectangular coordinate (Continued...)

Lecture 18 - NRLF in rectangular coordinate (Continued...)

Lecture 19 - Example of NRLF (Rectangular) Method

Lecture 20 - Fast decoupled load flow (FDLF)

Lecture 21 - FDLF (Continued...)

Lecture 22 - FDLF (Continued...)

Lecture 23 - AC- DC Load Flow

Lecture 24 - AC- DC Load Flow (Continued...)

Lecture 25 - AC- DC Load Flow (Continued...)

Lecture 26 - Sparsity and Gaussian Elimination

Lecture 27 - Gaussian Elimination Method

Lecture 28 - Example of Gaussian Elimination Method

Lecture 29 - Gaussian Elimination and Optimal Ordering

Lecture 30 - Triangular Factorization

Lecture 31 - LU Decomposition

Lecture 32 - Introduction to Contingency Analysis

Lecture 33 - Linear Sensitivity Factor

Lecture 34 - Linear Sensitivity Factors (Continued...)

Lecture 35 - Line outage sensitivity factor

Lecture 36 - Line outage sensitivity factor (Continued...)

Lecture 37 - Line outage sensitivity factor (Continued...)

Lecture 38 - State Estimation Technique

Lecture 39 - Weighted Least Square (WLS) Method

Lecture 40 - WLS (Continued...)

Lecture 41 - WLS Examples

Lecture 42 - Error Analysis

Lecture 43 - Error Analysis (Continued...)

Lecture 44 - Bad Data Detection

Lecture 45 - Power system state estimation

Lecture 46 - Power system state estimation (Continued...)

Lecture 47 - Power system state estimation (Continued...)

Lecture 48 - Power system state estimation (Continued...)

Lecture 49 - Fault Analysis

Lecture 50 - Fault Analysis (Continued...)

Lecture 51 - Fault Analysis (Continued...)

Lecture 52 - Fault Analysis (Continued...)

Lecture 53 - Fault Analysis (Continued...)

Lecture 54 - Fault Analysis (Continued...)

Lecture 55 - Fault Analysis (Continued...)

Lecture 56 - Fault Analysis (Continued...)

Lecture 57 - Fault Analysis (Continued...)

Lecture 58 - Fault Analysis (Continued...)

Lecture 59 - Fault Analysis (Continued...)

Lecture 60 - Fault Analysis (Continued...)

NPTEL : NOC:Advance Power Electronics and Control (Electrical Engineering)

Co-ordinators : Prof. Avik Bhattacharya

Lecture 1 - Introduction

Lecture 2 - Basic Concept of Switches

Lecture 3 - Device Physics - I

Lecture 4 - Device Physics - II

Lecture 5 - Device Physics - III

Lecture 6 - Device Physics - IV

Lecture 7 - Application and Analysis of Switches - I

Lecture 8 - Application and Analysis of Switches - II

Lecture 9 - Single Phase Converter

Lecture 10 - Single Phase Converters - II

Lecture 11 - Single Phase Converters - III

Lecture 12 - Three Phase Converters - I

Lecture 13 - Three Phase Converters - II

Lecture 14 - Multipulse Converters II

Lecture 15 - Effect of Source Inductance and PWM Rectifiers

Lecture 16 - PWM Rectifiers - II

Lecture 17 - PWM Rectifiers - III and Power Factor Improvement Techniques

Lecture 18 - PWM Rectifiers - IV and Power Factor Improvement Techniques - II

Lecture 19 - Power Factor Improvement Techniques III and Non Isolated DC- DC Converters

Lecture 20 - Non Isolated DC- DC Converters - II

Lecture 21 - Non Isolated and Isolated DC- DC Converters and Choppers

Lecture 22 - Isolated DC-DC Converters and Choppers

Lecture 23 - Isolated DC-DC Converters - II

Lecture 24 - Isolated DC-DC Converters - III

Lecture 25 - Isolated DC-DC Converters - IV and VSI and CSI

Lecture 26 - VSI and CSI

Lecture 27 - VSI and CSI II and MLI

Lecture 28 - PWM Techniques II and MLI

Lecture 29 - MLI II and ZSI

Lecture 30 - ZSI II and Space Vector Modulation (SVM)

Lecture 31 - SVM II and AC to AC Converters

Lecture 32 - SVM III and AC to AC Converters

Lecture 33 - Cycloconverters and Matrix Converters

Lecture 34 - Matrix Converter - II

Lecture 35 - Matrix Converter - III and Power Quality Mitigation Devices

Lecture 36 - Power Quality Mitigation Devices - II

Lecture 37 - Linear and Non Linear Control in Power Electronics - I

Lecture 38 - Linear and Non Linear Control in Power Electronics - II

Lecture 39 - Non-Linear Control in Power Electronics

Lecture 40 - Application and Conclusion

NPTEL : NOC:CMOS Digital VLSI Design (Electrical Engineering)

Co-ordinators : Prof. Sudeb Dasgupta

Lecture 1 - MOS Transistor Basics - I

Lecture 2 - MOS Transistor Basics - II

Lecture 3 - MOS Transistor Basics - III

Lecture 4 - MOS Parasitics and SPICE Model

Lecture 5 - CMOS Inverter Basics - I

Lecture 6 - CMOS Inverter Basics - II

Lecture 7 - CMOS Inverter Basics - III

Lecture 8 - Power Analysis - I

Lecture 9 - Power Analysis - II

Lecture 10 - SPICE Simulation - I

Lecture 11 - SPICE Simulation - II

Lecture 12 - Combinational Logic Design - I

Lecture 13 - Combinational Logic Design - II

Lecture 14 - Combinational Logic Design - III

Lecture 15 - Combinational Logic Design - IV

Lecture 16 - Combinational Logic Design - V

Lecture 17 - Combinational Logic Design - VI

Lecture 18 - Combinational Logic Design - VII

Lecture 19 - Combinational Logic Design - VIII

Lecture 20 - Combinational Logic Design - IX

Lecture 21 - Combinational Logic Design - X

Lecture 22 - Logical Efforts - I

Lecture 23 - Logical Efforts - II

Lecture 24 - Logical Efforts - III

Lecture 25 - Sequential Logic Design - I

Lecture 26 - Sequential Logic Design - II

Lecture 27 - Sequential Logic Design - III

Lecture 28 - Sequential Logic Design - IV

Lecture 29 - Sequential Logic Design - V

Lecture 30 - Sequential Logic Design - VI

Lecture 31 - Sequential Logic Design - VII

Lecture 32 - Sequential Logic Design - VIII

Lecture 33 - Clocking Strategies for Sequential Design - I

Lecture 34 - Clocking Strategies for Sequential Design - II

Lecture 35 - Clocking Strategies for Sequential Design - III

Lecture 36 - Clocking Strategies for Sequential Design - IV

Lecture 37 - Sequential Logic Design - IX

Lecture 38 - Clocking Strategies for Sequential Design - V

Lecture 39 - Concept of Memory and its Designing - I

Lecture 40 - Concept of Memory and its Designing - II

NPTEL : NOC:Microelectronics: Devices to Circuits (Electrical Engineering)

Co-ordinators : Prof. Sudeb Dasgupta

Lecture 1 - Bipolar Junction Transistor : Physical structure and Modes of Operation

Lecture 2 - Bipolar Junction Transistor : Modes of operation - I

Lecture 3 - Bipolar Junction Transistor : Modes of operation - II

Lecture 4 - BJT Operation in active mode Circuit symbol and conventions - I

Lecture 5 - BJT Operation in active mode Circuit symbol and conventions - II

Lecture 6 - BJT as an amplifier small circuit model - I

Lecture 7 - BJT as an amplifier small circuit model - II

Lecture 8 - BJT Small Signal Circuit Model - I

Lecture 9 - BJT Small Signal Circuit Model - II

Lecture 10 - BJT as a switch and Ebers Moll Model

Lecture 11 - Simple BJT Inverter and second order effects

Lecture 12 - BJT Second order effects - I

Lecture 13 - BJT Second order effects - II

Lecture 14 - MOS Transistor basics - I

Lecture 15 - MOS Transistor basics - II

Lecture 16 - MOS Transistor basics - III

Lecture 17 - MOS Parasitic and SPICE Model

Lecture 18 - CMOS Inverter Basics - I

Lecture 19 - CMOS Inverter Basics - II

Lecture 20 - CMOS Inverter Basics - III

Lecture 21 - Power Analysis - I

Lecture 22 - Logical Efforts - I

Lecture 23 - Fabrication-Process - I

Lecture 24 - Fabrication-Process - II

Lecture 25 - Biasing of Amplifier and its behaviour as an Analog switch - I

Lecture 26 - Biasing of Amplifier and its behaviour as an Analog switch - II

Lecture 27 - Biasing of Amplifier and its behaviour as an Analog switch - III

Lecture 28 - CMOS CS/CG/CD Amplifier Configuration

Lecture 29 - CMOS CG/CD Amplifier Configuration

Lecture 30 - Internal CAP Models and high frequency Modelling - I

Lecture 31 - Internal CAP Models and high frequency Modelling - II

Lecture 32 - JFET, Structure and Operation

Lecture 33 - Multistage and Differential Amplifier - I

Lecture 34 - Multistage and Differential Amplifier - II

Lecture 35 - MOS Differential Amplifier - I

Lecture 36 - MOS Differential Amplifier - II

Lecture 37 - Small signal operation and Differential Amplifiers - I

Lecture 38 - Small signal operation and Differential Amplifiers - II

Lecture 39 - Multistage Amplifier with SPICE Simulation

Lecture 40 - S-Domain Analysis, Transfer Function, Poles and Zeros - I

Lecture 41 - S-Domain Analysis, Transfer Function, Poles and Zeros - II

Lecture 42 - High Frequency response of CS and CE Amplifier

Lecture 43 - High Frequency response of CC and SF Configuration

Lecture 44 - Frequency response of Differential Amplifier

Lecture 45 - General Feedback Structure and properties of negative Feedback

Lecture 46 - Basic Feedback Topologies

Lecture 47 - Design of feedback amplifier for all configuration

Lecture 48 - Stability and amplifier poles

Lecture 49 - Bode plots and Frequency Plot

Lecture 50 - Ideal Operational Amplifier and its terminal

Lecture 51 - Op-amp as a Integrator and Differentiator

Lecture 52 - Large Signal Operation of Op-amp and second order effects

Lecture 53 - Combinational logic design - I

Lecture 54 - Combinational logic design - II

Lecture 55 - Combinational logic design - III

Lecture 56 - Combinational logic design - IV

Lecture 57 - Sequential logic design - I

Lecture 58 - Clocking strategies For Sequential design - I

Lecture 59 - Clocking strategies For Sequential design - II

Lecture 60 - Memory Design

NPTEL : NOC:DC Microgrid (Electrical Engineering)

Co-ordinators : Prof. Avik Bhattacharya

Lecture 1 - Overview of Microgrids

Lecture 2 - Concept of Microgrids

Lecture 3 - Microgrid and distributed generation

Lecture 4 - Microgrid vs Conventional Power System

Lecture 5 - AC and DC Microgrid with Distributed Energy Resources (AC Microgrid Part)

Lecture 6 - AC and DC Microgrid with Distributed Energy Resources (AC Microgrid Part) (Continued...)

Lecture 7 - Power Electronics for Microgrid

Lecture 8 - Power Electronic Converters in Microgrid Applications

Lecture 9 - Power Electronic Converters in Microgrid Applications (Power Electronic for Interfacing)

Lecture 10 - Power Electronic Converters in Microgrid Applications (Converter Modulation Techniques)

Lecture 11 - Modeling of converters in microgrid power system (AC/DC and DC/AC Converters Modeling)

Lecture 12 - Modeling of Power Converters in Microgrid Power System (DC/DC Converter Modeling and Control)

Lecture 13 - Modeling of Renewable Energy Resources (Modeling of Wind Energy System)

Lecture 14 - Modeling of Renewable Energy Resources (Modeling of Photovoltaic System)

Lecture 15 - Modeling of Energy Storage System

Lecture 16 - Microgrid Dynamics and Modeling

Lecture 17 - Microgrid Dynamics and Modeling (Continued...)

Lecture 18 - Microgrid Operation Modes and Standards - Part I

Lecture 19 - Microgrid Operation Modes and Standards - Part II

Lecture 20 - Microgrid Control Architectures

Lecture 21 - Microgrid Control Architectures (Continued...)

Lecture 22 - Intelligent Microgrid Operation and Control

Lecture 23 - Intelligent Microgrid Operation and Control (Continued...)

Lecture 24 - Intelligent Microgrid Operation and Control (Continued...)

Lecture 25 - Energy Management in Microgrid System (Continued...)

Lecture 26 - DC Microgrid System Architecture and AC Interface

Lecture 27 - DC Microgrid System Architecture and AC Interface (Continued...)

Lecture 28 - DC Microgrid System Architecture and AC Interface (Continued...)

Lecture 29 - DC Microgrid Dynamics and Modeling

Lecture 30 - DC Microgrid Dynamics and Modeling (Continued...)

Lecture 31 - Control of DC Microgrid System

Lecture 32 - Control of DC Microgrid System (Continued...)

Lecture 33 - Applications of DC Microgrids

Lecture 34 - Stability in Microgrid

Lecture 35 - Stability Analysis of DC Microgrid

Lecture 36 - Stability Analysis of DC Microgrid (Continued...)

