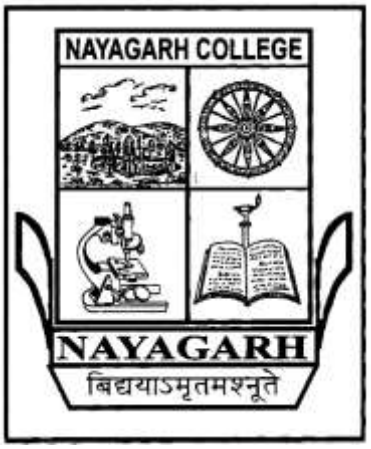
SYLLABUS FOR
UNDERGRADUATE COURSE IN ELECTRONICS

(Bachelor of Science Examination)

Admission Batch 2019



UNDER

CHOICE BASED CREDIT SYSTEM
Department of Electronics

Nayagarh Autonomous College, Nayagarh

Affiliated to Utkal University, Vani-vihar, Bhubaneswar, Odisha

Course Structure

Course	*Credits Theory+ Practical	Theory + Tutorial
I. Core Course(14 Papers)	14X4= 56	
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	
(4 Papers)		
A.2. Discipline Specific Elective		
Practical/ Tutorial*	4 X 2=8	
(4 Papers)		
B.1. Generic Elective/		
Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective		
Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		

- **Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses		
1. **Ability Enhancement Compulsory Courses (AECC)**		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. **Skill Enhancement Courses (SEC)**		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credit	**140**	**140**

*** wherever there is a practical there will be no tutorial and vice-versa**

Policy about ECA/ General Interest/Hobby/Sports/NCC/NSS/related courses as per University of Delhi rules and norms

Core Course Paper-1

Basic Circuit Theory and Network Analysis

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (13 Lectures)

Basic Circuit Concepts: Voltage and Current Sources, Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel.

Inductors: Fixed and Variable inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Inductance in series and parallel, Testing of resistance and inductance using multimeter.

Capacitors: Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Air, Paper, Mica, Teflon, Ceramic, Plastic and Electrolytic capacitor, Construction and application, capacitors in series and parallel, factors governing the value of capacitors, testing of capacitors using multimeter.

Unit- 2 (13 Lectures)

Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh

Analysis, Star-Delta Conversion.

DC Transient Analysis: RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial

Current, Time Constant, RL and RC Circuits With Sources, DC Response of Series RLC Circuits.

Unit-3 (18 Lectures)

AC Circuit Analysis: Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root

Mean Square and Average Values. Voltage-Current relationship in Resistor, Inductor and Capacitor, Phasor,

Complex Impedance, Power in AC Circuits: Instantaneous Power, Average Power, Reactive Power, Power

Factor. Sinusoidal Circuit Analysis for RL, RC and RLC Circuits.

Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits,

Quality (Q) Factor and Bandwidth. Passive Filters: Low Pass, High Pass, Band Pass and Band Stop.

Unit-4 (16 Lectures)

Network Theorems: Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem,

Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem.

Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD)

Parameters.

Suggested books:

1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)

2. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)

3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)

4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)

5. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)

Basic Circuit Theory and Network Analysis Lab (Hardware and Circuit Simulation Software)

60 Lectures

1. Familiarization with

a) Resistance in series, parallel and series – Parallel.

b) Capacitors & Inductors in series & Parallel.

c) Multimeter – Checking of components.

d) Voltage sources in series, parallel and series – Parallel

e) Voltage and Current dividers

2. Measurement of Amplitude, Frequency & Phase difference using CRO.

3. Verification of Kirchoff's Law.

4. Verification of Norton's theorem.

5. Verification of Thevenin's Theorem.

6. Verification of Superposition Theorem.

7. Verification of the Maximum Power Transfer Theorem.

8. RC Circuits: Time Constant, Differentiator, Integrator.

9. Designing of a Low Pass RC Filter and study of its Frequency Response.

10. Designing of a High Pass RC Filter and study of its Frequency Response.

11. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant

Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.

CC-2

Mathematics Foundation for Electronics

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (16 Lectures)

Ordinary Differential Equations: First Order Ordinary Differential Equations, Basic Concepts, Separable

Ordinary Differential Equations, Exact Ordinary Differential Equations, Linear Ordinary Differential

Equations. Second Order homogeneous and non-homogeneous Differential Equations.

Series solution of differential equations and special functions: Power series method, Legendre Polynomials, Frobenius Method

Unit-2 (14 Lectures)

Matrices: Introduction to Matrices, System of Linear Algebraic Equations, Gaussian Elimination Method,

Gauss-Seidel Method, LU decomposition, Solution of Linear System by LU decomposition. Eigen Values and
Eigen Vectors, Linear Transformation, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton
Theorem, Diagonalization, Powers of a Matrix. Real and Complex Matrices, Symmetric, Skew Symmetric,
Orthogonal Quadratic Form, Hermitian, Skew Hermitian, Unitary Matrices.

Unit-3 (14 Lectures)

Sequences and series: Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a
sequence, Infinite series, Necessary condition for Convergence, Cauchy's Integral Test, D'Alembert's Ratio
Test, Cauchy's nth Root Test, Alternating Series, Leibnitz's Theorem, Absolute Convergence and Conditional
Convergence, Power Series.

Unit-4 (16 Lectures)

Complex Variables and Functions: Complex Variable, Complex Function, Continuity, Differentiability,
Analyticity. Cauchy-Riemann (C- R) Equations, Harmonic and Conjugate Harmonic Functions, Exponential
Function, Trigonometric Functions, Hyperbolic Functions. Line Integral in Complex Plane, Cauchy's Integral
Theorem, Cauchy's Integral Formula, Derivative of Analytic Functions. Sequences, Series and Power Series,
Taylor's Series, Laurent Series, Zeroes and Poles. Residue integration method, Residue integration of real
Integrals.

Suggested Books

1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)
2. Murray Spiegel, Seymour Lipschutz, John Schiller, Outline of Complex Variables, Schaum Outline
Series, Tata McGraw Hill (2007)
3. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007)
4. C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)
5. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited
(2007)

**Mathematics Foundation for Electronics Lab (Scilab/MATLAB/ any other Mathematical Simulation
software)**

60 Lectures

1. Solution of First Order Differential Equations
2. Solution of Second Order homogeneous Differential Equations
3. Solution of Second Order non-homogeneous Differential Equations
4. Convergence of a given series.
5. Divergence of a given series.
6. Solution of linear system of equations using Gauss Elimination method.
7. Solution of linear system of equations using Gauss – Seidel method.
8. Solution of linear system of equations using L-U decomposition method.

