

Detailed Syllabus

Third Semester

L: 3	ET 361 Network Theory and Analysis
T: 1	Theory: 100 marks
P: 3	Sessional: 50 mark
	Practical: 50 marks

Objective:

- To study various network related analysis such as node and mesh analysis, various network theorems, Transient behaviour, concept of complex frequency, Two port network and interconnections, Behaviour of series and parallel resonant circuits, etc.

The students will be able to

CO1	Apply the fundamental laws in circuit analysis.
CO2	Analyze circuits both in time domain as well as in frequency domain.
CO3	Apply frequency domain analysis in representing the characteristic of a particular network.
CO4	Apply the knowledge of coupled circuits in system design.
CO5	Synthesize linear passive network.

UNIT 1: An Overview of Network Theorems

[10 hours]

Application of Ohm's Law and Kirchhoff's Laws to Circuit analysis, Mesh and nodal method for formulation of network equations and matrix methods of solving these equations; Representation in frequency domain; Phasor concept; Impedance, Admittance and their phasor diagram, Steady state response; Network theorems and application to DC and AC circuits, star to delta transformation.

UNIT 2: Two Port Networks and Network Functions

[5 hours]

General principle; Z, Y, Hybrid, Transmission and image parameters and equivalent circuits; Interrelationship between various parameters; Series, parallel and cascade connection of networks and parameters; Driving point and transfer Impedance and Admittance function; Pole-Zeros of Network function, Determination of time domain behavior from pole-zero plot; Magnitude and phase plot of network functions.

UNIT 3: Resonance and Coupled Circuits**[3 hours]**

Resonance – series and parallel; Q factor, BW; Analytical procedure for solving coupled circuits; Mutual Inductance, coefficient of coupling; Single tuned and double tuned circuits; Effects of over coupling and selectivity curve; Ideal transformer.

UNIT 4: Laplace Transform for Network Analysis**[8 hours]**

Complete response (steady state and transient response) of a network from the S domain circuit, Linear constant co-eff differential equation and continuous time domain analysis of RLC network.

UNIT 5: Network Synthesis**[8 hours]**

Elements of realizability theory; Hurwitz polynomial and positive real functions, their properties and testing procedures; Basic techniques used in synthesis of network; Synthesis of one port network with two kind of elements – LC, RC or RL.

UNIT 6: Network Topology**[3 hours]**

Graph of a network ; Concept of tree, co-tree link, chord , forest, co-forest; Planar and non planar graph; Incidence matrix, tie set matrix, cut set matrix; Fundamental cut set and tie set schedule; Introduction to equation formulation graphically; Duality of network.

UNIT 7: Passive Filter**[3 hours]**

Filter fundamentals, Classification of filters—Low pass, High Pass, Band Pass and Band Reject Filters.

Textbooks:-

1. Smarjit Ghosh, “Network Theory”, PHI
2. [M. E. Van Valkenburg](#), “Network Analysis”,3/E, PHI
3. A. Chakrabarty, “Circuit Theory : Analysis and Synthesis”,6/E, Dhanpat Rai & Co

References:-

1. M. S. Sukhija And T. K. Nagsarksr ,”*Circuits & Networks Analysis*”; Oxford University Press.

L: 3	ET 362 Electronic Devices
T: 1	Theory: 100 marks
P: 3	Sessional: 50 marks
	Practical: 50 marks

Objective:

- To introduce to students the theory and applications of semiconductor device physics.
- To prepare students to know the characteristics of different semiconductor devices.
- To introduce the students the operational principle, models, and the analysis of diode in analog circuits together with typical applications

The students will be able to

CO1	Explain the behavior of semiconductor devices.
CO2	Analyze the functioning of various solid- state devices, including diodes, BJTs and FETs.
CO3	Illustrate the biasing techniques for BJTs and FETs
CO4	Realize simple amplifier circuits using BJTs and FETs.

UNIT 1: Energy Bands and Charge Carriers in Semiconductors

[6 hours]

Energy bands in solid, Concept of forbidden gap, Insulator, Metals and Semiconductor. Transport phenomenon in semiconductors: - mobility and conductivity, intrinsic semiconductor, donor and acceptor impurities, Fermi level, Drift currents and Diffusion currents.

UNIT 2: PN Junction Diode

[12 hours]

Junction diode: PN junction, Depletion layer, characteristics, Piece-wise linear characteristics & equivalent circuits, Diode resistance, Capacitance, switching time.

Diode Applications: Half wave and Full wave Rectifier, bridge Rectifier, Capacitor Filter, Diode clipping, Clamping and voltage multiplying circuits.

Special diode Types: Zener diode, Schottky barrier diode, Varactor diode, Photodiode, Light emitting diode.