Lecture 37 - DC Microgrid stabilization strategies (Passive damping method)

Lecture 38 - DC Microgrid Stabilization Strategies (Impedance/Admittance stability criteria)

Lecture 39 - DC microgrid stabilization using nonlinear Techniques

Lecture 40 - General Summary of DC Microgrids

NPTEL : NOC:Power Quality Improvement Technique (Electrical Engineering)

Co-ordinators : Prof. Avik Bhattacharya

Lecture 1 - Introduction

Lecture 2 - Overview - I

Lecture 3 - Overview - II

Lecture 4 - Overview - III

Lecture 5 - Source of Poor Power Quality - I

Lecture 6 - Source of Poor Power Quality - II

Lecture 7 - AC Power Quality Standard

Lecture 8 - Improvement of Power Factor by Capacitor

Lecture 9 - Passive Filter - I

Lecture 10 - Passive Filter - II

Lecture 11 - Passive Filter Design - I

Lecture 12 - Passive Filter Design - II

Lecture 13 - PWM Rectifier - I

Lecture 14 - PWM Rectifier - II

Lecture 15 - PWM Rectifier - III

Lecture 16 - Three phase converters - I

Lecture 17 - Three Phase Converters - II and multi pulse Converters

Lecture 18 - Three Phase Converters - III and multi-pulse Converters

Lecture 19 - VSI and CSI

Lecture 20 - Multilevel Inverter - I

Lecture 21 - Multilevel Inverter - II

Lecture 22 - Multilevel Inverter - III

Lecture 23 - PWM for Voltage Source Inverter - I

Lecture 24 - PWM for Voltage Source Inverter - II

Lecture 25 - PWM for Voltage Source inverter - III

Lecture 26 - PWM for Voltage Source Inverter - IV

Lecture 27 - Operation and Control of Grid-Connected VSC

Lecture 28 - Grid Connected VSC with inner Current Control

Lecture 29 - Shunt Active Power Filter - I

Lecture 30 - Shunt Active Power Filter - II

Lecture 31 - Shunt Active Power Filter - III

Lecture 32 - Shunt Active Power Filter - IV

Lecture 33 - Hybrid Active Power Filter - I

Lecture 34 - Hybrid Active power Filter - II

Lecture 35 - Hybrid Shunt Active Power Filter

Lecture 36 - UPQC Introduction and classification

Lecture 37 - UPQC Classification

Lecture 38 - Operation and Control of UPQC

Lecture 39 - Control of UPQC

Lecture 40 - Conclusion

NPTEL : NOC:Power System Protection and Switchgear (Electrical Engineering)

Co-ordinators : Prof. Bhaveshkumar R. Bhalja

Lecture 1 - Fundamentals of Protective Relaying - I

Lecture 2 - Fundamentals of Protective Relaying - II

Lecture 3 - Fundamentals of Protective Relaying - III

Lecture 4 - Fundamentals of Protective Relaying - IV

Lecture 5 - Fundamentals of Protective Relaying - V

Lecture 6 - Current based Relaying Scheme - I

Lecture 7 - Current based Relaying Scheme - II

Lecture 8 - Current based Relaying Scheme - III

Lecture 9 - Current based Relaying Scheme - IV

Lecture 10 - Current based Relaying Scheme - V

Lecture 11 - Current based Relaying Scheme - VI

Lecture 12 - Current based Relaying Scheme - VII

Lecture 13 - Current based Relaying Scheme - VIII

Lecture 14 - Protection of Transmission Lines using Distance Relays - I

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

NPTEL : NOC:RF Transceiver of Design (Electrical Engineering)

Co-ordinators : Prof. Darshak Bhatt

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

Lecture 6 - Basic of Wireless Communication - VI

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

Lecture 17 - Transceiver Architecture - IV

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

NPTEL : NOC:VLSI Physical Design with Timing Analysis (Electrical Engineering)

Co-ordinators : Prof. Bishnu Prasad Das

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 - Fidduccia-Mattheyeses (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

NPTEL : An Introduction to Electronics Systems Packaging (Electrical Engineering)

Co-ordinators : Prof. G.V. Mahesh

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 â€œSand-to-Siliconâ€

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 â€“ I; Resistive Parasitic

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

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

Lecture 18 - Electrical Issues â€“ 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

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

NPTEL : Power Electronics and Distributed Generation (Electrical Engineering)

Co-ordinators : Dr. Vinod John

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

NPTEL : Pulse width Modulation for Power Electronic Converters (Electrical Engineering)

Co-ordinators : Dr. G. Narayanan

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

NPTEL : Basic Electrical Technology (Electrical Engineering)

Co-ordinators : Prof. L. Umanand

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

Lecture 21 - The Practical Transformer - Part 3

Lecture 22 - DC Machines - Part 1

Lecture 23 - DC Machines - Part 2

Lecture 24 - DC Generators - Part 1

Lecture 25 - DC Generators - Part 2

Lecture 26 - DC Motors - Part 1

Lecture 27 - DC Motors - Part 2

Lecture 28 - DC Motors - Part 3

Lecture 29 - Three Phase System - Part 1

Lecture 30 - Three Phase System - Part 2

Lecture 31 - Three Phase System - Part 3

Lecture 32 - Three Phase System - Part 4

Lecture 33 - Three Phase Transformer - Part 1

Lecture 34 - Three Phase Transformer - Part 2

Lecture 35 - Induction Motor - Part 1

Lecture 36 - Induction Motor - Part 2

Lecture 37 - Induction Motor - Part 3

Lecture 38 - Induction Motor - Part 4

Lecture 39 - Synchronous Machine

NPTEL : Industrial Drives - Power Electronics (Electrical Engineering)

Co-ordinators : Prof. K. Gopakumar

Lecture 1 - Electric Drive

Lecture 2 - Controlled Rectifier - Part-1

Lecture 3 - Controlled Rectifier - Part-2 (Three phase)

Lecture 4 - Controlled Rectifier - Part-3 (Three phase)

Lecture 5 - Controlled Rectifier - Part-4 (Three Phase)

Lecture 6 - Controlled Rectifier - Part-5 (Three Phase)

Lecture 7 - Power Electronics Improvements

Lecture 8 - Four Quadrant Dc to Dc Converter

Lecture 9 - Sine Triangle PWM Control of Converter

Lecture 10 - Front-end Ac-Dc Converter with harmonic control

Lecture 11 - Ac to Dc Converter Close Loop Control Schematic

Lecture 12 - Ac-Dc Converter Close loop Control Block Diagram

Lecture 13 - Design of the Converter Controller & AC to DC

Lecture 14 - Front-End Ac to Dc Converter-Design

Lecture 15 - Front-End Ac to Dc Converter - Simulation study

Lecture 16 - Dc Motor Speed Control - Introduction

Lecture 17 - Dc Motor Speed Control - Block Diagram

Lecture 18 - Dc Motor Speed Control Current Control & S C L

Lecture 19 - Dc-Motor Speed Control Controller Design - Part-1

Lecture 20 - Dc Motor Speed Control Controller Design - Part-2

Lecture 21 - Dc Motor Speed Control Controller Design - Part-3

Lecture 22 - Basics of DC to AC Converter - Part-1

Lecture 23 - Basics of DC to AC Converter - Part-2

Lecture 24 - Inverter Sine Triangle PWM

Lecture 25 - Inverter - Current Hysteresis Controlled PWM

Lecture 26 - C H controlled & Basics of space vector PWM

Lecture 27 - Space Vector PWM - Part-2

Lecture 28 - Space Vector PWM - Part-3

Lecture 29 - Space Vector PWM Signal Generation

Lecture 30 - Speed Control of Induction Motor - Part-1

Lecture 31 - Speed Control of Induction Motor - Part-2

Lecture 32 - High dynamic performance of I M Drive

Lecture 33 - Dynamic Model of Induction Motor - Part-1

Lecture 34 - Dynamic Model of Induction Motor - Part-2

Lecture 35 - Vector Control of Induction Motor

Lecture 36 - Effect of Switching Time lag in Inverter

Lecture 37 - Power Switch Protection - Snubbers

NPTEL : NOC:Design for Internet of Things (Electrical Engineering)

Co-ordinators : Prof. T.V. Prabhakar

Lecture 1 - Introduction to IOTs - Part I

Lecture 2 - Introduction to IOTs - Part II

Lecture 3 - Introduction to IOTs - Examples

Lecture 4 - IOT applications - I

Lecture 5 - IOT applications - II

Lecture 6 - Power management in IOT device

Lecture 7 - Introduction to LDO

Lecture 8 - Design with an LDO

Lecture 9 - Introduction to switching regulators

Lecture 10 - Designing with LDO's, switching regulators and case studies - Part I

Lecture 11 - Designing with LDO's, switching regulators and case studies - Part II

Lecture 12 - Designing with LDO's, switching regulators and case studies - Part II

Lecture 13 - Designing with LDO's, switching regulators and case studies - Part IV

Lecture 14 - Power Conditioning with Energy Harvesters - I

Lecture 15 - Power Conditioning with Energy Harvesters - II

Lecture 16 - Power Conditioning with Energy Harvesters - III

Lecture 17 - Battery less power supply and battery life calculation for embedded devices - I

Lecture 18 - Battery less power supply and battery life calculation for embedded devices - II

Lecture 19 - Battery less power supply and battery life calculation for embedded devices - III

Lecture 20 - Introduction to MQTT

Lecture 21 - Quality of Service in MQTT

Lecture 22 - Standards and Security in MQTT

Lecture 23 - Introduction and Implementation of AMQP

Lecture 24 - Implementation of CoAP and MDNS

Lecture 25 - Basics of RFID

Lecture 26 - RFID protocol and applications

Lecture 27 - BLE Security

Lecture 28 - LPWAN technologies

Lecture 29 - Choice of Microcontrollers

Lecture 30 - Case Study 1 - Joule Jotter

Lecture 31 - Case Study 2 - Cloud Based Systems

NPTEL : NOC:Advances in UHV Transmission and Distribution (Electrical Engineering)

Co-ordinators : Prof Subba Reddy B

Lecture 1 - Advantages of HVAC/DC Transmission, Introduction to Grid Management

Lecture 2 - Transmission system development, Important components of transmission system

Lecture 3 - Insulation coordination, over voltage in power systems

Lecture 4 - Design/selection of insulators, Importance of grading/cc rings

Lecture 5 - Non ceramic insulators performance-service experience

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

Lecture 7 - Pollution flashover phenomena, modeling etc

Lecture 8 - Planning of High Voltage laboratories

Lecture 9 - Importance of High Voltage testing and techniques employed

Lecture 10 - Basic philosophy of HV testing, tests for various HV apparatus

Lecture 11 - HV testing techniques for various apparatus

Lecture 12 - HV testing on Composite Insulators

Lecture 13 - Surface degradation studies on composite insulators

Lecture 14 - Surface morphological techniques for composite insulators

Lecture 15 - Conductors used for EHV/UHV transmission

Lecture 16 - Corona nad interference on transmission lines

Lecture 17 - Introduction of HTLS conductors and their advantages

Lecture 18 - Mechanical considerations for HV conductors

Lecture 19 - Introduction to Towers and importance of foundations

Lecture 20 - Selection/Design of clearances for HV towers

Lecture 21 - Design Optimization for UHV towers

Lecture 22 - Introduction to 1100kV HVDC

Lecture 23 - Introduction to HV Substations

Lecture 24 - Types of Substations, comparison

Lecture 25 - Insulation coordination, Components in a typical substation

Lecture 26 - Preventive maintenance of Substation

Lecture 27 - Electric and magnetic fields, mitigations techniques

Lecture 28 - Importance of Grounding, reducing Earthing resistance

Lecture 29 - Introduction to the use of Fiber optic cables, OPGW

Lecture 30 - Introduction to communication and SCADA

Lecture 31 - Precautions and safety measures in substation

Lecture 32 - Electrical hazards, minimum clearances in substation

Lecture 33 - Importance of Generation of HVDC in the laboratory

Lecture 34 - Importance of Generation of HVAC, Impulse Voltage and Currents in the laboratory

Lecture 35 - Measurements of High Voltages

Lecture 36 - Measurements of High Voltages (Continued...)

Lecture 37 - Introduction to digital recorders, measurement

Lecture 38 - Upgradation/uprating of transmission lines- advantages

Lecture 39 - Upgradation/uprating of transmission lines- advantages (Continued...)