CC-3

Semiconductor Devices
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit 1 (14 Lectures)

Semiconductor Basics: Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller
Indices, Energy Band in Solids, Concept of Effective Mass, Density of States, Carrier Concentration at
Normal Equilibrium in Intrinsic Semiconductors, Derivation of Fermi Level for Intrinsic & Extrinsic
Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration,
Temperature Dependence of Carrier Concentrations.
Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein
Relation, Current Density Equation, Carrier Injection, Generation And Recombination Processes, Continuity
Equation.

Unit 2 (14 Lectures)

P-N Junction Diode: Formation of Depletion Layer, Space Charge at a Junction, Derivation of Electrostatic
Potential Difference at Thermal Equilibrium, Depletion Width and Depletion Capacitance of an Abrupt
Junction. Concept of Linearly Graded Junction, Derivation of Diode Equation and I-V Characteristics. Zener
and Avalanche Junction Breakdown Mechanism.
Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics, applications

Unit 3 (14 Lectures)

Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Emitter
Efficiency, Base Transport Factor, Current Gain, Energy Band Diagram of Transistor in Thermal Equilibrium,
Quantitative Analysis of Static Characteristics (Minority Carrier Distribution and Terminal Currents), Base-
Width Modulation, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations.
Metal Semiconductor Junctions: Ohmic and Rectifying Contacts.

Unit 4 (18 Lectures)

Field Effect Transistors: JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage,
Current-Voltage Output Characteristics. MOSFET, types of MOSFETs, Circuit symbols, Working and
Characteristic curves of Depletion type MOSFET (both N channel and P Channel) and Enhancement type
MOSFET (both N channel and P channel). Complimentary MOS (CMOS).

Power Devices: UJT, Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio,
Characteristics and relaxation oscillator-expression. SCR, Construction,Working and Characteristics, Triac,
Diac, IGBT, MESFET, Circuit symbols, Basic constructional features, Operation and Applications.

Suggested Books:

1) S. M. Sze, Semiconductor Devices: Physics and Technology, 2ndEdition, Wiley India edition (2002).
2) Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
3) Dennis Le Croissette, Transistors, Pearson Education (1989)
4) Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
5) Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
6) Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)

Semiconductor Devices Lab (Hardware and Circuit Simulation Software)

60 Lectures

1. Study of the I-V Characteristics of Diode – Ordinary and Zener Diode.
2. Study of the I-V Characteristics of the CE configuration of BJT and obtain r_i, r_o, β.
3. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain r_i, r_o, α.
4. Study of the I-V Characteristics of the Common Collector Configuration of BJT and obtain voltage
gain, ri, r_o.
5. Study of the I-V Characteristics of the UJT.
6. Study of the I-V Characteristics of the SCR.
7. Study of the I-V Characteristics of JFET.
8. Study of the I-V Characteristics of MOSFET.
9. Study of Characteristics of Solar Cell
10. Study of Hall Effect.

CC-4

Applied Physics
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (19 Lectures)

Quantum Physics: Inadequacies of Classical physics. Compton's effect, Photo-electric Effect, Wave-particle duality, de Broglie waves. Basic postulates and formalism of quantum mechanics: probabilistic interpretation of waves. Schrodinger wave equation for a free particle and in a force field (1 dimension), Boundary and continuity conditions. Operators in Quantum Mechanics, Conservation of probability, Time-dependent form, Linearity and superposition, Operators, Timeindependent one dimensional Schrodinger wave equation, Stationary states, Eigen-values and Eigen functions. Particle in a one-dimensional box, Potential barrier problems, phenomenon of tunneling. Spherically symmetric potentials, the Hydrogen-like atom problem.

Unit-2 (11 Lectures)

Mechanical Properties of Materials: Elastic and Plastic Deformations, Hooke's Law, Elastic Moduli, Brittle and Ductile Materials, Tensile Strength, Theoretical and Critical Shear Stress of Crystals. Strengthening Mechanisms, Hardness, Creep, Fatigue, Fracture.

Unit-3 (15 Lectures)

Thermal Properties: Brief Introduction to Laws of Thermodynamics, Concept of Entropy, Concept of Phonons, Heat Capacity, Debye's Law, Lattice Specific Heat, Electronic Specific Heat, Specific Heat Capacity for Si and GaAs, Thermal Conductivity, Thermoelectricity, Seebeck Effect, Thomson Effect, Peltier Effect.

Unit-4 (15 Lectures)

Electric and Magnetic Properties: Conductivity of metals, Ohm's Law, relaxation time, collision time and mean free path, electron scattering and resistivity of metals, heat developed in current carrying conductor, Superconductivity.

Classification of Magnetic Materials, Origin of Magnetic moment, Origin of dia, para, ferro and antiferro
magnetism and their comparison, Ferrimagnetic materials, Saturation Magnetisation and Curie temperature,
Magnetic domains, Concepts of Giant Magnetic Resistance (GMR), Magnetic recording.

Suggested Books:

1. S. Vijaya and G. Rangarajan, Material Science, Tata Mcgraw Hill (2003)
2. W. E. Callister, Material Science and Engineering: An Introduction, Wiley India (2006)
3. A. Beiser, Concepts of Modern Physics , McGraw-Hill Book Company (1987)
4. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, Macmillan India (2004)

Applied Physics Lab

60 Lectures

1. To determine Young's modulus of a wire by Searle's method.
2. To determine the modulus of rigidity of a wire by static & dynamic method
3. To determine the elastic constants of a wire by Searle's method.
4. To measure the resistivity of a Ge crystal with temperature by four –probe method from room temperature to 200 ^{0}C).
5. To determine the value of Boltzmann Constant by studying forward characteristics of diode.
6. To determine the value of Planck's constant by using LEDs of at least 4 different wavelengths.
7. To determine e/m of electron by Bar Magnet or by Magnetic Focusing.