UNIT 3: Bipolar Junction Transistor

[14 hours]

Physical structure, Transistor current, CE, CB & CC configuration, CE Configuration characteristics curves (Cutoff, Active & saturation regions), requirement of biasing, Self biasing in CE configuration, Bias stability.

Transistor as amplifier: Small signal equivalent circuit, The Hybrid-pi model, The T-model, Augmenting these models for the Early effect, Graphical analysis of CE amplifier, Voltage gain, current gain and input-output impedance calculation, Approximate equivalent circuit in CE, CB and CC configurations. A general large signal model for BJT- The Ebers-Moll Model. Spice simulation.

UNIT 4: Field Effect Transistor

[8 hours]

Basic Structure, Physical operation of Enhancement type MOSFET and Depletion Type MOSFET, The MOS capacitor, Gate threshold voltage, The MOS current voltage equation- simple derivation, Types of MOS transistors, channel modulation. Spice simulation.

Textbooks:

1. Streetman, B.G. & Banerjee, Sanjay , “*Solid State Electronic Devices*” , PHI
2. Boylstad & Neshishkey, “*Electronic devices & circuits*” , PHI
3. Milliman, J. Halkias, “*Integrated Elctronics*”, TMH

References:

1. Adel S. Sedra ,Kenneth C. Smith, ”*Microelectronics Circuits*”,Oxford University Press
2. Bell David A. , “*Electronic Devices & Circuits*”, PHI

L: 3	ET 363 Digital Electronic Circuits
T: 1	Theory: 100 marks
P: 3	Sessional: 50 marks
	Practical: 50 marks
	Time: 3 hours

Objective:

- To introduce number systems and codes
- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits

The students will be able to

CO1	To differentiate between analog and digital electronics and explain different number systems.
CO2	To implement the Boolean algebra to minimize the logic function and K Map implementation.
CO3	To analyze combinational logic circuit and its operation.
CO4	To analyze sequential circuits and their operations.
CO5	To explain the logic families and clock circuits.

UNIT 1: Introduction

[5 hours]

Comparison between Analog and Digital in terms of quantity, signal and circuit, Characteristic-parameters of digital signal: Rise-time, Fall-time and duty-cycle; logic level, Bit, Byte and word, Number-systems and Code: Weighted and Unweighted numbers, conversion of base of number, Floating-point number codes: BCD, Gray, Excess-3, ASCII, Extended ASCII, Error-detection and correction code

UNIT 2: Logic gates

[6 hours]

Basic gates and derived gates, universality of NAND and NOR gates: Any other gate and any other digital circuits in terms of NAND only and NOR only; AND-OR logic, AND-OR-INVERT logic.

UNIT 3: Boolean Algebra**[7 hours]**

Laws, Rules and Theorems of Boolean Algebra and its uses in logic simplification, Truth-Table, one to one relationship between Boolean Algebra and Digital Electronics, Standard representation of logic expression: SOP & POS forms and conversion from one to the other, Min term & Max term, Logic simplification using K-Map: Completely and incompletely(Don't care) specified functions

UNIT 4: Combinational logic circuits**[8 hours]**

Combinational logic circuit design using truth-table, Different Adders and Subtrators, Comparator, Encoder, Decoder, Multiplexer, Demultiplexer, Parity generator/checker, logic function realization using Decoder, Multiplexer, Demultiplexer, ROM

UNIT 5: Sequential logic circuits**[9 hours]**

SR latch realization using NAND and NOR gates, Gated latch, D-latch, Flip-Flops: SR, D, J-K and T-flip-flops, characteristic (Next state) equations, conversion of flip-flops from one type to other using excitation table, Counters: Asynchronous/Ripple counter, Synchronous counter, design of synchronous counter using state diagram, transition-table etc., Shift-registers, Ring-counter, Johnson/Twisted ring counter.

UNIT 6: Logic Families**[5 hours]**

Brief idea about DTL, TTL, ECL, MOS and CMOS families and their comparison considering fan-in, fan-out, propagation delay and speed-power product

Textbooks:

1. Thomas I. Floyd and R.P. Jain, "Digital Fundamentals", Pearson Education
2. M. Morris Mano, "Digital Design", Prentice Hall of India

L: 3	ET 364 Signals and Systems
T: 1	Theory: 100 marks
P: 3	Sessional: 50 marks
	Practical: 50 marks
	Time: 3 hours

Objective:

- Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that are necessary for the analysis of continuous and discrete-time signals and systems.
- Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc.
- Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform
- Concepts of the sampling process

The students will be able to

CO1	Characterize and analyze the properties of CT and DT signals and systems
CO2	Analyze CT and DT systems in Time domain using convolution
CO3	Analyze CT and DT systems in the Frequency domain using Fourier Analysis tools like CTFS, CTFT, DTFS and DTFT.
CO4	Estimate the effects of sampling at CT signal.
CO5	Analyze CT and DT systems using Laplace transforms and Z Transforms.