Lecture 40 - Summary of the course

NPTEL : NOC:Mathematical Methods and Techniques in Signal Processing (Electrical Engineering)

Co-ordinators : Prof. Shayan Srinivasa Garani

Lecture 1 - Introduction to signal processing

Lecture 2 - Basics of signals and systems

Lecture 3 - Linear time-invariant systems

Lecture 4 - Modes in a linear system

Lecture 5 - Introduction to state space representation

Lecture 6 - State space representation

Lecture 7 - Non-uniqueness of state space representation

Lecture 8 - Introduction to vector space

Lecture 9 - Linear independence and spanning set

Lecture 10 - Unique representation theorem

Lecture 11 - Basis and cardinality of basis

Lecture 12 - Norms and inner product spaces

Lecture 13 - Inner products and induced norm

Lecture 14 - Cauchy Schwartz inequality

Lecture 15 - Orthonormality

Lecture 16 - Problem on sum of subspaces

Lecture 17 - Linear independence of orthogonal vectors

Lecture 18 - Hilbert space and linear transformation

Lecture 19 - Gram Schmidt orthonormalization

Lecture 20 - Linear approximation of signal space

Lecture 21 - Gram Schmidt orthogonalization of signals

Lecture 22 - Problem on orthogonal complement

Lecture 23 - Problem on signal geometry (4-QAM)

Lecture 24 - Basics of probability and random variables

Lecture 25 - Mean and variance of a random variable

Lecture 26 - Introduction to random process

Lecture 27 - Statistical specification of random processes

Lecture 28 - Stationarity of random processes

Lecture 29 - Problem on mean and variance

Lecture 30 - Problem on MAP Detection

Lecture 31 - Fourier transform of dirac comb sequence

Lecture 32 - Sampling theorem

Lecture 33 - Basics of multirate systems

Lecture 34 - Frequency representation of expanders and decimators

Lecture 35 - Decimation and interpolation filters

Lecture 36 - Fractional sampling rate alterations

Lecture 37 - Digital filter banks

Lecture 38 - DFT as filter bank

Lecture 39 - Noble Identities

Lecture 40 - Polyphase representation

Lecture 41 - Efficient architectures for interpolation and decimation filters

Lecture 42 - Problems on simplifying multirate systems using noble identities

Lecture 43 - Problem on designing synthesis bank filters

Lecture 44 - Efficient architecture for fractional decimator

Lecture 45 - Multistage filter design

Lecture 46 - Two-channel filter banks

Lecture 47 - Amplitude and phase distortion in signals

Lecture 48 - Polyphase representation of 2-channel filter banks, signal flow graphs and perfect reconstruction

Lecture 49 - M-channel filter banks

Lecture 50 - Polyphase representation of M-channel filter bank

Lecture 51 - Perfect reconstruction of signals

Lecture 52 - Nyquist and half band filters

Lecture 53 - Special filter banks for perfect reconstruction

Lecture 54 - Introduction to wavelets

Lecture 55 - Multiresolution analysis and properties

Lecture 56 - The Haar wavelet

Lecture 57 - Structure of subspaces in MRA

Lecture 58 - Haar decomposition - 1

Lecture 59 - Haar decomposition - 2

Lecture 60 - Wavelet Reconstruction

Lecture 61 - Haar wavelet and link to filter banks

Lecture 62 - Demo on wavelet decomposition

Lecture 63 - Problem on circular convolution

Lecture 64 - Time frequency localization

Lecture 65 - Basic analysis: Pointwise and uniform continuity of functions

Lecture 66 - Basic Analysis : Convergence of sequence of functions

Lecture 67 - Fourier series and notions of convergence

Lecture 68 - Convergence of Fourier series at a point of continuity

Lecture 69 - Convergence of Fourier series for piecewise differentiable periodic functions

Lecture 70 - Uniform convergence of Fourier series of piecewise smooth periodic function

Lecture 71 - Convergence in norm of Fourier series

Lecture 72 - Convergence of Fourier series for all square integrable periodic functions

Lecture 73 - Problem on limits of integration of periodic functions

Lecture 74 - Matrix Calculus

Lecture 75 - KL transform

Lecture 76 - Applications of KL transform

Lecture 77 - Demo on KL Transform

Lecture 78 - Live Session

Lecture 79 - Live Session 2

NPTEL : NOC:Electronics Enclosures Thermal Issues (Electrical Engineering)

Co-ordinators : Prof. N. V Chalapathi Rao

Lecture 1 - Electronic Equipment Thermal issues

Lecture 2 - Practical Examples - 1

Lecture 3 - Practical Examples - 2

Lecture 4 - CEDT worked examples - 1

Lecture 5 - CEDT worked examples - 2

Lecture 6 - Text book theory

Lecture 7 - Sample heat sinks

Lecture 8 - Published correlations - 1

Lecture 9 - Published correlations - 2

Lecture 10 - Parallel combined effects

Lecture 11 - Mounting of packages

Lecture 12 - Combined Rth of devices

Lecture 13 - Schonholzer moduls

Lecture 14 - 1972 model paper

Lecture 15 - Jensen model

Lecture 16 - Thermal management - 1

Lecture 17 - Thermal management - 2

Lecture 18 - Round up of full model

Lecture 19 - Fan cooling

Lecture 20 - Thermo-electric cooling

Lecture 21 - On-the-net DIY work

Lecture 22 - Practical video

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27 - Real packages

Lecture 28 - Prior art

Lecture 29 - OTS standard profiles

Lecture 30 - CAD detailed design of profiles

Lecture 31 - Round up

Lecture 32 - 4X Peltier Cooler

Lecture 33 - Manufacturing Video

Lecture 34 - Peltier heat sink

NPTEL : NOC:Integrated Circuits, MOSFETs, Op-Amps and their Applications (Electrical Engineering)

Co-ordinators : Prof. Hardik Jeetendra Pandya

Lecture 1 - Introduction to Integrated Circuits (IC) Technology

Lecture 2 - Introduction to fabrication of IC: Substrates

Lecture 3 - Introduction to IC fabrication

Lecture 4 - Introduction to IC fabrication (Continued...)

Lecture 5 - Introduction to the fabrication of sensors

Lecture 6 - Introduction to fabrication technology

Lecture 7 - Introduction to fabrication technology (Continued...)

Lecture 8 - Introduction to fabrication technology (Continued...)

Lecture 9 - Introduction to fabrication technology (Continued...)

Lecture 10 - Introduction to fabrication technology (Continued...)

Lecture 11 - Process flow for Fabrication of MOSFETs

Lecture 12 - Operation of Enhancement type MOSFET

Lecture 13 - Operation of Depletion type MOSFET

Lecture 14 - MOSFETs Characteristics and Applications (Current Mirrors)

Lecture 15 - Introduction to Operational Amplifiers

Lecture 16 - Operational Amplifier Characteristics

Lecture 17 - Operational Amplifier Characteristics (Continued...)

Lecture 18 - Characteristics of an op-amp (Continued...)

Lecture 19 - Operational Amplifier Configarations

Lecture 20 - Operational Amplifier Configarations (Continued...)

Lecture 21 - Applications of Operational Amplifier: Differential Amplifier

Lecture 22 - Applications of Operational Amplifier: Integerator

Lecture 23 - Applications of Operational Amplifier: Differentiator

Lecture 24 - Introduction to Passive and Active Filters and op-amp as Low Pass Filter

Lecture 25 - Operational Amplifier as a High Pass Filter

Lecture 26 - Operational Amplifier as a Band Pass and Band Reject Filter

Lecture 27 - Introduction to Oscillator

Lecture 28 - RC Phase Shift Oscillator using Op-amp

Lecture 29 - Wein Bridge Oscillator using Op-amp

Lecture 30 - Hartley and Colpitts Oscillator using Op-amp

Lecture 31 - Working of Crystal Oscillators

Lecture 32 - Construction and Operation of UJT Relaxation Oscillators

Lecture 33 - Introduction to Noise and its Types

Lecture 34 - Analysis of Data Sheets of an Op-Amp

Lecture 35 - Analysis of Data Sheets of an Op-Amp (Continued...)

Lecture 36 - Analysis of Data Sheets of an Op-Amp (Continued...)

Lecture 37 - Experiment - Introduction to Laboratory Equipment

Lecture 38 - Experiment - Measurement of Active and Passive elements using Multimeter

Lecture 39 - Experiment - Working with Laboratory Equipment: Power Supply

Lecture 40 - Experiment - Working with Laboratory Equipment: Function Generator, Oscilloscope

Lecture 41 - Experiment - Op-Amp Characteristics: Input Bias Current

Lecture 42 - Experiment - Op-Amp Characteristics: Input Offset Current

Lecture 43 - Experiment - Op-Amp Characteristics: Input Offset Voltage

Lecture 44 - Experiment - Op-Amp as Inverting Amplifier

Lecture 45 - Experiment - Op-Amp as Non-Inverting Amplifier

Lecture 46 - Experiment - To study input and output voltage range of an Op-Amp

Lecture 47 - Experiment - Differential amplifier using op-amp

Lecture 48 - Experiment - To study the gain of instrumentation amplifier

Lecture 49 - Experiment - Summing amplifier using op-amp

Lecture 50 - Experiment - To study op-amp based comparator

Lecture 51 - Experiment - To study op-amp based integrator and differentiator

Lecture 52 - Experiment - Study of passive low pass filter

Lecture 53 - Experiment - Op-amp based active low pass filter

Lecture 54 - Experiment - Passive and active high pass filter

Lecture 55 - Experiment - Introduction to experimental set-up of band pass filter

Lecture 56 - Experiment - Passive and active band pass filter

Lecture 57 - Experiment - Introduction to experimental set-up for band reject filter

Lecture 58 - Experiment - Active band reject filter

Lecture 59 - Experiment - Peak detector circuit using Op-Amp

NPTEL : NOC:Semiconductor Devices and Circuits (Electrical Engineering)

Co-ordinators : Prof. Sanjiv Sambandan

Lecture 1 - Quantum Mechanics: Concept of Wave Particle, Schrodinders Equation

Lecture 2 - Quantum Mechanics:Â Particle in a Box

Lecture 3 - Quantum Mechanics:Â Particle in a Box (Continued...), Harmonic Oscillator

Lecture 4 - Solids: Formation of Bands, Kronig-Penny Model

Lecture 5 - Solids: Kronig-Penny Model (Continued...)

Lecture 6 - Solids: Electrons and Holes

Lecture 7 - Solids: Electrons and Holes (Continued...)

Lecture 8 - Solids: Crystals

Lecture 9 - Density of States

Lecture 10 - Density of States (Continued...), Fermi Function

Lecture 11 - Fermi Function - Carrier Concentration

Lecture 12 - Doping

Lecture 13 - Doping (Continued...)

Lecture 14 - Recombination and Generation

Lecture 15 - Recombination and Generation (Continued...)

Lecture 16 - Recombination and Generation (Continued...), Charge Transport

Lecture 17 - Charge Transport (Continued...)

Lecture 18 - Continuity Equation

Lecture 19 - Junctions

Lecture 20 - Metal Semiconductor Junctions

Lecture 21 - Schottky Contact: Electrostatics

Lecture 22 - Schottky Contact: Current-Voltage (IV) Characteristics

Lecture 23 - Schottky Contact: IV Characteristics (Continued...)

Lecture 24 - Schottky Contact: Small Signal Impedance

Lecture 25 - PN Junctions: Electrostatics

Lecture 26 - PN Junctions: IV Characteristics

Lecture 27 - PN Junctions: Small Signal Impedance

Lecture 28 - PN Junctions: Non-Idealities

Lecture 29 - Bipolar Junction Transistors (BJT)

Lecture 30 - BJT: IV Characteristics

Lecture 31 - BJT: Non-Idealities and Equivalent Circuit Modeling

Lecture 32 - Metal Oxide Semiconductor Capacitor (MOSCAP)

Lecture 33 - MOSCAP (Continued...)

Lecture 34 - MOSCAP: CV Characteristics

Lecture 35 - MOSCAP: CV Characteristics (Continued...)

Lecture 36 - MOSFET: Introduction

Lecture 37 - MOSFET: I-V characteristics

Lecture 38 - MOSFET: I-V characteristics (Continued...)

Lecture 39 - MOSFET: I-V characteristics (Continued...)

Lecture 40 - Subthreshold swing, Additional concepts

Lecture 41 - Trapped charge, Body-bias

Lecture 42 - Scaling of MOSFETs

Lecture 43 - Scaling of MOSFETs (Continued...), Leakage currents in MOSFETs

Lecture 44 - MOSFET characterization: Parameter extraction

Lecture 45 - MOSFET characterization: Trapped charges, contact resistance

Lecture 46 - MOSFET as a switch

Lecture 47 - MOSFET as a switch (Continued...)

Lecture 48 - Amplifiers using MOSFET

Lecture 49 - Amplifiers using MOSFET (Continued...)

Lecture 50 - Circuits: Frequency Response, Noise

Lecture 51 - Introduction: Amorphous Semiconductors

Lecture 52 - Thin Film Transistors

Lecture 53 - Tutorials Session - 1

Lecture 54 - Tutorials Session - 2

Lecture 55 - Tutorials Session - 3

NPTEL : NOC:Fabrication Techniques for MEMs-based Sensors: Clinical Perspective (Electrical Engineering)

Co-ordinators : Prof. Hardik Jeetendra Pandya

Lecture 1 - Introduction to Microengineering Devices

Lecture 2 - Introduction to Microengineering Devices (Continued...)

Lecture 3 - Introduction to Microengineering Devices (Continued...)

Lecture 4 - Silicon, silicon di-oxide and photolithography

Lecture 5 - Silicon, silicon di-oxide and photolithography (Continued...)

Lecture 6 - Physical Vapour Deposition

Lecture 7 - Physical Vapour Deposition (Continued...)

Lecture 8 - Photolithography

Lecture 9 - Mask Aligner

Lecture 10 - Mask Aligner (Continued...)

Lecture 11 - Micromachining

Lecture 12 - Micromachining: Fabrication of VOC Sensor

Lecture 13 - Micromachining: Fabrication of VOC Sensor (Continued...)

Lecture 14 - Micromachining: Fabrication of VOC Sensor and Cantilever

Lecture 15 - Chemical Vapour Deposition

Lecture 16 - Typical Microfabricated Devices for Biomedical Applications

Lecture 17 - Cancer Diagnostic Tool

Lecture 18 - Process flow for Fabrication of Micro Heater

Lecture 19 - Process flow for Fabrication of Interdigited Electrodes

Lecture 20 - Process flow for Fabrication of Interdigited Electrodes (Continued...)

Lecture 21 - Process flow for Fabrication of ETM phenotyping

Lecture 22 - Process flow for Fabrication of Piezo canteliver

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27 - Microchip for Rapid Drug Screening

Lecture 28 - Microchip for Rapid Drug Screening (Continued...)

Lecture 29 - A Microfluidic chip for rapid bacterial antibiotic Susceptibility testing

Lecture 30 - Smart Catheter

Lecture 31 - Smart Catheter: Flexible Force Sensor

Lecture 32 - Smart Catheter: Flexible Force Sensor (Continued...)