CC-5

Electronics Circuits

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (14 Lectures)

Diode Circuits: Ideal diode, piecewise linear equivalent circuit, dc load line analysis, Quiescent (Q) point.

Clipping and clamping circuits. Rectifiers: HWR, FWR (center tapped and bridge). Circuit diagrams, working and waveforms, ripple factor & efficiency, comparison. Filters: types, circuit diagram and explanation of shunt capacitor filter with waveforms.

Zener diode regulator circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.

Unit- 2 (15 Lectures)

Bipolar Junction Transistor: Review of CE, CB Characteristics and regions of operation. Hybrid parameters. Transistor biasing, DC load line, operating point, thermal runaway, stability and stability factor,

Fixed bias without and with RE, collector to base bias, voltage divider bias and emitter bias (+VCC and –VEE bias), circuit diagrams and their working.

Transistor as a switch, circuit and working**,** Darlington pair and its applications.

BJT amplifier (CE), dc and ac load line analysis, hybrid model of CE configuration, Quantitative study of the frequency response of a CE amplifier, Effect on gain and bandwidth for Cascaded CE amplifiers (RC coupled).

Unit- 3 (13 Lectures)

Feedback Amplifiers: Concept of feedback, negative and positive feedback, advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, gain, input and output impedances . Barkhausen criteria for oscillations, Study of phase shift oscillator, Colpitts oscillator and Hartley oscillator.

Unit- 4 (18 Lectures)

MOSFET Circuits: Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits.

Power Amplifiers: Difference between voltage and power amplifier, classification of power amplifiers, Class A, Class B, Class C and their comparisons.

Operation of a Class A single ended power amplifier. Operation of Transformer coupled Class A power amplifier, overall efficiency. Circuit operation of complementary symmetry Class B push pull power amplifier, crossover distortion, heat sinks.

Single tuned amplifiers: Circuit diagram, Working and Frequency Response for each, Limitations of single
tuned amplifier, Applications of tuned amplifiers in communication circuits.

Suggested Books:

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
2. Electronic devices, David A Bell, Reston Publishing Company
3. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
4. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
5. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
6. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
7. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
8. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

Electronics Circuits Lab (Hardware and Circuit Simulation Software)

60 Lectures

1. Study of the half wave rectifier and Full wave rectifier.
2. Study of power supply using C filter and Zener diode.
3. Designing and testing of 5V/9 V DC regulated power supply and find its load-regulation
4. Study of clipping and clamping circuits .
5. Study of Fixed Bias, Voltage divider and Collector-to-Base bias Feedback configuration for transistors.
6. Designing of a Single Stage CE amplifier.
7. Study of Class A, B and C Power Amplifier.
8. Study of the Colpitt's Oscillator.
9. Study of the Hartley's Oscillator.
10. Study of the Phase Shift Oscillator
11. Study of the frequency response of Common Source FET amplifier.

CC-6

Digital Electronics and Verilog/VHDL

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (11 Lectures)

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions,

Binary, octal and hexadecimal arithmetic (addition, subtraction by complement method, multiplication),
representation of signed and unsigned numbers, Binary Coded Decimal code.
Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Truth Tables of
OR, AND, NOT, Basic postulates and fundamental theorems of Boolean algebra, Truth tables, construction
and symbolic representation of XOR, XNOR, Universal (NOR and NAND) gates.
Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power
product, TTL and CMOS families and their comparison.
Unit-2 (13 Lectures)
Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS),
Karnaugh map minimization, Encoder and Decoder, Multiplexers and Demultiplexers, Implementing logic
functions with multiplexer, binary Adder, binary subtractor, parallel adder/subtractor.
Unit-3 (18 Lectures)
Sequential logic design: Latches and Flip flops , S-R Flip flop, J-K Flip flop, T and D type Flip flop,
Clocked and edge triggered Flip flops, master slave flip flop, Registers, Counters (synchronous and
asynchronous and modulo-N), State Table, State Diagrams, counter design using excitation table and
equations. , Ring counter and Johnson counter.
Programmable Logic Devices: Basic concepts- ROM, PLA, PAL, CPLD, FPGA
Unit-4 (18 Lectures)
Introduction to Verilog: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and
Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. Verilog Modules, Delays, data flow
style, behavioral style, structural style, mixed design style, simulating design.
Introduction to Language Elements, Keywords, Identifiers, White Space Characters, Comments, format,
Integers, reals and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets,
Register type, Parameters. Expressions, Operands, Operators, types of Expressions
Data flow Modeling and Behavioral Modeling: Data flow Modeling: Continuous assignment, net
declaration assignments, delays, net delays.
Behavioral Modeling: Procedural constructs, timing controls, block statement, procedural assignments,
conditional statement, loop statement, procedural continuous assignment.
Gate level modeling - Introduction, built in Primitive Gates, multiple input gates, Tri-state gates, pull gates,
MOS switches, bidirectional switches, gate delay, array instances, implicit nets, Illustrative Examples (both
combinational and sequential logic circuits).
OR
Introduction to VHDL: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and

Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. VHDL Modules, Delays, data flow
style, behavioral style, structural style, mixed design style, simulating design.
Introduction to Language Elements, Keywords, Identifiers, White Space Characters, Comments, format.
VHDL terms, describing hardware in VHDL, entity, architectures, concurrent signal assignment, event
scheduling, statement concurrency, structural designs, sequential behavior, process statements, process
declarative region, process statement region, process execution, sequential statements, architecture selection,
configuration statements, power of configurations.
Behavioral Modeling: Introduction to behavioral modeling, inertial delay, transport delay , inertial delay
model, transport delay model, transport vs inertial delay, simulation delta drivers, driver creation, generics,
block statements, guarded blocks.
Sequential Processing: Process statement, sensitivity list, signal assignment vs variable assignment,
sequential statements, IF, CASE ,LOOP, NEXT, ,EXIT and ASSERT statements, assertion BNF, WAIT ON
signal, WAIT UNTIL expression, WAIT FOR time expression, multiple wait conditions, WAIT Time-Out,
Sensitivity List vs WAIT Statement Concurrent Assignment, Passive Processes.
Data types: Object types-signal, variable, constant, Data types –scalar types, composite types, incomplete
types, File Type caveats, subtypes, Subprograms and functions

Suggested Books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of
India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. A Verilog HDL Primer – J. Bhasker, BSP, 2003 II Edition.
6. Verilog HDL-A guide to digital design and synthesis-Samir Palnitkar, Pearson, 2nd edition.

