SIGNAL AND SYSTEMS

The focus of this course is to introduce you to the fundamental concepts and tools used in both analogue and digital signal processing (ASP and DSP) which are areas of interest if you are studying any program relating to electronic, communication and/or computer engineering.

COURSE CONTENTS:

Overview of signals: Basic definitions. Classification of signals, Continuous and discrete time signals, Signal operations and properties, discretization of continuous time signals, Signal sampling and quantization.

Continuous Time and Discrete Time System characterization: Basic system properties: Linearity, Static and dynamic, stability and causality, time invariant and variant system, invertible and non-invertible, representation of continuous systems.

Response of Continuous Time–LTI System: Impulse response and convolution integral, properties of convolution, signal responses to CT-LTI system.

z-Transform: Introduction, ROC of finite duration sequence, ROC of infinite duration sequence, Relation between Discrete time Fourier Transform and z-transform, properties of the ROC, Properties of z-transform, Inverse z-Transform, Analysis of discrete time LTI system using z-Transform, Unilateral z-Transform

Discrete Time System: Impulse response characterization and convolution sum, Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system and its properties.

Fourier analysis of discrete time signals: Introduction, Properties and application of discrete time Fourier series, Representation of Aperiodic signals, Fourier transform and its properties, Convergence of discrete time Fourier transform, Fourier Transform for periodic signals, Applications of DTFT

Systems with Finite and infinite duration response: Recursive and non-recursive discrete time systems-realization structures-direct form-I, direct form-II, Transpose, cascade and parallel forms, state space analysis: Representation and solution for continuous and discrete time LTI system.

COURSE OUTPUT:

As an outcome of completing this course, students should be able to

1. Understand the terminology of signals and basic engineering systems.
2. Understand the role of signals and systems in engineering design and society.
3. Understand signal representation techniques and signal characteristics.
4. Understand the difference and the applications of analog versus discrete signals and the conversion between them.
5. Understand the process of sampling & Fourier transforms.

TEXT BOOKS

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, PearsonEducation.
2. A. Anandkumar signal and system 3rdEdition, PHI.
3. http://www.nptelvideos.in/2012/11/estimation-of-signals-and-systems.html

REFERENCES:

1. Edward W. Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education.
2. H. P. Hsu, RakeshRanjan "Signals and Systems", Schaum's Outlines, Tata McGrawHill.
3. Simon Haykins and Barry Van Veen: Signals and Systems, John Wiley & sons.
4. Rawat: Signal and Systems, Oxford Publication.
5. Nagoorkani: signal and system (TMH).
6. Iyer: signal and system, Cengage learning.
7. Gabel, Roberts, "Signals and Linear Systems" Wiley India Pvt. Ltd, 2012.
8. Rao: Signal and system (TMH).

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List of Experiments:

Introduction to MATLAB

1. To implement delta function
2. , unit step function, Ramp function.
3. To explore the commutation of even and odd symmetries in a signal with algebraic operations.
4. To explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling and time-shifting).
5. To explore the time variance and time invariance property of a given system.
6. To explore causality and non-causality property of a system.
7. To demonstrate the convolution and correlation of two continuous-time signals.
8. To demonstrate the convolution and correlation of two discrete-time signals.
9. To determine Magnitude and Phase Response of Fourier Transform of given signals.

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Integrated Circuits and its Applications

COURSE OBJECTIVE: The objective of this course is to deal with integrated circuits which are imperative and versatile requirement in today's electronics. Operational amplifier is a device which is used in various electronics application, such as summer, integrator and differentiator and so on. This course comprehends the introduction of various IC's such as IC-741, TL082, and IC-555 timer. The course also deals with the analysis and design of circuits including analog signal processing using linear ICs.

COURSE CONTENTS:

Feedback Amplifier and Oscillators: Concept of feedback and their types, Amplifier with negative feedback and its advantages. Feedback Topologies.

Oscillators: Concept of Positive feedback, Classification of Oscillators, Barkhausen criterion, Types of oscillators: RCoscillator, RC Phase Shift,Wien Bridge Oscillators. LC Oscillator: Hartley, Colpitt's, Clapp and Crystal oscillator.

Introduction to integrated circuits: Advantages and characteristic parameters of IC's, basic building components, data sheets,

Operational Amplifier: Differential amplifier and analysis, Configurations- Dual input balanced output differential amplifier, Dual input Unbalanced output differential amplifier, Single input balanced output differential amplifier, Single input Unbalanced output differential amplifier Introduction of op-amp, Block diagram, characteristics and equivalent circuits of an ideal op- amp, Power supply configurations for OP-AMP.

Characteristics of op-amp: Ideal and Practical, Input offset voltage, offset current, Input bias current, Output offset voltage, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio (CMRR), Slew rate and its Effect, PSRR and gain bandwidth product, frequency limitations and compensations, transient response, analysis of TL082 datasheet.

OP-AMP applications: Inverting and non-inverting amplifier configurations, Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO, Comparator, Zero Crossing Detector.

OP-AMP AS FILTERS**:** Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter; all pass filters, self-tuned filters, AGC,AVC using op-AMP.