Lecture 33 - Tissue and Cell Culture Techniques

Lecture 34 - Clean Room: Equipments Required

Lecture 35 - GLP: Gowning Procedure for using Lab

Lecture 36 - Introduction to Equipments: Refridgerator

Lecture 37 - Gowning Procedure for using Biological Lab Setup

Lecture 38 - Introduction to Equipments: Desiccator

Lecture 39 - Introduction to Equipments: Impedance Analyzer

Lecture 40 - Introduction to Equipments: DAQ

Lecture 41 - Function generator, Multimeter, Sampling, LabVIEW, NI-CDAQ

Lecture 42 - Introduction to Equipments: Stereo Microscope

Lecture 43 - Introduction to Equipments: Metallurgical Microscope

Lecture 44 - Introduction to Equipments: Inverted Microscope

Lecture 45 - Introduction to Equipments: Fire Alarm

Lecture 46 - Introduction to Equipments: Bio-safety Hood

Lecture 47 - Introduction to Equipments: Peristaltic Pump

Lecture 48 - Introduction to Equipments: Incubator

Lecture 49 - Introduction to Equipments: Oven

Lecture 50 - Introduction to Equipments: Micromanipulator

Lecture 51 - PDMS Moulding

Lecture 52 - 3D Printing

Lecture 53 - Introduction to Fabricated Sensors

Lecture 54 - Simulation: Electro- Thermo- Mechanical Properties of Micro-heater using COMSOL Multiphysics

Lecture 55 - Simulation: Electro- Thermo- Mechanical Properties of Micro-heater using COMSOL Multiphysics (Continued...)

NPTEL : NOC:Op-Amp Practical Applications: Design, Simulation and Implementation (Electrical Engineering)

Co-ordinators : Prof. Hardik Jeetendra Pandya

Lecture 1 - Introduction/Summary on Op-amps

Lecture 2 - Introduction/Summary on Op-amps (Continued...)

Lecture 3 - Introduction/Summary on Op-amps (Continued...)

Lecture 4 - Effect of Loading and Input Impedance - Part 1

Lecture 5 - Effect of Loading and Input Impedance - Part 2

Lecture 6 - Effect of Loading and Input Impedance - Part 3

Lecture 7 - Effect of Loading and Input Impedance - Part 4

Lecture 8 - Introduction to an Analog Circuit Development Board (TI ASLK Pro)

Lecture 9 - Op-amp Applications: Half Wave Rectifier

Lecture 10 - Op-amp Applications: Full Wave Rectifier

Lecture 11 - Op-amp Applications: Clipper

Lecture 12 - Op-amp Circuits using Diodes: Clamper

Lecture 13 - Understanding the Range of Feedback Amplifiers

Lecture 14 - Op-amps as Phase Shift Oscillator

Lecture 15 - Op-amp as Wein Bridge Oscillator

Lecture 16 - Op-amp as Hartley Oscillator

Lecture 17 - Op-amp as Colpitts Oscillator

Lecture 18 - Op-amps as Comparator: Window Comparator

Lecture 19 - Op-amp with Positive Feedback: Inverting Schmitt Trigger

Lecture 20 - Op-amp with Positive Feedback: Non-Inverting Schmitt Trigger

Lecture 21 - Op-amp with Positive Feedback: Astable Multivibrator

Lecture 22 - Op-amp with Positive Feedback: Monostable Multivibrator

Lecture 23 - Op-amp based Voltage Controlled Current Source

Lecture 24 - Measure of Unknown Resistance by Constant Current Drive Circuit Implemented using Op-amp

Lecture 25 - Design and Development of Temperature Controlled Circuit using Op-amp as ON-OFF, Proportional and Proportional Integral Controllers: Introduction

Lecture 26 - Implemetation of Error Detector Ciruicit and Signal Conditioning Circuit for Temperature Control

Lecture 27 - Implementation of Plant/Heating Circuit and ON-OFF Controller

Lecture 28 - Implementation of P and PI Controllers

Lecture 29 - Experiment on Controlling the Temperature on the Plant using different Controllers

Lecture 30 - Experiment: Design and Implementation of Signal Conditioning unit for Thermocouple Cold Junction Compensation

Lecture 31 - Introduction to ECG Experiment

Lecture 32 - Desing and Implementation of ECG Preprocessing Stage - Part 1

Lecture 33 - Desing and Implementation of ECG Preprocessing Stage - Part 2

Lecture 34 - Desing and Implementation of ECG Preprocessing Stage - Part 3

Lecture 35 - Desing and Implementation of ECG Preprocessing Stage - Part 4

Lecture 36 - Desing and Implementation of Peak Detetor and Thresholding Circuit for ECG Signal Conditioning

Lecture 37 - Live Demonstration on ECG Signal Acquistion, Conditioning and Measurement of BPM

Lecture 38 - Understanding Analog Multipliers using Development Board

Lecture 39 - Application: Automatic Gain Controller using Development Board

Lecture 40 - Introdution to Data-Acquisition

Lecture 41 - Analog to Digital Conversion Circuits and Experiment on 2-bit Flash Type ADC

Lecture 42 - Digital to Analog Conversion Circuits and Experiment on 4-bit R-2R DAC

Lecture 43 - DAC Basics using Development Board - Introduction

Lecture 44 - Understanding DAC 7821 Datasheet

Lecture 45 - Basic DAC Experiment on Variable Gain Amplifier

Lecture 46 - Understanding DAC: Experiment on Variable Square and Triangular Wave Generator

Lecture 47 - Introduction to CDAQ (Compact DAQ)

Lecture 48 - Software-in-Loop based Temperature Controller using CDAQ and LabVIEW

NPTEL : NOC:Physical Modelling for Electronics Enclosures using Rapid prototyping (Electrical Engineering)

Co-ordinators : Prof. N. V Chalapathi Rao

Lecture 1 - Products prototyping

Lecture 2 - Prototype concepts

Lecture 3 - Physical simulation

Lecture 4 - Rapid Prototyping

Lecture 5 - Products detailing

Lecture 6 - Advantages of Design Modelling

Lecture 7 - Sample product concept

Lecture 8 - Product sample exercise 1

Lecture 9 - Exercise in product sample 2

Lecture 10 - Integration of components 1

Lecture 11 - Components integration in models

Lecture 12 - 3D printing detail 1

Lecture 13 - 3D printing detail 2

Lecture 14 - 3D print assembly design

Lecture 15 - Heat spreader to 3D print

Lecture 16 - Metallic, 3D, build up 1

Lecture 17 - 3D build up 2

Lecture 18 - 3D design 1 from Photo snap

Lecture 19 - 3D design 2 from Photo snap

Lecture 20 - 3D Laser cuts 1, prints

Lecture 21 - 3D Laser cuts 2, open source public prints

Lecture 22 - Demo of 3D Part print

Lecture 23 - Building a model 1

Lecture 24 - Building a model 2

Lecture 25 - Common place objects

Lecture 26 - Materials

Lecture 27 - Future 3D In biology

Lecture 28 - Product clamp variants

Lecture 29 - Product clamp build up

Lecture 30 - Multi direction features

Lecture 31 - Multi direction features (Continued...)

Lecture 32 - Fastening detail

Lecture 33 - Flat objects

Lecture 34 - Modularity

Lecture 35 - Creative design work

Lecture 36 - Creative designs

Lecture 37 - Using flat features

Lecture 38 - Organic shapes

Lecture 39 - Simulation for alternate use

NPTEL : NOC:Recent Advances in Transmission Insulators (Electrical Engineering)

Co-ordinators : Prof Subba Reddy B

Lecture 1 - Introduction to Transmission and distribution Insulators

Lecture 2 - Manufacturing process for Ceramic/glass Insulators

Lecture 3 - Manufacturing process for Polymeric Insulators

Lecture 4 - Design Considerations of Transmission Insulators

Lecture 5 - Field experience of Ceramic/Glass and Polymeric Insulators

Lecture 6 - Comparison of Transmission Insulators

Lecture 7 - Environmental issues with transmission Insulators

Lecture 8 - Reliability and Philosophy of Testing

Lecture 9 - Testing of Ceramic, Glass and Composite Insulators

Lecture 10 - Cleaning methods adopted for Insulators

Lecture 11 - Cleaning methods adopted for Insulators (Continued...)

Lecture 12 - Coating techniques for Insulators

Lecture 13 - Introduction to Hybrid Insulators

NPTEL : NOC:Fundamentals of Semiconductor Devices (Electrical Engineering)

Co-ordinators : Prof. Digbijoy N. Nath

Lecture 1 - Introduction to semiconductors

Lecture 2 - Introduction to energy bands

Lecture 3 - Fundamentals of band structure

Lecture 4 - Band structure (Continued...) and Fermi-Dirac distribution

Lecture 5 - Density of states

Lecture 6 - Doping and intrinsic carrier concentration

Lecture 7 - Equilibrium carrier concentration

Lecture 8 - Temperature-dependence of carrier concentration

Lecture 9 - High doping effects and incomplete ionization

Lecture 10 - Carrier scattering and mobility

Lecture 11 - Low-field and high-field transport, introduction to diffusion

Lecture 12 - Drift-diffusion and trap statistics

Lecture 13 - Current continuity equation

Lecture 14 - Continuity equation (Continued...) and introduction to p-n junction

Lecture 15 - p-n junction under equilibrium

Lecture 16 - p-n junction under equilibrium (Continued...)

Lecture 17 - p-n junction under bias

Lecture 18 - p-n junction under bias (Continued...)

Lecture 19 - p-n junction: generation-recombination currents

Lecture 20 - Application of p-n junctions

Lecture 21 - Breakdown of junction and C-V profiling

Lecture 22 - Introduction to Schottky junction

Lecture 23 - Schottky junction under equilibrium

Lecture 24 - Schottky junction under bias

Lecture 25 - Introduction to transistors: BJT

Lecture 26 - Basics of BJT

Lecture 27 - Working of BJT

Lecture 28 - Working of BJT (Continued...)

Lecture 29 - Delays in BJT

Lecture 30 - MOS: Introduction

Lecture 31 - MOS: Capacitance-voltage

Lecture 32 - Ideal MOS system: derivation of threshold voltage

Lecture 33 - MOS C-V in more details

Lecture 34 - MOSFET - An introduction

Lecture 35 - Gradual Channel Approximation: Derivation of I-V characteristics

Lecture 36 - Substrate bias effect and subthreshold conduction in MOSFET

Lecture 37 - Short Channel Effects in MOSFET

Lecture 38 - Introduction to compound semiconductors

Lecture 39 - Basics of heterojunctions

Lecture 40 - Band diagram of heterojunctions

Lecture 41 - Heterojunctions (Continued....)

Lecture 42 - Heterojunction transistors

Lecture 43 - III-nitrides

Lecture 44 - Solar cell basics

Lecture 45 - Solar cell (Continued...)

Lecture 46 - Solar cell: Shockley Quiesser Limit

Lecture 47 - Basics of photodetectors

Lecture 48 - Photodetectors: figures of merit and types of devices

Lecture 49 - Junction photodetectors

Lecture 50 - Basics of recombination

Lecture 51 - Basics of LED

Lecture 52 - LED: light extraction and design issues

Lecture 53 - Visible LED: photometry and colorimetry

Lecture 54 - Transistors for power electronics

Lecture 55 - Transistors for power electronics (Continued...) and for RF electronics

Lecture 56 - Transistors for RF (Continued...) and transistors for Memory

Lecture 57 - Basics of microelectronic fabrication

Lecture 58 - Microelectronic fabrication (Continued...)

Lecture 59 - Summary

NPTEL : NOC:Advanced IOT Applications (Electrical Engineering)

Co-ordinators : Prof. T V Prabhakar

Lecture 1 - Overview of localization using IoT sensors

Lecture 2 - Outdoor localization without GPS - I

Lecture 3 - Outdoor localization without GPS - II

Lecture 4 - Outdoor localization using elevation - pressure mapping

Lecture 5 - Localization using IMU sensors - I

Lecture 6 - Localization using IMU sensors - II

Lecture 7 - Localization using IMU sensors - III

Lecture 8 - RFID based localization - I

Lecture 9 - RFID based localization - II

Lecture 10 - Simulation of simple algorithms for object detection

Lecture 11 - Building smart vehicle for collision avoidance

Lecture 12 - Basic computer vision algorithms - Part 1

Lecture 13 - Basic computer vision algorithms - Part 2

Lecture 14 - Code walkthrough of computer vision algorithm

Lecture 15 - Introduction to LiDAR

Lecture 16 - Range estimation and Obstacle avoidance

Lecture 17 - Introduction to vehicle platooning

Lecture 18 - Building blocks for autonomous vehicles - 1

Lecture 19 - Building blocks for autonomous vehicles - 2

Lecture 20 - On Board Diagnostics and protocols

Lecture 21 - Diagnostic services and fuel-injection ratio control unit

Lecture 22 - Real time event processing and Anomaly detection

Lecture 23 - OBD-II and stream processing demonstration

Lecture 24 - Speech recognition - Part 1

Lecture 25 - Speech recognition - Part 2

Lecture 26 - Speech recognition - Part 3

Lecture 27 - Speech recognition - Part 4

Lecture 28 - Device Security - Part 1

Lecture 29 - Device Security - Part 2

Lecture 30 - Device Security - Part 3

Lecture 31 - Need for air quality monitoring

Lecture 32 - Air quality : pollutants and standards

Lecture 33 - Introduction to air quality sensors

Lecture 34 - Calibration techniques for IoT air quality sensors

Lecture 35 - Sensor types : semiconductor and electrochemical

Lecture 36 - Air quality : Overview of system design

Lecture 37 - Air quality : System design - Part 1

Lecture 38 - Air quality : System design - Part 2

Lecture 39 - Air quality : Real time measurement for a drive cycle

Lecture 40 - Introduction to First Responder networks

Lecture 41 - First Responders - Applications - Part 1

Lecture 42 - First Responders - Applications - Part 2

Lecture 43 - Cargo monitoring for tamper detection - Part 1

Lecture 44 - Cargo monitoring for tamper detection - Part 2

NPTEL : NOC:Electronic Systems for Cancer Diagnosis (Electrical Engineering)

Co-ordinators : Prof. Hardik Jeetendra Pandya

Lecture 1 - Tissue and Cell Culture Techniques: Introduction

Lecture 2 - Tissue and Cell Culture Techniques: Methods

Lecture 3 - Tissue and Cell Culture Techniques: Devices

Lecture 4 - Cleanroom Equipments

Lecture 5 - Cleanroom Equipments (Continued...)