Digital Electronics and Verilog/VHDL Lab (Hardware and Circuit Simulation Software)
60 lectures

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. To convert a Boolean expression into logic gate circuit and assemble it using logic gate IC's.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.
6. Design a 4 X 1 Multiplexer using gates.
7. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
8. Design a counter using D/T/JK Flip-Flop.
9. Design a shift register and study Serial and parallel shifting of data.

Experiments in Verlog/VHDL

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.
4. Clocked D FF, T FF and JK FF (with Reset inputs).

5. Multiplexer (4x1, 8x1) and Demultiplexer using logic gates.
6. Decoder (2x4, 3x8), Encoders and Priority Encoders.
7. Design and simulation of a 4 bit Adder.
8. Code converters (Binary to Gray and vice versa).
9. 2 bit Magnitude comparator.
10. 3 bit Ripple counter.

CC-7

C Programming and Data Structures
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (12 Lectures)

C Programming Language: Introduction, Importance of C, Character set, Tokens, keywords, identifier,
constants, basic data types, variables: declaration & assigning values. Structure of C program
Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement
operators, conditional operators, bit wise operators, expressions and evaluation of expressions, type cast
operator, implicit conversions, precedence of operators. Arrays-concepts, declaration, accessing elements,
storing elements, two-dimensional and multi-dimensional arrays. Input output statement and library functions
(math and string related functions).

Unit-2 (19 Lectures)

Decision making, branching & looping: Decision making, branching and looping: if, if-else, else-if, switch
statement, break, for loop, while loop and do loop. Functions: Defining functions, function arguments and
passing, returning values from functions.

Structures: defining and declaring a structure variables, accessing structure members, initializing a structure,
copying and comparing structure variables, array of structures, arrays within structures, structures within
structures, structures and functions. Pointers.
Introduction to C++: Object oriented programming, characteristics of an object-oriented language.
Unit-3 (15 Lectures)
Data Structures: Definition of stack, array implementation of stack, conversion of infix expression to prefix,
postfix expressions, evaluation of postfix expression. Definition of Queue, Circular queues, Array
implementation of queues.
Unit-4 (14 Lectures)
Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort, linear Search, binary search.
Trees : Introduction to trees, Binary search tree, Insertion and searching in a BST, preorder, postorder and
inorder traversal (recursive)
Suggested Books:
1. Yashavant Kanetkar, Let Us C , BPB Publications
2. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
3. Byron S Gottfried, Programming with C , Schaum Series
4. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall
5. Yashavant Kanetkar, Pointers in C, BPB Publications
6. S. Sahni and E. Horowitz, "Data Structures", Galgotia Publications
7. Tanenbaum: "Data Structures using C", Pearson/PHI.
8. Ellis Horowitz and Sartaz Sahani "Fundamentals of Computer Algorithms", Computer Science Press.
C Programming and Data Structures Lab
60 Lectures
1. Generate the Fibonacci series up to the given limit N and also print the number of elements in the
series.
2. Find minimum and maximum of N numbers.
3. Find the GCD of two integer numbers.
4. Calculate factorial of a given number.
5. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non – zero coefficients A, B and C.
Else report error.
6. Calculate the value of sin (x) and cos (x) using the series. Also print sin (x) and cos (x) value using
library function.
7. Generate and print prime numbers up to an integer N.
8. Sort given N numbers in ascending order.
9. Find the sum & difference of two matrices of order MxN and PxQ.
10. Find the product of two matrices of order MxN and PxQ.
11. Find the transpose of given MxN matrix.
12. Find the sum of principle and secondary diagonal elements of the given MxN matrix.
13. Calculate the subject wise and student wise totals and store them as a part of the structure.
14. Maintain an account of a customer using classes.
15. Implement linear and circular linked lists using single and double pointers.

16. Create a stack and perform Pop, Push, Traverse operations on the stack using Linear Linked list
17. Create circular linked list having information about a college and perform Insertion at front, Deletion
at end.
18. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete,
and Display the queue elements.
19. Implement polynomial addition and subtraction using linked lists.
20. Implement sparse matrices using arrays and linked lists.
21. Create a Binary Tree to perform Tree traversals (Preorder, Postorder, Inorder) using the concept of
recursion.
22. Implement binary search tree using linked lists. Compare its time complexity over that of linear
search.
23. Implement Insertion sort, Merge sort, Bubble sort, Selection sort.

CC-8

Operational Amplifiers and Applications
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (18 Lectures)

Basic Operational Amplifier: Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator, block diagram of an operational amplifier (IC 741)

Op-Amp parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.

Unit-2 (18 Lectures)

Op-Amp Circuits: Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, Summing and difference amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter.

Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger.

Signal generators: Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator, and Voltage controlled oscillator(IC 566).

Unit-3 (12 Lectures)

Multivibrators (IC 555): Block diagram, Astable and monostable multivibrator circuit, Applications of Monostable and Astable multivibrators. Phase locked loops (PLL): Block diagram, phase detectors, IC565.

Fixed and variable IC regulators: IC 78xx and IC 79xx -concepts only, IC LM317- output voltage equation

Unit-4 (12 Lectures)

Signal Conditioning circuits: Sample and hold systems, Active filters: First order low pass and high pass butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Log and antilog amplifiers.

Suggested Books:

1. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)

2. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson
Education (2001)
3. J. Millman and C.C. Halkias, Integrated Electronics, Tata McGraw-Hill,(2001)
4. A.P.Malvino, Electronic Principals,6th Edition , Tata McGraw-Hill,(2003)
5. K.L.Kishore,OP-AMP and Linear Integrated Circuits, Pearson(2011)

Operational Amplifiers and Application Lab (Hardware and Circuit Simulation Software)
60 Lectures

1. Study of op-amp characteristics: CMRR and Slew rate.
2. Designing of an amplifier of given gain for an inverting and non-inverting configuration using an opamp.
3. Designing of analog adder and subtractor circuit.
4. Designing of an integrator using op-amp for a given specification and study its frequency response.
5. Designing of a differentiator using op-amp for a given specification and study its frequency response.
6. Designing of a First Order Low-pass filter using op-amp.
7. Designing of a First Order High-pass filter using op-amp.
8. Designing of a RC Phase Shift Oscillator using op-amp.
9. Study of IC 555 as an astable multivibrator.
10. Study of IC 555 as monostable multivibrator.
11. Designing of Fixed voltage power supply using IC regulators using 78 series and 79 series

CC-9

Signals & Systems

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (17 Lectures)

Signals and Systems: Continuous and discrete time signals, Transformation of the independent variable,
Exponential and sinusoidal signals, Impulse and unit step functions, Continuous-Time and Discrete-Time
Systems, Basic System Properties.