UNIT 1: Introduction

[7 hours]

Definitions, continuous and discrete-time signals and systems and their classifications; Signal operations: scaling, shifting, inversion, etc

UNIT 2: LTI Systems

[5 hours]

Continuous-time LTI systems - the convolution integral. Discrete time LTI systems – the convolution sum. Properties of LTI systems. Systems described by linear differential and difference equations.

UNIT3:Fourier Analysis and Continuous Time Fourier analysis

[8 hours]

Response of LTI systems to complex exponential waveforms. Representations of periodic signals by the Fourier series. Representation of aperiodic signals by Fourier transforms. Properties of Fourier transforms. System analysis by Fourier transforms, frequency response, group and phase delays.

Discrete Time Fourier analysis

Response of LTI systems to complex exponential waveforms. Discrete time Fourier series discrete time Fourier transform and their properties. Analysis of systems.

UNIT 4: Sampling and Reconstruction [5 hours]

The sampling theorem, Effects of undersampling. Spectrum of sampled signal, aliasing; signal reconstruction.

UNIT 5: Laplace Transform [5 hours]

Definition and properties, Methods of inversion. Application to LTI system analysis.

UNIT 6: Z – Transform [5 hours]

Definition. The region of convergence. Properties of z-transform. Inversion of Z- transforms. Application to system analysis.

UNIT 7: Review of Random Signals and Systems [5 hours]

Random variables. Distribution and density functions. Statistical averages. Different probability distribution models. Binomial, Poisson and normal distributions, Random processes. Ensemble averages and correlation. Stationary and ergodic processes. Spectral density and the correlation functions Response of linear random inputs.

Textbooks:

1. T.K. Rawat, “*Signals and Systems*”, Oxford University Press
2. M.J. Roberts, “*Fundamentals of Signals and Systems*”, PHI

References:

1. A.V. Oppenheim, A.S. Willsky and H.S. Nawab, “*Signals and Systems*”, PHI
2. B.P. Lathi, “*Principles of Linear Systems and Signals*”, 2/e, Oxford University Press

L:3	CS 371 Object Oriented Programming
T:1	Theory 100
P:3	Sessional 50

Objectives:

- Understanding the object-oriented concepts and the issues involved in effective class design.
- Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
- Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
- Demonstrate ability to implement one or more patterns involving realization of an abstract interface
- and utilization of polymorphism in the solution of problems which can take advantage of dynamic
- dispatching.
- Learn syntax, features of, and how to utilize the Standard Template Library.

The students will be able to

CO1	Differentiate and analyze the features of object oriented programming.
CO2	Apply encapsulation, inheritance and polymorphism.
CO3	Handle the files and various operations on files.
CO4	Implement templates and exception handling.
CO5	Solve problem with object oriented design methodologies and can evaluate the solution of such problems.

UNIT 1: Basics of Object Oriented Programming (OOP)

[4 hours]

Introduction to OOP- difference between OOP and procedure oriented programming–Classes, Objects and Methods–Overview of Inheritance and Polymorphism.

UNIT 2: Data abstraction

[6 hours]

Class definition, Control access to other functions, Different types of constructors, Destructors Objects and classes, Dynamic creations and destructions of objects.

UNIT 3: Inheritance**[7 hours]**

Derived classes –Syntax of derived classes–access to the base class –overloading inherited member functions –Multiple inheritance –Virtual base class virtual function and Polymorphism: Static and dynamic bindings –Virtual functions.

UNIT 4: Polymorphism**[6 hours]**

Overloading functions and operators-Run time polymorphism –Overloading new and delete operators.

UNIT 5: File Handling in OOP**[6 hours]**

Input Stream, Output Stream, File stream classes, opening file with open(), Opening file with constructor, File modes, File Pointers, Sequential file operations, Random access files, Error handling, Command-line arguments. String handling with files.

UNIT 6: Generic classes in OPP**[6 hours]**

Necessities of templates –Generic class using Macros –Class templates –Function templates– Advance templates. Exception Handling.

UNIT 7: Object Oriented Design**[5 hours]**

Trends in software design-Notation of objects-Hybrid design method-Separation of responsibilities –Responsibility driven design-design phases and tools-step by step design– Greedy Booch approach.

Books and References

1. Object Oriented Programming by Barkataki, PHI
2. Object Oriented Programming with C++ by E. Balaguruswamy, TMH
3. Object Oriented Analysis and Design with applications by Grady Booch, Benjamin/Cummings Publishing.
4. thinking in C-including Object Oriented Programming with C++ by P.B. Mahapatra, Wheeler Publishing
5. Deitel's “ C++ How to Program”, Deitel & Deitel.
6. Robert Lafore, “Object-Oriented Programming in C++”, Sams
7. Bjarne Stroustrup, “The C++ Programming Language: Special Edition”, Addison-Wesley.