Lecture 6 - Introduction to photolithography

Lecture 7 - Photolithography: Mask Aligner

Lecture 8 - Photolithography: Designing Mask Aligner

Lecture 9 - Micromachining Techniques

Lecture 10 - Breast Cancer and Oral Cancer Statistics

Lecture 11 - Fabrication of MEMs-based Biochip for cancer diagnosis

Lecture 12 - Fabrication of MEMs-based Biochip for cancer diagnosis (Continued...)

Lecture 13 - Fabrication of Piezoresistive Sensor

Lecture 14 - Fabrication of Piezoresistive Sensor (Continued...)

Lecture 15 - Fabrication of SU-8 pillar on piezoresistive Sensor

Lecture 16 - Portable Cancer Diagnostic Tool Using a Disposable MEMS-Based Biochip

Lecture 17 - Mechanical Phenotyping of Breast Cancer using MEMS

Lecture 18 - Electrical characterization of Breast Tissue Cores

Lecture 19 - Fabrication of MEMS-based sensor for electro-mechanical phenotyping of breast cancer

Lecture 20 - Fabrication of electro-mechanical sensor (Continued...)

Lecture 21 - Assemby of the electro-mechanical sensor

Lecture 22 - Silicon substrate devices for breast cancer diagnosis

Lecture 23 - Understanding the methods and mechanism to study cell morphology

Lecture 24 - Cytology - A detail study on Spin Coater and Cytospin

Lecture 25 - Techniques in oral cytology studies

Lecture 26 - Techniques in cell morphology analysis

Lecture 27 - Comparitive study on diagnostic tools for oral cancer screening

Lecture 28 - Basic building blocks of Electronics System: Amplifiers

Lecture 29 - Basic building blocks of Electronics System: Amplifiers (Continued...)

Lecture 30 - Basic building blocks of Electronics System: Amplifiers (Continued...)

Lecture 31 - Basic building blocks of Electronics System: Filters

Lecture 32 - Basic building blocks of Electronics System: Filters (Continued...)

Lecture 33 - Basic building blocks of Electronics System: Filters (Continued...)

Lecture 34 - Basic building blocks of Electronics System: Data Converteres

Lecture 35 - Basic building blocks of Electronics System: Data Converteres (Continued...)

Lecture 36 - Basic building blocks of Electronics System: Signal Conditioning Circuits

Lecture 37 - Etching Process and Figure of Merits

Lecture 38 - ECG Signal Processing to calculate BPM

Lecture 39 - ECG Signal Processing to calculate BPM (Continued...)

Lecture 40 - ECG Signal Processing to calculate BPM (Continued...)

Lecture 41 - ECG Signal Processing to calculate BPM (Continued...)

Lecture 42 - ECG Signal Processing to calculate BPM (Continued...)

Lecture 43 - ECG Signal Processing to calculate BPM [Continued...)

Lecture 44 - MEMS based Force Sensor for Catheter Contact Force Measurement

Lecture 45 - 3D Printing: Introduction and Work Flow

Lecture 46 - 3D Fabrication Techniques

Lecture 47 - Gowning Procedure in Clean Room

Lecture 48 - Introduction to Equipments: Desiccators

Lecture 49 - PDMS Moulding procedure

Lecture 50 - Introduction to Equipments: Pristaltic Pump

Lecture 51 - Introduction to Equipments: Stereo Microscopy, Metallurgical Microscopy, Inverted Microscopy

Lecture 52 - Micromanipulator

Lecture 53 - Biosafety Cabinet and Ultrasonicbath

Lecture 54 - Incubator Shaker

Lecture 55 - Hotplate and Microcentrifuge

Lecture 56 - Autoclave

Lecture 57 - Impedance Analyser

Lecture 58 - Rapid Prototyping using 3D Printer

Lecture 59 - Etching Process

Lecture 60 - Electronic System for Drug Screening

Lecture 61 - Introduction to Equipments: DAQ

Lecture 62 - Introduction to Equipments: DAQ (Continued...)

Lecture 63 - Electronic Module for Gas sensor

Lecture 64 - Fabrication process flow for a metal oxide gas sensor

Lecture 65 - MEMS Simulation using Comsol Multiphysics

Lecture 66 - Introduction to COMSOL Multiphysics

Lecture 67 - COMSOL Examples for MEMS Applications

Lecture 68 - COMSOL Examples for MEMS Applications (Continued...)

Lecture 69 - Demonstration of Thermal Acutator and Understanding of Application Builder

Lecture 70 - Closed loop control of temperature sensor

Lecture 71 - Experimental Set-up of closed loop control of temperature sensor

NPTEL : NOC:Electronic Modules for Industrial Applications using Op-Amps (Electrical Engineering)

Co-ordinators : Prof. Hardik Jeetendra Pandya

Lecture 1 - Introduction to Op-amp

Lecture 2 - Introduction Wafer Manufacturing Process and Clean room Protocols

Lecture 3 - Introduction to Fabrication Process Technology and Op-amp

Lecture 4 - Op-amp Characteristics and Datasheet Parameters

Lecture 5 - Overview of Active Filters and Oscillators

Lecture 6 - Overview of Op-amp Oscillators

Lecture 7 - Introduction to ECG Experiment

Lecture 8 - Design and Implementation of ECG Preprocessing Stage - Part 1

Lecture 9 - Design and Implementation of ECG Preprocessing Stage - Part 2

Lecture 10 - Design and Implementation of ECG Preprocessing Stage - Part 3

Lecture 11 - Design and Implementation of ECG Preprocessing Stage - Part 4

Lecture 12 - Design and Implementation of Peak Detector and Thresholding Circuit for ECG Signal Conditioning

Lecture 13 - Experiment: Live Demonstration of ECG Signal Acquistion, Conditioning and Measurement of BPM

Lecture 14 - Application: ECG Signals for detecting AF and the role of sensors

Lecture 15 - Photolithography: Masks

Lecture 16 - Understanding the process of photolithography

Lecture 17 - Photolithography: Mask Aligner

Lecture 18 - Photolithography: Designing of Mask Aligner System

Lecture 19 - Fabrication of Piezoresistive Sensor

Lecture 20 - Fabrication of MEMS based Catheter Contact Force Sensor

Lecture 21 - Design of Speed Control of DC Motor: Introduction

Lecture 22 - Design of Speed Control of DC Motor: Circuit Explanation

Lecture 23 - Design of Speed Control of DC Motor: Encoder Calibration

Lecture 24 - Design of Speed Control of DC Motor: Encoder Signal Conditioning Circuit - 1

Lecture 25 - Design of Speed Control of DC Motor: Encoder Signal Conditioning Circuit - 2

Lecture 26 - Design of Speed Control of DC Motor: Encoder Signal Conditioning Circuit - 3

Lecture 27 - Design of Speed Control of DC Motor: Encoder Signal Conditioning Circuit - 4

Lecture 28 - Design of Speed Control of DC Motor: Error Amplifier

Lecture 29 - Design of Speed Control of a DC Motor using Op-amp: Controllers

Lecture 30 - Design of Speed Control of a DC Motor using Op-amp: Circuit Implementation

Lecture 31 - Design of Speed Control of a DC Motor using DAQ - Part 1

Lecture 32 - Design of Speed Control of a DC Motor using DAQ - Part 2

Lecture 33 - Design of Speed Control of a DC Motor using DAQ - Part 3

Lecture 34 - Introduction to Hot-Wire Anemometer

Lecture 35 - Signal-conditioning Circuit for Hot-Wire Anemometer

Lecture 36 - Signal-conditioning Circuit for Hot-Wire Anemometer Part 2

Lecture 37 - Signal-conditioning Circuit for Hot-Wire Anemometer: Simulation

Lecture 38 - Signal-conditioning Circuit for Hot-Wire Anemometer: Experiment

Lecture 39 - Introduction to Gas Sensors

Lecture 40 - Fabrication Process for Gas Sensor

Lecture 41 - Signalconditioning Circuit for Operating Heater Voltage of MQ-7 Gas Sensor - Part 1

Lecture 42 - Signalconditioning Circuit for Operating Heater Voltage of MQ-7 Gas Sensor - Part 2

Lecture 43 - Signalconditioning Circuit for Operating Heater Voltage of MQ-7 Gas Sensor - Part 3

Lecture 44 - Fundamentals of Electrophysiological signals

Lecture 45 - Fundamentals of EEG Signal

Lecture 46 - Application of EEG Signal for Detection of Hearing Loss

Lecture 47 - Closed loop control of temperature using DAQ and LabVIEW

Lecture 48 - Experimental Set-up of closed loop control of temperature sensor

Lecture 49 - Introduction to MEMS Simulation using Comsol Multiphysics

Lecture 50 - Introduction to COMSOL Multiphysics

Lecture 51 - COMSOL Examples for MEMS Applications

Lecture 52 - COMSOL Examples for MEMS Applications (Continued...)

Lecture 53 - Demonstration of Thermal Acutator and Understanding of Application Builder

NPTEL : NOC:Sensors and Actuators (Electrical Engineering)

Co-ordinators : Prof. Hardik Jeetendra Pandya

Lecture 1 - Sensors - Part 1

Lecture 2 - Sensors - Part 2

Lecture 3 - Sensors - Part 3

Lecture 4 - Sensors - Part 4

Lecture 5 - Sensors - Part 5

Lecture 6 - Recent Microsensors based system: E-Nose

Lecture 7 - Recent Microsensors based system: Force Sensor, Basics of Actuators

Lecture 8 - Microfabrication Basics

Lecture 9 - Introduction to cleanroom

Lecture 10 - Cleanroom Protocols

Lecture 11 - Introduction to Cleanroom Equipments: Micromanipulator, Stereo Microscope, metallurgical microscope, Incubator, Static Incubator, Inverted Microscope, Oven, Autoclave, Sonicator

Lecture 12 - Fabrication Process Flow of Microheater and Micromachining

Lecture 13 - Wafer Bonding and PDMS moulding

Lecture 14 - Overview of MEMS based sensors

Lecture 15 - Introduction to Cleanroom Equipments: Impedance Analyzer, LCR Meter, Micromanipulator

Lecture 16 - Introduction to Cleanroom Equipments: Biosafety Hood and safety

Lecture 17 - Process Sensor Process Flow, Cell based Diagnosis Device

Lecture 18 - Basics of Patterning and Drug Screening Device

Lecture 19 - MEMS applications in automobile system

Lecture 20 - Arduino Interfacing for Sensors and Actuators

Lecture 21 - Demonstration of DC Motor as an actuator

Lecture 22 - Demonstration of peristaltic pump using Arduino

Lecture 23 - Demonstration of PDMS Patterning

Lecture 24 - Crystal Orientation and Si-SiO2 interface

Lecture 25 - Surface Profilometry and Physical Vapour Deposition Techniques

Lecture 26 - Introduction to COMSOL Multiphysics and Modelling Examples

Lecture 27 - Demonstration of Thermal Actuators using COMSOL

Lecture 28 - Demonstration of MQ3 Gas sensor using Arduino

Lecture 29 - Photolithography - Part 1

Lecture 30 - Signal Conditioning Circuit for Temperature Sensors

Lecture 31 - Demonstration of Microheaters in COMSOL Multiphysics

Lecture 32 - Introduction to Cleanroom facilities for biomedical applications

Lecture 33 - Physical Deposition Techniques

Lecture 34 - Demonstration on peristaltic pump in cleanroom

Lecture 35 - Installation of Oxygen Plasma System

Lecture 36 - Demonstration of IR Based Sensor using Arduino

Lecture 37 - Illustration of fabricated Microfluidic Device for biochips with PDMS moulding

Lecture 38 - Photolithography - Part 2

Lecture 39 - Photolithography - Part 3

Lecture 40 - Introduction and Demonstration of Shape Memory Alloy

Lecture 41 - Applications of Shape Memory Alloy as a light weight actuators

Lecture 42 - Discussion on Fabricated Sensor with Silicon as Substrate

Lecture 43 - Discussion and Microscopic Inspection of Fabricated Sensor with Silicon as a Substrate

Lecture 44 - Tissue Deparaffinization for Biosensors

Lecture 45 - Clean room guidelines and Cancer Dianostic tool

Lecture 46 - Basics of Pressure Sensor and Demonstration using Arduino Microcontroller

Lecture 47 - Basics of Stepper Motor and Demonstration using Arduino Microcontroller

Lecture 48 - Microscopic Inspection of Diced wafers and CNT Sensing Layer for fabricated sensor

Lecture 49 - Process flow for Microcantilever for Mechanical Phenotyping of breast cancer tissues

Lecture 50 - Applications of microcantilever for Mechanical Phenotyping of breast cancer tissues

Lecture 51 - Installation and Introduction to Physical Vapour Deposition System

Lecture 52 - Human Machine Interface for Controlling Deposition System

Lecture 53 - Flexible MEMS for phenotyping tissue properties - I

Lecture 54 - Flexible MEMS for phenotyping tissue properties - II

Lecture 55 - System Demonstration for Physical Vapor Deposition

Lecture 56 - Introduction to CAD Modelling - I

Lecture 57 - Introduction to CAD Modelling - II

Lecture 58 - Biosensors for ETM Phenotyping of breast cancer tissues for better prognosis

Lecture 59 - Biosensors for Electrothermal sensor

Lecture 60 - MEMS based sensor for catheter contact force measurement

Lecture 61 - Microfluidics based Drug Screening

Lecture 62 - Basic aspects of 3D Printing

Lecture 63 - 3D Printing Materials and Demonstration of Remote 3D Printing

NPTEL : NOC:Neural Networks for Signal Processing-I (Electrical Engineering)