Unit-2 (13 Lectures)

Linear Time -Invariant Systems (LTI): Discrete time LTI systems, the Convolution Sum, Continuous time
LTI systems, the Convolution integral. Properties of LTI systems, Commutative, Distributive, Associative.
LTI systems with and without memory, Invariability, Causality, Stability, Unit Step response. Differential and
Difference equation formulation, Block diagram representation of first order systems.

Unit-3 (18 Lectures)

Fourier Series Representation of Periodic Signals: Continuous-Time periodic signals, Convergence of the
Fourier series, Properties of continuous-Time Fourier series, Discrete-Time periodic signals, Properties of
Discrete-Time Fourier series. Frequency-Selective filters, Simple RC highpass and lowpass filters

Fourier Transform: Aperiodic signals, Periodic signals, Properties of Continuous-time Fourier transform,
Convolution and Multiplication Properties, Properties of Fourier transform and basic Fourier transform
Pairs.

Unit-4 (12 Lectures)

Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace Transform,
Laplace Transform Pairs, Laplace Transform for signals, Laplace Transform Methods in Circuit Analysis,
Impulse and Step response of RL, RC and RLC circuits.

Suggested Books:

1. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education (2007)
2. S. Haykin and B. V. Veen, Signal and Systems, John Wiley & Sons (2004)
3. C. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
4. H. P. Hsu, Signals and Systems, Tata McGraw Hill (2007)
5. S. T. Karris, Signal and Systems: with MATLAB Computing and Simulink Modelling, Orchard
Publications (2008)
6. W. Y. Young, Signals and Systems with MATLAB, Springer (2009)
7. M. Roberts, Fundamentals of Signals and Systems, Tata McGraw Hill (2007)

Signals & Systems Lab (Scilab/MATLAB/ Other Mathematical Simulation software)
60 Lectures

1. Generation of Signals: continuous time
2. Generation of Signals: discrete time

3. Time shifting and time scaling of signals.
4. Convolution of Signals
5. Solution of Difference equations.
6. Fourier series representation of continuous time signals.
7. Fourier transform of continuous time signals.
8. Laplace transform of continuous time signals.
9. Introduction to Xcos/similar function and calculation of output of systems represented by block
Diagrams

CC-10

Electronic Instrumentation
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (15 Lectures)

Qualities of Measurement: Specifications of instruments, their static and dynamic characteristics, Error
(Gross error, systematic error, absolute error and relative error) and uncertainty analysis. Statistical analysis of
data and curve fitting.

Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement - ammeter,
voltmeter, **o**hm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating types),
digital multimeters, digital frequency meter system (different modes and universal counter).
Connectors and Probes: low capacitance probes, high voltage probes, current probes, identifying electronic
connectors – audio and video, RF/Coaxial, USB etc.
Unit-2 (15 Lectures)
Measurement of Resistance and Impedance: Low Resistance: Kelvin's double bridge method, Medium
Resistance by Voltmeter Ammeter method, Wheatstone bridge method, High Resistance by Megger. A.C.
bridges, Measurement of Self Inductance, Maxwell's bridge, Hay's bridge, and Anderson's bridge, Measurement of Capacitance, Schering's bridge, DeSauty's bridge, Measurement of frequency, Wien's bridge.
A-D and D-A Conversion: 4 bit binary weighted resistor type D-A conversion, circuit and working. Circuit
of R-2R ladder. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for
all).
Unit-3 (16 Lectures)
Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep synchronization,
measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope,
Sampling Oscilloscope, DSO and Powerscope: Block diagram, principle and working, Advantages and
applications, CRO specifications (bandwidth, sensitivity, rise time).
Signal Generators: Audio oscillator, Pulse Generator, Function generators.
Unit-4 (14 Lectures)
Transducers and sensors: Classification of transducers, Basic requirement/characteristics of transducers,
active & passive transducers, Resistive (Potentiometer, Strain gauge – Theory, types, temperature compensation and applications), Capacitive (Variable Area Type – Variable Air Gap type – Variable
Permittivity type), Inductive (LVDT) and piezoelectric transducers.
Measurement of displacement, velocity and acceleration (translational and rotational). Measurement of
pressure (manometers, diaphragm, bellows), Measurement of temperature (RTD, thermistor, thermocouple,
semiconductor IC sensors), Light transducers (photoresistors, photovoltaic cells, photodiodes).
Suggested Books:
1. H. S. Kalsi, Electronic Instrumentaion, TMH(2006)
2. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice-
Hall (2005).
3. Instrumentation Measurement and analysis: Nakra B C, Chaudry K, TMH
4. E.O.Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition
(2003).

5. Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education (2005)
6. David A. Bell, Electronic Instrumentation and Measurements, Prentice Hall (2013).
7. Oliver and Cage, "Electronic Measurements and Instrumentation", TMH (2009).
8. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Buterworth Heinmann-
2008).
9. A. K Sawhney, Electrical and Electronics Measurements and Instrumentation, DhanpatRai and Sons
(2007).
10. C. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill
(1998).

Electronic Instrumentation Lab

60 Lectures

1. Design of multi range ammeter and voltmeter using galvanometer.
2. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
3. Measurement of Capacitance by de'Sautys.
4. Measure of low resistance by Kelvin's double bridge.
5. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using
half and full bridge.)
6. To determine the Characteristics of LVDT.
7. To determine the Characteristics of Thermistors and RTD.
8. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal
temperature sensor), PT-100, J- type, K-type.
9. To study the Characteristics of LDR, Photodiode, and Phototransistor:
(i) Variable Illumination.
(ii) Linear Displacement.
10. Characteristics of one Solid State sensor/ Fiber optic sensor

CC-11

Microprocessor and Microcontrollers
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (18 Lectures)

Introduction to Microprocessor: Introduction, Applications, Basic block diagram, Speed, Word size, Memory
capacity, Classification of microprocessors (mention of different microprocessors being used)

Microprocessor 8085: Features, Architecture -block diagram, General purpose registers, register pairs, flags,
stack pointer, program counter, types of buses. Multiplexed address and data bus, generation of control signals, pin
description of microprocessor 8085. Basic interfacing concepts, Memory mapped I/O and I/O mapped I/O.

8085 Instructions: Operation code, Operand & Mnemonics. Instruction set of 8085, instruction classification,
addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrement
instructions, logical instructions, branch instructions and machine control instructions. Assembly language
programming examples.

Unit-2 (10 Lectures)

Stack operations, subroutine, call and return instructions. Delay loops, use of counters, timing diagrams-instruction
cycle, machine cycle, T- states, time delay.

Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, latency time and
response time; Handling multiple interrupts

Microcontrollers: Introduction, different types of microcontrollers, embedded microcontrollers, processor
architectures. Harvard vs. Princeton, CISC vs. RISC architectures, microcontroller memory types, microcontroller
features, clocking, I/O pins, interrupts, timers, peripherals.

Unit-3 (18 Lectures)

PIC16F887 Microcontroller: Core features, Architecture, pin diagram, memory organization- Program and data
memory organization, I/O Ports, oscillator module, Timer modules (Timer 0, Timer 1 and Timer 2), comparator
module, analog-to-digital converter (ADC) module, data EEPROM, Enhanced capture/compare/PWM module ,
EUSART, master synchronous serial port (MSSP) module, special features of the CPU, interrupts, addressing
modes, instruction set.

Unit-4 (14 Lectures)

Interfacing to PIC16F887: LED, Switches, Solid State Relay, Seven Segment Display, 16x2 LCD display, 4x4
Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor. Interfacing program examples using
C language.

Suggested Books:

1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar - Wiley
Eastern Limited- IV Edition.
2. Fundamentals of Microprocessor & Microcomputer: B. Ram—Danpat Rai Publications.
3. Microchip PIC16F87X datasheet
4. PIC Microcontrollers, Milan Verle, , mikro Elektronika, 1st edition (2008)
5. Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006

Microprocessor and Microcontrollers Lab

60 Lectures

8085 Assembly language programs:

1. Program to transfer a block of data.
2. Program for multibyte addition
3. Program for multibyte subtraction
4. Program to multiply two 8-bit numbers.
5. Program to divide a 16 bit number by 8 bit number.
6. Program to search a given number in a given list.
7. Program to generate terms of Fibonacci series.
8. Program to find minimum and maximum among N numbers
9. Program to find the square root of an integer.
10. Program to find GCD of two numbers.
11. Program to sort numbers in ascending/descending order.
12. Program to verify the truth table of logic gates.

PIC Microcontroller Programming

Note: Programs to be written using C programming language

1. LED blinking with a delay of 1 second.
2. Solid State Relay Interface
2. Interfacing of LCD (2X16).
3. Interfacing of stepper motor and Rotating stepper motor by N steps clockwise/anticlockwise with speed control.
4. To test all the gates of a given IC74XX is good or bad.
5. Generate sine, square, saw tooth, triangular and staircase waveform using DAC interface.

6. Display of 4- digit decimal number using the multiplexed 7-segment display interface.
7. Analog to digital conversion using internal ADC and display the result on LCD.
8. Implementation of DC-Volt meter (0-5V) using internal ADC and LCD
9. Digital to analog conversion using PWM (pulse delay to be implemented using timers).
10. Speed control of DC motor using PWM (pulse delay to be implemented using timers).
11. Interfacing of matrix keyboard (4X4).
12. Serial communication between microcontroller and PC.

CC-12

Electromagnetics
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (16 Lectures)

Vector Analysis: Scalars and Vectors, Vector Algebra, Rectangular (Cartesian) Coordinate System, Vector
Components and Unit Vector, Vector Field, Products, Cylindrical Coordinates, Spherical Coordinates,
Differential Length, Area and Volume, Line Surface and Volume integrals, Del Operator, Gradient of a
Scalar, Divergence and Curl of a Vector, the Laplacian.

Electrostatic Fields: Coulomb's Law and Electric Field, Field due to Discrete and Continuous Charge
Distributions, Electric Flux Density, Gauss's Law and Applications, Divergence Theorem and Maxwell's
First Equation. Electric Potential, Potential due to a Charge and Charge distribution, Electric dipole. Electric
Fields in Conductors, Current and Current Density, Continuity of Current, Metallic Conductor Properties and
Boundary Conditions, Method of Images. Dielectric materials, Polarization, Dielectric Constant, Isotropic and
Anisotropic dielectrics, Boundary conditions, Capacitance and Capacitors. Electrostatic Energy and Forces.

Unit- 2 (14 Lectures)

Poisson's Equation and Laplace's Equation: Derivation of Poisson's and Laplace's equation, Uniqueness
Theorem, Examples of Solution of Laplace's Equation: Cartesian, Cylindrical and Spherical Coordinates.

Magnetostatics: Biot Savert's law and Applications, Magnetic dipole, Ampere's Circuital Law, Curl and
Stoke's Theorem, Maxwell's Equation, Magnetic Flux and Magnetic Flux Density, Scalar and Vector
Magnetic Potentials. Magnetization in Materials and Permeability, Anisotropic materials, Magnetic Boundary
Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits. Inductances and Inductors,

Magnetic Energy, Forces and Torques.

Unit-3 (13 Lectures)

Time-Varying Fields and Maxwell's Equations: Faraday's Law of Electromagnetic Induction, Stationary
Circuit in Time-Varying Magnetic Field, Transformer and Motional EMF, Displacement Current, Maxwell's
Equations in differential and integral form and Constitutive Relations. Potential Functions, Lorentz gauge and
the Wave Equation for Potentials, Concept of Retarded Potentials. Electromagnetic Boundary Conditions.
Time-Harmonic Electromagnetic Fields and use of Phasors

Unit-4 (17 Lectures)

Electromagnetic Wave Propagation: Time-Harmonic Electromagnetic Fields and use of Phasors, the
Electromagnetic Spectrum, Wave Equation in a source free isotropic homogeneous media, Uniform Plane
Waves in Lossless and Lossy unbounded homogeneous media, Wave Polarization, Phase and Group velocity,
Flow of Electromagnetic Power and Poynting Vector. Uniform Plane wave incident on a Plane conductor
boundary, concept of reflection and standing wave.