Co-ordinators : Prof. Shayan Srinivasa Garani

Lecture 1 - The human brain

Lecture 2 - Introduction to Neural Networks

Lecture 3 - Models of a neuron

Lecture 4 - Feedback and network architectures

Lecture 5 - Knowledge representation

Lecture 6 - Prior information and invariances

Lecture 7 - Learning processes

Lecture 8 - Perceptron - 1

Lecture 9 - Perceptron - 2

Lecture 10 - Batch perceptron algorithm

Lecture 11 - Perceptron and Bayes classifier

Lecture 12 - Linear regression - 1

Lecture 13 - Linear regression - 2

Lecture 14 - Linear regression - 3

Lecture 15 - Logistic regression

Lecture 16 - Multi-layer perceptron - 1

Lecture 17 - Multi-layer perceptron - 2

Lecture 18 - Back propagation - 1

Lecture 19 - Back propagation - 2

Lecture 20 - XOR problem

Lecture 21 - Universal approximation function

Lecture 22 - Complexity Regularization and Cross validation

Lecture 23 - Convolutional Neural Networks (CNN)

Lecture 24 - Coverâ€™s Theorem

Lecture 25 - Multivariate interpolation problem

Lecture 26 - Radial basis functions (RBF)

Lecture 27 - Recursive least squares algorithm

Lecture 28 - Comparison of RBF with MLP

Lecture 29 - Kernel regression using RBFs

Lecture 30 - Kernel Functions

Lecture 31 - Basics of constrained optimization

Lecture 32 - Optimization with equality constraint

Lecture 33 - Optimization with inequality constraint

Lecture 34 - Support Vector Machines (SVM)

Lecture 35 - Optimal hyperplane for linearly separable patterns

Lecture 36 - Quadratic optimization for finding optimal hyperplane

Lecture 37 - Optimal hyperplane for non-linearly separable patterns

Lecture 38 - Inner product kernel and Mercerâ€™s theorem

Lecture 39 - Optimal design of an SVM

Lecture 40 - Îµ-insensitive loss function

Lecture 41 - XOR problem revisited using SVMs

Lecture 42 - Hilbert Space

Lecture 43 - Reproducing Kernel Hilbert Space

Lecture 44 - Representer Theorem

Lecture 45 - Generalized applicability of the representer theorem

Lecture 46 - Regularization Theory

Lecture 47 - Euler-Lagrange Equation

Lecture 48 - Regularization Networks

Lecture 49 - Generalized RBF networks

Lecture 50 - XOR problem revisited using RBF

Lecture 51 - Structural Risk Minimization

Lecture 52 - Bias-Variance Dilemma

Lecture 53 - Estimation of regularization parameters

Lecture 54 - Basics of L1 regularization

Lecture 55 - Grafting

Lecture 56 - Kernel PCA

Lecture 57 - Hebbian based maximum eigen filter - 1

Lecture 58 - Hebbian based maximum eigen filter - 2

Lecture 59 - Hebbian based maximum eigen filter - 3

Lecture 60 - VC dimension

Lecture 61 - Autoencoders

Lecture 62 - Denoising Autoencoders

Lecture 63 - Demo - Perceptron

Lecture 64 - Demo - Motivation for CNN

Lecture 65 - Back propagation in Convolutional Neural Network

Lecture 66 - Ethics in AI research and coverage summary

NPTEL : NOC:Electronics Equipment Integration and Prototype Building (Electrical Engineering)

Co-ordinators : Prof. N.V.Chalapathi Rao

Lecture 1 - Introduction to electronics products

Lecture 2 - Examples from real life: Parts to system

Lecture 3 - Common Simulation of flat prismatic parts

Lecture 4 - Common flat parts enclosures

Lecture 5 - Real life parts to scale on a graph

Lecture 6 - Early First steps

Lecture 7 - Top down, outside to internals

Lecture 8 - Using a print and fabrication video

Lecture 9 - Details of displays and keys

Lecture 10 - Improvement on marking and skill

Lecture 11 - Mass production in sheet metal

Lecture 12 - Prototyping of user interfaces for concepts

Lecture 13 - Stacking of equipment to make a system

Lecture 14 - Recapitualising a sub system

Lecture 15 - Off the shelf enclosures and making a user interface

Lecture 16 - Looking around for concepts and integration

Lecture 17 - Representation on paper

Lecture 18 - Example features of surfaces and solids

Lecture 19 - Simple and curved surfaces

Lecture 20 - Describing inclined surfaces

Lecture 21 - Basics of engineering Drawing

Lecture 22 - Introduction to sizing and fits

Lecture 23 - Practical mechanical assemblies

Lecture 24 - Analogous Mechanical - Electronics detailing

Lecture 25 - Solid modelling

Lecture 26 - Importance of dimensioning

Lecture 27 - Ease of editing redesign

Lecture 28 - Dimensioning of electronics components

Lecture 29 - 2D flat representation

Lecture 30 - Electronics to Mechanical interfacing

Lecture 31 - Complexity of 3D assemblies with wiring

Lecture 32 - Illustrative simple design

Lecture 33 - Practical detailing

Lecture 34 - Rendered on screen

Lecture 35 - Fastenings and hardware

Lecture 36 - Fastener representation, deatiling

Lecture 37 - Practical detailing.

Lecture 38 - Recapitulation, context of course

Lecture 39 - Low cost is the key

NPTEL : NOC:Design and Simulation of Power Conversion using Open Source Tools (Electrical Engineering)

Co-ordinators : Prof. L. Umanand

Lecture 1 - Getting started with NgSpice

Lecture 2 - Refractoring the .cir

Lecture 3 - Sub-circuits

Lecture 4 - gschem and netlist generation

Lecture 5 - Setting up for simulation with Octave

Lecture 6 - Getting started with equation based simulation

Lecture 7 - Resuming a simulation in Octave

Lecture 8 - PV cell model - review

Lecture 9 - PV cell characteristic - review

Lecture 10 - PV cell - symbol and subcircuit

Lecture 11 - Rectifier-capacitor filter - operation review

Lecture 12 - Rectifier-capacitor filter - NgSpice simulation

Lecture 13 - Rectifier-capacitor filter with non-idealities

Lecture 14 - 3 phase Rectifier-capacitor filter

Lecture 15 - Equation based simulation in Octave

Lecture 16 - Passive power factor improvement - review

Lecture 17 - Passive power factor circuit in NgSpice

Lecture 18 - Buck converter - review

Lecture 19 - Buck converter - NgSpice

Lecture 20 - Boost converter - review

Lecture 21 - Boost converter - NgSpice

Lecture 22 - Buck-boost converter - review

Lecture 23 - Buck-boost converter - NgSpice

Lecture 24 - Equation based simulation of converters

Lecture 25 - Forward Converter - review

Lecture 26 - Forward Converter simulation

Lecture 27 - Understanding Core flux reset

Lecture 28 - Core flux reset - simulation

Lecture 29 - Flyback converter - review

Lecture 30 - Flyback converter - simulation

Lecture 31 - Pushpull converter - review

Lecture 32 - Pushpull converter - simulation

Lecture 33 - Half bridge converter - review

Lecture 34 - Half bridge converter - simulation

Lecture 35 - Full bridge converter - review

Lecture 36 - Full bridge converter - simulation

Lecture 37 - Close loop operation

Lecture 38 - Close loop with feed forward control

Lecture 39 - NgSpice simulation of close loop control

Lecture 40 - Battery charging with current control

Lecture 41 - Slope compensation for current control

Lecture 42 - NgSpice simulation of battery charging

Lecture 43 - Single phase PWM for single phase inverter

Lecture 44 - NgSpice simulation of single phase PWM

Lecture 45 - 2-axes theory for 3-phase systems

Lecture 46 - Transformations for 2 and 3 axes systems

Lecture 47 - Maximum power point tracking - NgSpice

Lecture 48 - Space vector PWM - digital

Lecture 49 - Space vector PWM - analog

Lecture 50 - SVPWM analog - NgSpice simulation

Lecture 51 - Induction motor model

Lecture 52 - Induction motor simulation in Octave

Lecture 53 - V/F control of induction motor - NgSpice

NPTEL : NOC:Introductory Neuroscience and Neuro-Instrumentation (Electrical Engineering)

Co-ordinators : Prof. Mahesh Jayachandra

Lecture 1 - Cellular (Microscopic) Structure of the Central Nervous System (CNS)

Lecture 2 - Anatomical (Macroscopic) structure of the CNS

Lecture 3 - Introduction to Cleanroom and IC Fabrication Techniques

Lecture 4 - Introduction to EEG applications for Hearing Loss

Lecture 5 - Electrophysiological Recordings

Lecture 6 - Neocortical Circuits

Lecture 7 - The resting Membrane Potential

Lecture 8 - Applications of MEMS Fabrication Technologies

Lecture 9 - Fundamentals of biopotentials and applications

Lecture 10 - Fundamentals of EEG and applications

Lecture 11 - The Action Potential (1)

Lecture 12 - The Action Potential (2)

Lecture 13 - Axonology, Neuronal Biophysics (1)

Lecture 14 - Axonology, Neuronal Biophysics (2)

Lecture 15 - Experimental Setup for EEG Recording

Lecture 16 - Introduction to Cleanroom Protocols and Demonstration of Gowning Procedure

Lecture 17 - Electromagnetic Stimulation of the Brain (1)

Lecture 18 - Electromagnetic Stimulation of the Brain (2)

Lecture 19 - Introduction to Event Related Potentials

Lecture 20 - Introduction to 3D Printing

Lecture 21 - 3D Printing: Applications and Demonstrations

Lecture 22 - Introduction to Event Related Potentials (2)

Lecture 23 - Different Event Related Potentials (1)

Lecture 24 - Different Event Related Potentials (2)

Lecture 25 - Introduction to Silicone Wafer Processing Techniques

Lecture 26 - Basics of Silicone Dioxide: Oxidation, Characterization and Applications

Lecture 27 - Inverse Problem, EEG source localization (1)

Lecture 28 - Inverse Problem, EEG source localization (2)

Lecture 29 - Introduction to Brain Computer Interfaces

Lecture 30 - Signal Conditioning Circuit for EEG Bioamplifiers

Lecture 31 - Basics of BCI Experimentation: Introdcution BCI Applications

Lecture 32 - Different Brain Computer Interfaces

Lecture 33 - Introduction to EEGLAB, ERPLAB and AEP Demonstration (1)

Lecture 34 - Introduction to EEGLAB, ERPLAB and AEP Demonstration (2)

Lecture 35 - Introduction to Photolithography

Lecture 36 - Basics of BCI Experimentation: Stimuli Generation and Insertion

Lecture 37 - MMN Demonstration with EEGLAB and ERPLAB (1)

Lecture 38 - MMN Demonstration with EEGLAB and ERPLAB (2)

Lecture 39 - Introduction to Photolithography (2)

Lecture 40 - Basics of Instrumentation Amplifier and Online Simulation

Lecture 41 - Basics of BCI Experimentation: Experimental Setup and Biopotential Acquisition

Lecture 42 - P300 Demonstration with EEGLAB/ERPLAB (1)

Lecture 43 - P300 Demonstration with EEGLAB/ERPLAB (2)

Lecture 44 - Wavelet Analysis with VEP (1)

Lecture 45 - Details of Lithography, E-beam Lithography and Mask Aligner

Lecture 46 - Basics of BCI Experimentation: Signal Acquisition using MATLAB (EEGLAB)

Lecture 47 - Wavelet Analysis with VEP (2)

Lecture 48 - Demonstration: Resting Membrane Potential

Lecture 49 - Demonstration: Membrane Time Constant (Ï„)

Lecture 50 - Photoresist (SU-8) and soft lithography

Lecture 51 - Physical Vapour Deposition: Thermal Evaporation

Lecture 52 - Introduction to Epilepsy and Classification

Lecture 53 - Epileptogenisis

Lecture 54 - Demonstration: Membrane Length Constant (Î»)

Lecture 55 - Demonstration: Action Potential

Lecture 56 - Demonstration: Voltage Clamp

Lecture 57 - Demonstration: Synaptic Potentials & Current

Lecture 58 - Physical Vapour Deposition: E-beam Evaporation

Lecture 59 - Physical Vapour Deposition: Sputtering

Lecture 60 - Recent Trends: Epilepsy Classification using EEG data

Lecture 61 - Demonstration: Wireless EEG with dry electrodes

Lecture 62 - Basics of EEG, ERP and acquisition

Lecture 63 - Photolithography with example

Lecture 64 - Stress Tissue Analysis using COMSOL Multiphysics

Lecture 65 - Recent Trends: Microelectrode Arrays and Deep Brain Stimulation

NPTEL : NOC:Information Theory (Electrical Engineering)

Co-ordinators : Prof. Himanshu Tyagi

Lecture 1 - What is information?

Lecture 2 - How to model uncertainty?