Guided Electromagnetic Wave Propagation: Waves along Uniform Guiding Structures, TEM, TE and TM
waves, Electromagnetic Wave Propagation in Parallel Plate and Rectangular Metallic Waveguides.

Suggested Books:

1. Murray. R. Spiegel, Vector Analysis, Schaum series, Tata McGraw Hill (2006)
2. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press (2001)
3. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
4. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
5. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006)
6. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006)
7. Introduction to Electrodynamics, D.J. Griffiths, Pearson Education (2012)
8. Electromagnetic Wave and Radiating System, Jordan and Balmain, Prentice Hall (1979)

Electromagnetics Lab (using Scilab/ any other similar freeware)

60 Lectures

1. Understanding and Plotting Vectors.
2. Transformation of vectors into various coordinate systems.
3. 2D and 3D Graphical plotting with change of view and rotation.
4. Representation of the Gradient of a scalar field, Divergence and Curl of Vector Fields.
5. Plots of Electric field and Electric Potential due to charge distributions.
6. Plots of Magnetic Flux Density due to current carrying wire.
7. Programs and Contour Plots to illustrate Method of Images
8. Solutions of Poisson and Laplace Equations – contour plots of charge and potential distributions
9. Introduction to Computational Electromagnetics: Simple Boundary Value Problems by Finite Difference/Finite Element Methods.

CC-13

Communication Electronics

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (10 Lectures)

Electronic communication: Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation, concept of channels and base-band signals. Concept of Noise, Types of Noise, Signal to noise ratio, Noise Figure, Noise Temperature, Friss formula.

Unit-2 (20 Lectures)

Amplitude Modulation: Amplitude Modulation, modulation index and frequency spectrum. Generation of AM, Amplitude Demodulation (diode detector), Concept of Double side band suppressed carrier, Single side band suppressed carrier, other forms of AM (Pilot Carrier Modulation, Vestigial Side Band modulation, Independent Side Band Modulation). Block diagram of AM Transmitter and Receiver

Angle modulation: Frequency and Phase modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods), FM detector (PLL). Block diagram of FM Transmitter and Receiver

Comparison between AM, FM and PM.

Unit -3 (14 Lectures)

Pulse Analog Modulation: Channel capacity, Sampling theorem, PAM, PDM, PPM modulation and detection techniques, Multiplexing, TDM and FDM.

Pulse Code Modulation: Need for digital transmission, Quantizing, Uniform and Nonuniform Quantization, Quantization Noise, Companding, Coding, Decoding, Regeneration.

Unit -4 (16 Lectures)

Digital Carrier Modulation Techniques: Block diagram of digital transmission and reception, Information capacity, Bit Rate, Baud Rate and M-ary coding. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK)

Suggested Books:

1. Electronic communication systems- Kennedy, 3rd edition, McGraw international publications
2. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
3. Communication Systems, S. Haykin, Wiley India (2006)
4. Advanced electronic communications systems – Tomasi, 6th edition, PHI.
5. Communication Systems, S. Haykin, Wiley India (2006)

Communication Electronics Lab (Hardware and Circuit Simulation Software)

60 Lectures

1. Study of Amplitude Modulation
2. Study of Amplitude Demodulation
3. Study of Frequency Modulation
4. Study of Frequency Demodulation
5. Study of Pulse Amplitude Modulation
6. AM Transmitter/Receiver
7. FM Transmitter/Receiver
8. Study of TDM, FDM
9. Study of Pulse Width Modulation
10. Study of Pulse Position Modulation
11. Study of Pulse Code Modulation
12. Study of Amplitude Shift Keying
13. Study of Phase Shift Keying,

14. Study of Frequency Shift Keying.

CC-14

Photonics

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit-1 (22 Lectures)

Light as an Electromagnetic Wave: Plane waves in homogeneous media, concept of spherical waves. Reflection and transmission at an interface, total internal reflection,

Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion.

Interference : Superposition of waves of same frequency, Concept of coherence, Interference by division of wavefront, Young's double slit, Division of Amplitude, thin film interference, anti-reflecting films, Newton's rings; Michelson interferometer. Holography.

Diffraction: Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations. Fraunhoffer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes; Diffraction grating: Resolving power and Dispersive power

Unit-2 (13 Lectures)

Polarization: Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electro-optic effect.

Unit-3 (13 Lectures)

Light Emitting Diodes: Construction, materials and operation.

Lasers: Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Examples of common lasers. The semiconductor injection laser diode.

Photodetectors: Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.

LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

Unit-4 (12 Lectures)

Guided Waves and the Optical Fiber: TE and TM modes in symmetric slab waveguides, effective index, field distributions, Dispersion relation and Group Velocity. Step index optical fiber, total internal reflection, concept of linearly polarized waves in the step index circular dielectric waveguides, single mode and multimode fibers, attenuation and dispersion in optical fiber.

Suggested Books:

1. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005)
2. E. Hecht, Optics, Pearson Education Ltd. (2002)
3. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996)
4. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)
5. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998)

Photonics Lab

60 Lectures

1. To verify the law of Malus for plane polarized light.
2. To determine wavelength of sodium light using Michelson's Interferometer.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determine the resolving power and Dispersive power of Diffraction Grating.
5. Diffraction experiments using a laser.
6. Study of Faraday rotation.
7. Study of Electro-optic Effect.
8. To determine the specific rotation of scan sugar using polarimeter.
9. To determine characteristics of LEDs and Photo- detector.
10. To measure the numerical aperture of an optical fiber.

DSE-1

Power Electronics

(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (12 Lectures)

Power Devices: Need for semiconductor power devices, Power diodes, Enhancement of reverse blocking capacity, Introduction to family of thyristors.

Silicon Controlled Rectifier (SCR): structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Factors affecting the characteristics/ratings of SCR, Gate-triggering circuits, Control circuits design and Protection circuits, Snubber circuit.