Lecture 3 - Basic concepts of probability

Lecture 4 - Estimates of random variables

Lecture 5 - Limit theorems

Lecture 6 - Review

Lecture 7 - Source model

Lecture 8 - Motivating examples

Lecture 9 - A compression problem

Lecture 10 - Shannon entropy

Lecture 11 - Random hash

Lecture 12 - Review 2

Lecture 13 - Uncertainty and randomness

Lecture 14 - Total variation distance

Lecture 15 - Generating almost random bits

Lecture 16 - Generating samples from a distribution using uniform randomness

Lecture 17 - Typical sets and entropy

Lecture 18 - Review 3

Lecture 19 - Hypothesis testing and estimation

Lecture 20 - Examples

Lecture 21 - The log-likelihood ratio test

Lecture 22 - Kullback-Leibler divergence and Stein's lemma

Lecture 23 - Properties of KL divergence

Lecture 24 - Review 4

Lecture 25 - Information per coin-toss

Lecture 26 - Multiple hypothesis testing

Lecture 27 - Error analysis of multiple hypothesis testing

Lecture 28 - Mutual information

Lecture 29 - Fano's inequality

Lecture 30 - Measures of information

Lecture 31 - Chain rules

Lecture 32 - Shape of measures of information

Lecture 33 - Data processing inequality

Lecture 34 - Midyear Review

Lecture 35 - Proof of Fano's inequality

Lecture 36 - Variational formulae

Lecture 37 - Capacity as information radius

Lecture 38 - Proof of Pinsker's inequality

Lecture 39 - Continuity of entropy

Lecture 40 - Lower bound for compression

Lecture 41 - Lower bound for hypothesis testing

Lecture 42 - Review 7

Lecture 43 - Lower bound for random number generation

Lecture 44 - Strong converse

Lecture 45 - Lower bound for minmax statistical estimation

Lecture 46 - Variable length source codes

Lecture 47 - Review 8

Lecture 48 - Kraft's inequality

Lecture 49 - Shannon code

Lecture 50 - Huffman code

Lecture 51 - Minmax Redundancy

Lecture 52 - Type based universal compression

Lecture 53 - Review 9

Lecture 54 - Arithmetic code

Lecture 55 - Online probability assignment

Lecture 56 - Compression of databases: A scheme

Lecture 57 - Compression of databases: A lower bound

Lecture 58 - Repetition code

Lecture 59 - Channel capacity

Lecture 60 - Sphere packing bound for BSC

Lecture 61 - Random coding bound for BSC

Lecture 62 - Random coding bound for general channel

Lecture 63 - Review 11

Lecture 64 - Converse proof for channel coding theorem

Lecture 65 - Additive Gaussian Noise channel

Lecture 66 - Mutual information and differential entropy

Lecture 67 - Channel coding theorem for Gaussan channel

Lecture 68 - Parallel channels and water-filling

NPTEL : NOC:Photonic Integrated Circuit (Electrical Engineering)

Co-ordinators : Prof. Shankar Kumar Selvaraja

Lecture 1 - Photonic integrated circuits course introduction

Lecture 2 - Wave optics review

Lecture 3 - Electromagnetic theory review - 1

Lecture 4 - Electromagnetic theory review - 2

Lecture 5 - Photonic integrated circuits: an introduction

Lecture 6 - Photonic integrated circuits evolution

Lecture 7 - Photonic integrated circuit components - 1

Lecture 8 - Photonic integrated circuit components - 2

Lecture 9 - Dispersion

Lecture 10 - Phase velocity and Group velocity

Lecture 11 - Anisotropic medium and reciprocity

Lecture 12 - Polarisation in anisotropic medium

Lecture 13 - Optical axes

Lecture 14 - Waveguide structure

Lecture 15 - Waveguide modes - 1

Lecture 16 - Waveguide modes - 2

Lecture 17 - Field Equation

Lecture 18 - Guided modes in symmetric slab waveguides

Lecture 19 - Waveguide design - Boundary value formulation

Lecture 20 - Waveguide design - BVP solution

Lecture 21 - Waveguide design - Perturbation approach

Lecture 22 - Waveguide design - Effective Index method

Lecture 23 - Coupled mode theory - 1

Lecture 24 - Coupled mode theory - 2

Lecture 25 - Two-mode coupling

Lecture 26 - Co and counter propagating mode coupling

Lecture 27 - Phase matching

Lecture 28 - Directional coupler

Lecture 29 - Y-splitter

Lecture 30 - Multi-Mode Interference coupler

Lecture 31 - MZI

Lecture 32 - Micro-Ring Resonators

Lecture 33 - Light-chip coupling

Lecture 34 - End-fire coupling

Lecture 35 - Light Modulator introduction

Lecture 36 - Electro-Optic effect

Lecture 37 - Waveguide modulator

Lecture 38 - Optical transition in semiconductors

Lecture 39 - Transition rates

Lecture 40 - Absorption and gain in semiconductors

Lecture 41 - Semiconductor Light Emitting Diodes

Lecture 42 - Semiconductor Light Emitting Diodes (Continued...)

Lecture 43 - Semiconductor Lasers

Lecture 44 - Semiconductor photodetector

Lecture 45 - Semiconductor photodetector noise

Lecture 46 - Fabrication process - 1

Lecture 47 - Fabrication process - 2

Lecture 48 - PIC technology - Building a simple circuit

Lecture 49 - PIC for communication

Lecture 50 - PIC for sensing - 1

Lecture 51 - PIC for sensing - 2

NPTEL : NOC:Design for Internet of Things (2021) (Electrical Engineering)

Co-ordinators : Prof. T V Prabhakar

Lecture 1 - Introduction and Definition of IoT

Lecture 2 - Location, Applications, and Power

Lecture 3 - Challenges - Part 1

Lecture 4 - Challenges - Part 2

Lecture 5 - Challenges - Part 3

Lecture 6 - Challenges - Part 4

Lecture 7 - Unique ID

Lecture 8 - Introduction to RFID

Lecture 9 - RFID DEMO

Lecture 10 - RFID Theory - 1

Lecture 11 - RFID Theory - 2

Lecture 12 - RFID Theory - 3

Lecture 13 - Energy harvesting - 1

Lecture 14 - Energy harvesting - 2

Lecture 15 - Energy harvesting - 3

Lecture 16 - Power management systems - 1

Lecture 17 - Power management systems - 2

Lecture 18 - Battery life calculation

Lecture 19 - Introduction to System Design for low power

Lecture 20 - LDO - 1

Lecture 21 - LDO - 2

Lecture 22 - LDO - 3

Lecture 23 - Buck converter - 1

Lecture 24 - Buck converter - 2

Lecture 25 - Lab experiment

Lecture 26 - Introduction to Sensors and Actuators

Lecture 27 - Sensors

Lecture 28 - Actuators

Lecture 29 - Case study on Sensing and Actuation

Lecture 30 - Introduction to low power software

Lecture 31 - ADC driver design and development

Lecture 32 - Power optimization

Lecture 33 - Introduction to protocols

Lecture 34 - MQTT - 1

Lecture 35 - MQTT - 2

Lecture 36 - COAP - 1

Lecture 37 - COAP - 2

Lecture 38 - Websockets

Lecture 39 - Introduction to low power wireless - 1

Lecture 40 - Introduction to low power wireless - 2

Lecture 41 - Bluetooth low energy (BLE) - 1

Lecture 42 - Bluetooth low energy (BLE) - 2

Lecture 43 - IEEE 802.15.4e - 1

Lecture 44 - IEEE 802.15.4e - 2

Lecture 45 - IEEE 802.15.4e - 3

Lecture 46 - Wi-Fi

Lecture 47 - Introduction to Wide area technologies

Lecture 48 - LoRa - 1

Lecture 49 - LoRa - 2

Lecture 50 - NBIoT, LTEM1

Lecture 51 - BLE mesh technology

Lecture 52 - Course conclusion

NPTEL : NOC:Mathematical Aspects of Biomedical Electronic System Design (Electrical Engineering)

Co-ordinators : Prof. Chandramani Singh

Lecture 1 - Introduction to Signals and Systems

Lecture 2 - MATLAB Demo on Signal Types and Moving Average System

Lecture 3 - Microfabrication Basics for Biomedical Systems

Lecture 4 - Fluid Flow in Body Lumen

Lecture 5 - Fourier Series

Lecture 6 - Continuous Time Fourier Transform

Lecture 7 - Biological Tissues as disordered systems

Lecture 8 - Introduction to electrical equivalent circuit models for biological systems

Lecture 9 - Discrete Time Fourier Transform and Sampling

Lecture 10 - Percolation Theory and applications in biological tissues

Lecture 11 - Electrical properties of cells and tissues revisited: Examples and Applications

Lecture 12 - Linear Algebra - I

Lecture 13 - MATLAB Live Demo on Moving average and signal acquisition

Lecture 14 - Oxidation and Thickness Characterization

Lecture 15 - Basics of Photolithography with Process flow examples

Lecture 16 - Linear Algebra - II

Lecture 17 - Introduction to Biomedical Optics

Lecture 18 - Optical Properties of Tissues and Mathematical modelling

Lecture 19 - System of Linear Equations

Lecture 20 - Scaling Laws

Lecture 21 - Thermal Properties of a tissue

Lecture 22 - Introduction to Probability

Lecture 23 - Tissue Electrode Interface

Lecture 24 - Thermal Properties of a tissue and cells

Lecture 25 - Probability: Random Variables and CDF

Lecture 26 - Basics of Silicon, Silicon Dioxide for Microfabrication Process

Lecture 27 - Mechanical Properties of human brain tissues and modelling

Lecture 28 - Probability: Important measures and generating functions

Lecture 29 - Near Infrared Spectroscopy and Ultrasound Techniques

Lecture 30 - Thermal Properties of Tissues and Modelling

Lecture 31 - Multisim Simulations for Biomedical Signal Conditioning Circuit

Lecture 32 - Cleanroom Entry Demonstration

Lecture 33 - Spin Coating Demonstration

Lecture 34 - Common Random Variables

Lecture 35 - Introduction to signal Conditioning circuits for biomedical devices

Lecture 36 - Siganl Conditioning circuits units and design

Lecture 37 - E Beam Evaporation System Demonstration

Lecture 38 - Joint and Marginal Probability Distribution

Lecture 39 - Temprature Sensor Interfacing Analysis

Lecture 40 - Demo of Temprature data acqusitio system using LabVIEW

Lecture 41 - Recent Trends in Biomedical Electronic System Design

Lecture 42 - Aspects of Biomedical Electronics System Design

NPTEL : NOC:Concentration Inequalities (Electrical Engineering)

Co-ordinators : Prof. Himanshu Tyagi

Lecture 1 - Why study concentration inequalities?

Lecture 2 - Chernoff bound

Lecture 3 - Examples of Chernoff bound for common distributions

Lecture 4 - Hoeffding and Bernstein inequalities

Lecture 5 - Azuma and McDiarmid inequalities

Lecture 6 - Bounding variance using the Efron-Stein inequality

Lecture 7 - The Gaussian-Poincare inequality

Lecture 8 - Tail bounds using the Efron-Stein inequality

Lecture 9 - Herbst's argument and the entropy method

Lecture 10 - Log-Sobolev inequalities

Lecture 11 - Binary and Gaussian Log-Sobolev inequalities and concentration

Lecture 12 - Variational formulae forKullback-Leibler and Bregman Divergence

Lecture 13 - A modified log-Sobolev inequality and concentration

Lecture 14 - Introduction to the transportation method for showing concentration bounds

Lecture 15 - Transportation lemma and a proof of McDiarmid's inequality using the transportation method

Lecture 16 - Concentration bounds for functions beyond bounded difference using transportation method

Lecture 17 - Marton's conditional transportation cost inequality

Lecture 18 - Isoperimetry and concentration of measure

Lecture 19 - Isoperimetry and bounded difference

Lecture 20 - Equivalence of Stam's inequality and log Sobolev inequality

Lecture 21 - An information theoretic proof of log Sobolev inequality

Lecture 22 - Hypercontractivity and strong data processing inequality for RÃ©nyi divergence

Lecture 23 - An information theoretic characterization of hypercontractivity

Lecture 24 - Equivalence of Gaussian hypercontractivity and Gaussian log Sobolev inequality

Lecture 25 - Uniform deviation bounds for random walks and the law of the iterated logarithm

Lecture 26 - Self normalized concentration inequalities and application to online regression

NPTEL : NOC:Real-Time Digital Signal Processing (Electrical Engineering)

Co-ordinators : Prof. Rathna G N

Lecture 1 - Introduction

Lecture 2 - Basics of Signal Processing

Lecture 3 - Lab - CCS

Lecture 4 - Number System

Lecture 5 - Architecture - 1

Lecture 6 - Architecture - 2

Lecture 7 - Real-time Constraints

Lecture 8 - FIR - Filters

Lecture 9 - Pipelining and Parallel Processing for Low Power Applications - I

Lecture 10 - Pipelining and Parallel Processing for Low Power Applications - II

Lecture 11 - Lab: Sine Generation

Lecture 12 - IIR Filters - 1

Lecture 13 - IIR Filters - 2

Lecture 14 - Lab: Sine Generatioon, FIR and IIR

Lecture 15 - Lab 3 IIR Filter as Resonator

Lecture 16 - Lab 4 Use of FDA tool box to generate co-efficients

Lecture 17 - Lab: Real-Time Audio Output through Sine Generation

Lecture 18 - IIR Filters 4

Lecture 19 - Lab: FIR Filter in generation of music

Lecture 20 - Lab: Real-Time Audio Output through FIR Filter

Lecture 21 - DFT, DTFT, twiddle factors, properties, circular convolution and examples

Lecture 22 - Complexity of Filtering and the FFT

Lecture 23 - Lab: Filtering Using FFT

Lecture 24 - Lab: FFT in CCS

Lecture 25 - FFT - 1

Lecture 26 - FFT - 2

Lecture 27 - FFT - 3

Lecture 28 - Overlap - Add

Lecture 29 - Overlap Save Method

Lecture 30 - Lab: Overlap Add and Save Method using MATLAB

Lecture 31 - Correlation

Lecture 32 - Lab: Different ways of implementing FFT in CCS

Lecture 33 - Adaptive Filter

Lecture 34 - Lab: LMS Algorith in MATLAB

Lecture 35 - LMS Algorithm

Lecture 36 - Lab: Error surface and error contour

Lecture 37 - Adaptive Filter Applications

Lecture 38 - Lab: Application of adaptive filter in MATLAB

Lecture 39 - Adaptive Echo Cancellation

Lecture 40 - Lab: Application of adaptive filter in CCS, Echo, scrambling and graphic equilizer in MATLAB

Lecture 41 - Graphic Equalizer

Lecture 42 - Lab: Adaptive filters (MATLAB)

Lecture 43 - Speech Coding - I

Lecture 44 - Speech Coding - II

Lecture 45 - Speech Coding - III

Lecture 46 - Lab: LPC for speech synthesis

Lecture 47 - Discrete Cosine Transform - 1

Lecture 48 - Discrete Cosine Transform - 2

Lecture 49 - Discrete Cosine Transform - 3

Lecture 50 - Discrete Cosine Transform - 4

Lecture 51 - Lab: Adaptive filters (CCS) - 1

Lecture 52 - Lab: Adaptive filters (CCS) - 2

Lecture 53 - Lab: Discrete Cosine Transformation

Lecture 54 - Lab: Echogeneration

Lecture 55 - Lab: Using JiDSP

Lecture 56 - Summary

NPTEL : NOC:Advanced Neural Science for Engineers (Electrical Engineering)

Co-ordinators : Prof. Vikas V

Lecture 1 - Introduction to Biomedical Research

Lecture 2 - Fabricated Biosensors and Systems

Lecture 3 - Lab 1 - Introduction to the Fabrication lab

Lecture 4 - Lab 2 - Cleanroom and Gowning Protocol

Lecture 5 - Developed Systems at a glance

Lecture 6 - Silicon and Silicon Dioxide

Lecture 7 - Piranha Cleaning of Silicon Wafer

Lecture 8 - Polyimide Coating on Silicon Wafer

Lecture 9 - Thermal Oxidation of Silicon and Thickness measurement

Lecture 10 - Fundamental of Physical Vapour Deposition

Lecture 11 - Lab 3 - Lithography: Demonstration

Lecture 12 - Sputtering

Lecture 13 - Basics of Photolithography

Lecture 14 - Lab 4 - E-Beam Evaporation: Demo

Lecture 15 - Photolithography - II

Lecture 16 - Photolithography - III

Lecture 17 - Lab 5 - E-Beam Evaporation: Demo - II

Lecture 18 - Lab 6 - Liftoff Demonstration

Lecture 19 - Lithography Optics - I

Lecture 20 - Soft Lithography - I

Lecture 21 - Soft Lithography - II

Lecture 22 - Lab 7 - Sputtering Demonstration - I

Lecture 23 - Lab 8 - Sputtering Demonstration - II

Lecture 24 - Thin Film Deposition: CVD - I

Lecture 25 - Thin Film Deposition: CVD - II

Lecture 26 - Lithography Optics - II

Lecture 27 - Role of Fabrication in Neural Engineering

Lecture 28 - Micromachining

Lecture 29 - Overview of Experimental Neurophysiology

Lecture 30 - Fabrication of Neural Implants

Lecture 31 - Introduction to Packaging for Neural Systems

Lecture 32 - Lab 9 - 3D Printing for neural devices

Lecture 33 - Introduction to Biopotentials

Lecture 34 - EEG: Introduction, Demonstration and Applications

Lecture 35 - Neural Implants: Fabrication and Characterization

Lecture 36 - Design of Wireless Biphasic Pulse Generator

Lecture 37 - Basics of EEG/ERP Experimental Desing

Lecture 38 - Micromachining and Etching

Lecture 39 - Epileptic Seizure Detection and Classification

Lecture 40 - Newborn Hearing Screening - I

Lecture 41 - Newborn Hearing Screening - II

Lecture 42 - Applications of EEG/ERP Experimental Design

Lecture 43 - Flexible MEA for Electrocorticography Signal Acquisition

Lecture 44 - Flexible biodegradable MEAs

Lecture 45 - Microneedle Electrode Array

Lecture 46 - Neurosurgery-based MEA Implantation - I

Lecture 47 - Neurosurgery-based MEA Implantation - II

Lecture 48 - Neurosurgery-based MEA Implantation - III

Lecture 49 - Neurosurgery-based MEA Implantation - IV

Lecture 50 - Deep Brain Stimulation/Recording for Parkinson's - I

Lecture 51 - Deep Brain Stimulation/Recording for Parkinson's - II

Lecture 52 - Computational Neuroscience Fundamentals

Lecture 53 - Mathematical Analysis in Neural Science

Lecture 54 - Neuroanatomy for Neural Engineering

NPTEL : NOC:Design of Electric Motors (Electrical Engineering)

Co-ordinators : Dr. Prathap Reddy

Lecture 1 - History Prospect of Electrical Machines

Lecture 2 - Electric Fields

Lecture 3 - Magnetic Fields - 1

Lecture 4 - Magnetic Fields - 2

Lecture 5 - Electric and Magnetic Circuits Interface

Lecture 6 - Magnetic Materials and Concepts of BH Curves

Lecture 7 - Analysis of Magnetic Circuits With and Without Air Gaps

Lecture 8 - Example Problems of Magnetic Circuits

Lecture 9 - Magnetic Circuits with Multiple Windings and Permanent Magnets

Lecture 10 - Force Equations in Electromechanical Systems - 1

Lecture 11 - Force Equations in Electromechanical Systems - 2

Lecture 12 - Design of Electromagnetic Systems

Lecture 13 - Realization of Electrical Machines - 1

Lecture 14 - Realization of Electrical Machines - 2

Lecture 15 - Magnetic Fields in DC Machines - 1

Lecture 16 - Magnetic Fields in AC Machines - 1

Lecture 17 - Magnetic Fields in AC Machines - 2

Lecture 18 - Magnetic Fields in AC Machines - 3

Lecture 19 - MMFDistribution ofAC Machines

Lecture 20 - Basics of Electrical Machine Windings

Lecture 21 - Stator winding design-single layer winding

Lecture 22 - Stator winding design-double layer winding

Lecture 23 - Stator Winding Design-Fractional Slot Double Layer Winding

Lecture 24 - Variable Pole Machine Stator Winding Design (Pole-Phase Modulation) - 1

Lecture 25 - Variable Pole Machine Stator Winding Design (Pole-Phase Modulation) - 2

Lecture 26 - Importance of Motor Design and Standards of Electric Motors

Lecture 27 - Electric Machine Sizing Equations-Output Power and Volume (D2L) Product Equation

Lecture 28 - Lab Session on Re-winding of Induction Motor (Example: Double Layer Winding)

Lecture 29 - The Figure of Merits for Electric Motors and Aspect Ratio to Decouple the D2L Product

Lecture 30 - Electric Machine Sizing Equations-Output Power Equation in terms of D3L Product - 1

Lecture 31 - Electric Machine Sizing Equations-Output Power Equation in terms of D3L Product - 2

Lecture 32 - Analysis of Copper Function and Output Function w r t the Electric Machine D3L Product Eqn

Lecture 33 - Example Problems on Output Power Equation in terms of D3L Product

Lecture 34 - Electric Machine Sizing Equations-Output Power Equation in terms of D the power 2.5 L Product

Lecture 35 - Design Procedure of an Electric Machine

Lecture 36 - Name Plate Details and Datasheets of Induction Motor

Lecture 37 - Design of Induction Machine- Stator Design - 1 (Stator Core design)

Lecture 38 - Design of Induction Machine- Stator Design - 2 (Stator Winding Design)

Lecture 39 - Design of Induction Machine- Stator Design - 3 (Stator Slot Geometry)

Lecture 40 - Design of Induction Machine- Rotor Design - 1 (Rotor Slots Selection)

Lecture 41 - Design of Induction Machine- Rotor Design - 2 (Rotor MMF and Bar Currents)

Lecture 42 - Design of Induction Machine- Rotor Design - 3 (Rotor Slot Geometry)

Lecture 43 - Design of Induction Machine- Rotor Design - 4 (Skewing of Rotor)

Lecture 44 - Design of Induction Machine- Rotor Design - 4 (Resistance of Rotor Winding)

Lecture 45 - Carter's Coefficient of Electrical Machines

Lecture 46 - Effective Length Equations of the Machine Core with Different Stator and Rotor Lengths

Lecture 47 - Stator MMF and Magnetizing Current Equations of Induction Machine

Lecture 48 - Magnetizing Inductance of Induction Machine

Lecture 49 - Stator and Rotor Leakage Inductances of Induction Machine

Lecture 50 - Equivalent Circuit Parameters of Induction Machine

Lecture 51 - Loss Calculation of Induction Machine - 1

Lecture 52 - Loss Calculation of Induction Machine - 2 and Performance Parameters of Induction Motor

Lecture 53 - Switched Reluctance Machine Sizing Equations-Output Power and Volume (D2L) Product Equation

Lecture 54 - The Figure of Merits for SRM and Example Problem on Output Power Equation i t f D2L Product

Lecture 55 - Design of Switched Reluctance Machine: Stator Design - 1

Lecture 56 - Design of Switched Reluctance Machine: Stator Design - 2 and Rotor Design

Lecture 57 - Procedure for Calculation of SRM Inductance: Aligned Inductance - 1

Lecture 58 - Calculation of SRM Inductance: Aligned Inductance - 2

Lecture 59 - Efficiency and Loss Calculation of SRM

Lecture 60 - Importance of Thermal Design and Thermal Limits for Electrical Machines

Lecture 61 - Electric and Thermal Circuits Interface

Lecture 62 - Heat Transfer Methods and Basic Equations for Thermal Resistance

Lecture 63 - Heat Flow in Electrical Machines

Lecture 64 - Cooling Methods and Standards for Electrical Machines

Lecture 65 - Basics of Thermal Equivalent Circuits

Lecture 66 - Thermal Equivalent Circuit - 1

Lecture 67 - Thermal Equivalent Circuit - 2

NPTEL : NOC:Basics of Semiconductor Microwave Devices (Electrical Engineering)

Co-ordinators : Prof Digbijoy N Nath

Lecture 1 - An Introduction to the course and outline of the course

Lecture 2 - Historical overview of the development of microwave devices

Lecture 3 - Applications of semiconductor microwave devices

Lecture 4 - Applications of semiconductor microwave devices (Continued...)

Lecture 5 - Heterojunction device physics

Lecture 6 - Heterojunction device physics (Continued...) and III-nitrides

Lecture 7 - III-nitrides and polarization

Lecture 8 - III-nitride high electron mobility transistors

Lecture 9 - Varactors and Schottky multipliers

Lecture 10 - Varactors and Schottky multipliers (Continued...)

Lecture 11 - Diodes for microwave applications

Lecture 12 - IMPATT diode

Lecture 13 - Tunnel diodes and Introduction to Gunn diodes

Lecture 14 - Gunn diode and its modes

Lecture 15 - Introduction to MESFETs

Lecture 16 - Advanced concepts of GaAs MESFETs

Lecture 17 - GaAs MESFET fabrication and practical aspects

Lecture 18 - Practical aspects of FET design and small-signal model

Lecture 19 - GaAs MESFETs: cut-off frequency and aspects of power devices

Lecture 20 - GaAs MESFETs for power amplifiers

Lecture 21 - Modulation doping in compound semiconductors

Lecture 22 - Band diagram of MODFETs/HEMTs

Lecture 23 - Design issues and methodology for microwave HEMTs

Lecture 24 - Small-signal model and noise in HEMTs

Lecture 25 - The concept of pseudomorphic or pHEMTs

Lecture 26 - Multi-finger HEMTs

Lecture 27 - pHEMTs for low noise and introduction to InP HEMT

Lecture 28 - InP HEMTs for power and the concept of metamorphic HEMTs

Lecture 29 - AlGaN/GaN HEMT: applications, structure, substrates and FOM

Lecture 30 - AlGaN/GaN HEMT: device basics, current collapse and passivation

Lecture 31 - AlGaN/GaN HEMT: gate process, field-plate and trade-offs in design

Lecture 32 - AlGaN/GaN HEMT: Practical aspects and commercial HEMTs

Lecture 33 - GaN RF HEMT on eval board, and emerging topics of research

Lecture 34 - Linearity in GaN HEMTs - A device perspective

Lecture 35 - Nanoscale MOSFETs and short channel effects

Lecture 36 - Parasitic resistances and capacitances in nanoscale MOSFETs

Lecture 37 - RF MOSFET Layout and RF Silicon-on-insulator

Lecture 38 - Noise in MOSFETs and Introduction to LDMOS

Lecture 39 - Working of LDMOS and VDMOS

Lecture 40 - LDMOS: Parasitics, and the concept of RESURF

Lecture 41 - LDMOS: HCI, snapback, finger layout and some aspects of commercial devices

Lecture 42 - BJT: common base and common emitter from the device point of view

Lecture 43 - BJT: Kirk effect, Ebers-Moll model and base transit time

Lecture 44 - BJT: small-signal model, gain and cut-off frequency

Lecture 45 - BJT: Emitter and base designs and drift transistor

Lecture 46 - Collector design in modern BJT and Introduction to HBTs

Lecture 47 - HBT: base current and collapse of the current gain

Lecture 48 - High-frequency HBT and Introduction to SiGe HBT

Lecture 49 - SiGe HBT: various resistances and capacitances, scaling and aspects of BiCMOS

Lecture 50 - Basics of microwave: transmission line theory

Lecture 51 - Waveguides, T-lines and introduction to 2-port networks

Lecture 52 - S-parameters and the basics of Smith Chart

Lecture 53 - Smith chart and matching

Lecture 54 - Impedance matching using Smith Chart and stub line

Lecture 55 - Passives in microwave circuits

Lecture 56 - Inductors in microwave circuits

Lecture 57 - More on passive elements in microwave circuits

Lecture 58 - On-wafer measurement and S-parameters

Lecture 59 - On-wafer de-embedding

Lecture 60 - On-wafer and fixture-based measurements and calibration

Lecture 61 - More on fixtures and basic transistor concepts for power amplifiers