Unit- 2 (14 Lectures)

Diac and Triac: Basic structure, working and V-I characteristic of, application of a Diac as a triggering device for a Triac.

Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.

Application of SCR: SCR as a static switch, phase controlled rectification, single phase half wave, full wave and bridge rectifiers with inductive & non-inductive loads; AC voltage control using SCR and Triac as a switch.

Power MOSFETs: operation modes, switching characteristics, power BJT, second

breakdown, saturation and quasi-saturation state.

Unit- 3 (17 Lectures)

Power Inverters: Need for commutating circuits and their various types, d.c. link invertors, Parallel capacitor commutated invertors with and without reactive feedback and its analysis, Series Invertor, limitations and its improved versions, bridge invertors.

Choppers: basic chopper circuit, types of choppers(Type A-D), step-down chopper, step-up chopper, operation of d.c. chopper circuits using self commutation (A & B-type commutating circuit), cathode pulse turn-off chopper(using class D commutation), load sensitive cathode pulse turn-off chopper (Jones Chopper), Morgan's chopper

Unit- 4 (17 Lectures)

Electromechanical Machines: DC Motors, Basic understanding of field and armature, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, Thyristor based speed control of dc motors, AC motor (Induction Motor only), Rotor and stator, torque & speed of induction motor, Thyristor control of ac motors(block diagrams only)

Suggested Books:

1. Power Electronics, P.C. Sen, TMH
2. Power Electronics & Controls, S.K. Dutta
3. Power Electronics, M.D. Singh & K.B. Khanchandani, TMH
4. Power Electronics Circuits, Devices and Applications, 3rd Edition, M.H. Rashid, Pearson Education
5. Power Electronics, Applications and Design, Ned Mohan, Tore.
6. Power Electronics, K. HariBabu, Scitech Publication.
7. Power Electronics, M.S. Jamil Asghar, PHI.
8. A Textbook of Electrical Technology-Vol-II, B.L. Thareja, A.K. Thareja, S.Chand

Power Electronics Lab

60 Lectures

1. Study of I-V characteristics of DIAC
2. Study of I-V characteristics of a TRIAC
3. Study of I-V characteristics of a SCR
4. SCR as a half wave and full wave rectifiers with R and RL loads
5. DC motor control using SCR.
6. DC motor control using TRIAC.
7. AC voltage controller using TRIAC with UJT triggering.
8. Study of parallel and bridge inverter.
9. Design of snubber circuit
10. VI Characteristic of MOSFET and IGBT (Both)
11. Study of chopper circuits

DSE-2

Digital Signal Processing
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- 1 (15 Lectures)

Discrete Time systems: Discrete sequences, linear coefficient difference equation, Representation of DTS, LSI Systems. Stability and causality, frequency domain representations and Fourier transform of DT sequences.

Unit- 2 (15 Lectures)

Z-Transform: Definition and properties, Inverse Z Transform and stability. Parsevals Theorem and applications.

System Function: signal flow graph, its use in representation and analysis of Discrete Time Systems. Techniques of representations. Matrix generation and solution for DTS evaluations.

Unit- 3 (15 Lectures)

Discrete Fourier Transform: DFT assumptions and Inverse DFT. Matrix relations, relationship with FT and its inverse, circular convolution, DFT theorems, DCT. Computation of DFT. FFT Algorithms and processing gain, Discrimination, interpolation and extrapolation. Gibbs phenomena. FFT of real functions interleaving and resolution improvement. Word length effects.

Unit- 4 (15 Lectures)

Digital Filters: Analog filter review. System function for IIR and FIR filters, network representation. Canonical and decomposition networks. IIR filter realization methods and their limitations. FIR filter realization techniques. Discrete correlation and convolution; Properties and limitations.

Suggested Books:

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.

Digital Signal Processing Lab (Scilab/MATLAB/Other Mathematical Simulation software)

60 Lectures

1. Generation of unit sample sequence, unit step, ramp function, discrete time sequence, real sinusoidal sequence.
2. Generate and plot sequences over an interval.
3. Given x[n], write program to find X[z].
4. Fourier Transform, Discrete Fourier Transform and Fast Fourier Transform
5. Design of a Butterworth analog filter for low pass and high pass.
6. Design of digital filters.

DSE-3

Computer Networks
(Credits: Theory-04, Practicals-02)

Theory Lectures 60

Unit- I (15 Lectures)

Data Communications : Components, protocols and standards,Network and Protocol Architecture, Reference Model ISO-OSI, TCP/IP-Overview ,topology, transmission mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface standards, modems, cable modem, transmission media- guided and unguided, transmission impairment, Performance, wavelength and Shannon capacity. Review of Error Detection and Correction codes.

Switching: Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

Unit-2 (15 Lectures)

Data Link Layer: Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack,

Medium Access Sub layer: Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANS and WLAN, high-speed LANs, Token ring, Token Bus, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

Unit-3 (15 Lectures)

Network Layer: Design issues, Routing algorithms, Congestion control algorithms, Host to Host Delivery: Internetworking, addressing and routing, IP addressing (class full & Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6, ICMPV6.

Unit- 4 (15 Lectures)

Transport Layer: Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

Application Layer: Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

Suggested Books:

1. S. Tannenbum, D. Wetherall, "Computer Networks", Prentice Hall, Pearson, 5th Ed
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, 4th Ed

Computer Networks Lab

60 Lectures

1. Introduction to Computer Network laboratory
Introduction to Discrete Event Simulation
Discrete Event Simulation Tools - ns2/ns3, Omnet++
2. Using Free Open Source Software tools for network simulation of telnet and ftp between N sources - N sinks (N = 1, 2, 3). Evaluate the effect of increasing data rate on congestion.
3. Using Free Open Source Software tools for network simulation to study the effect of queuing disciplines on network performance - Random Early Detection/Weighted RED / Adaptive RED.
4. Using Free Open Source Software tools for network simulation for http, ftp and DBMS access in networks
5. Using Free Open Source Software tools for network simulation to study effect of VLAN on network performance - multiple VLANs and single router.
6. Using Free Open Source Software tools for network simulation to study effect of VLAN on network performance - multiple VLANs with separate multiple routers.
7. Using Free Open Source Software tools for network simulation to study the performance of wireless networks