TIMER:IC-555 Timer concept, Block pin configuration of timer. Monostable, Bistable and Astable Multivibrator using timer 555-IC, Schmitt Trigger, Voltage limiters, Clipper and clampers circuits, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers, Voltage-to-current converter, Current-to-voltage converter.

Voltage Regulator:simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs.

COURSE OUTPUT:

Upon successful completion of this course students will able to understand the working of different integrated circuits, their pin configurations and about their applications. Students will also able to understand the performance of ICs on practical basis.

TEXT BOOKS:

1.RamakantA.Gaikward,"OP- Amp and linear Integrated circuits"Third edition- 2006, Pearson.

2.B. VisvesvaraRao Linear Integrated Circuits Pearson.

3.http://www.nptelvideos.in/2012/11/analog-ics.html

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REFERENCES:

1.David A. Bell: Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition,2010.

2.D. Roy Choudhury:Linear Integrated Circuits New Age Publication.

3.B. Somanathan Nair: Linear Integrated Circuits analysis design and application Wiley India Pvt. Ltd.

4.Maheshwary and Anand: Analog Electronics, PHI.

5.S.Salivahanan,V S KanchanaBhaaskaran: Linear Integrated Circuits",second edition, McGraw Hill.

6. Gray Hurst Lewis Meyer Analysis and design of analog Integrated Circuits fifth edition Wiley India.

7. RobertF.Coughlin, Frederick,F.Driscoll: Operational Amplifiers and Linear Integrated Circuits, sixth edition, Pearson.

8.Millman and Halkias: Integrated electronics, TMH.

9.Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.

10. Sedra and Smith: Microelectronics, Oxford Press.

List of Experiments

Apparatus Required –Function Generator, TL082, MPY634/ASLK Pro, Power Supply, Oscilloscopes, connecting wires, bread board.

1.To determine voltage gain and frequency response of inverting and non-inverting amplifiers using IC-741.

2.To measure offset voltages, bias currents, CMRR, Slew Rate of OPAMP using IC-741.

3.To design an instrumentation amplifier and determine its voltage gain using IC-741.

4.To design op-amp integrator (low pass filter) and determine its frequency response.

5.To design op-amp differentiator (high pass filter) and determine its frequency response.

6.To design Analog filters – I and II and analyse its characteristics.

7.To design Astable,Monostable and Bistable multi vibrator using IC-555 and analyse its characteristics.

8.Automatic Gain Control (AGC) Automatic Volume Control (AVC).

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COMMUNICATION SYSTEMS

Course Objective

The course is designed to cover the fundamentals, principles, concepts, and techniques of analog communication systems like various modulation techniques, data transmission, communication technologies, time-domain and frequency domain multiplexing technique and noise analysis.

Syllabus

Frequency domain representation of signal: Fourier transform and its properties, condition of existence, Fourier transform of impulse, step, signum , cosine, sine, gate pulse, constant, properties of impulse function. Convolution theorem (time & frequency), correlation(auto & cross), energy & power spectral density.

AM modulation: Block diagram of a communication system, need of modulation, types of modulations techniques, Amplitude modulation, Equation and its frequency domain representation, Bandwidth, Power requirement, efficiency. AM suppressed carrier(DSB-SC, SSB-SC, VSB-SC) Power requirement, efficiency waveform equation and frequency domain representation, Generation of AM, DSB-SC, SSB-SC, VSB-SC & its detection, synchronous generation& detection & errors.

AM transmitter& receiver: Tuned radio receiver &super heterodyne, limitation of TRF, IF frequency, image signal rejection, selectivity, sensitivity and fidelity, Noise in AM, FM

Angle modulation: Types of angle modulation, narrowband FM, wideband FM, its frequency spectrum, transmission BW, methods of generation (Direct & Indirect), detection of FM (discriminators: balanced, phase shift and PLL detector),pre emphasis and de-emphasis.

FM transmitter & receiver: Block diagram of FM transmitter& receiver, AGC, AVC, AFC, **Noise:** Classification of noise, Sources of noise, Noise figure and Noise temperature, Noise bandwidth, Noise figure measurement, Noise in analog modulation, Figure of merit for various AM and FM, effect of noise on AM &FM receivers.

Course Outcomes

Students who are successful in this class will demonstrate at least the abilities to:

1.Solve communication engineering Problems using the knowledge of time domain & frequency domain.

2.Analyze various analog modulation schemes for communication systems.

3.Analyze and compare the noise performance of various analog communication systems.

4.Understand the basic of digital transmission system.

TEXT BOOKS

1.Simon Haykins, Communication System, John Willy

2.Singh & Sapre, Communication System, TMH

3. http://www.nptelvideos.in/2012/11/communication-engineering.html

REFERENCES

1.B.P. Lathi, Modern Digital and analog communication system; TMH

2.Singhal, analog and Digital communication, TMH

3.Rao, Analog communication, TMH

4.P K Ghose, principal of communication of analog and digital, universities press.

5.Taub& shilling, Communication System, TMH

6.Hsu; Analog and digital communication(Schaum); TMH

7.Proakis fundamental of communication system. (Pearson edition).

List of experiment

1.To analyze characteristics of AM modulator & Demodulators.

2.To analyze characteristics of FM modulators& Demodulators.

3.To analyze characteristics of super heterodyne receivers.

4.To analyze characteristics of FM receivers.

5.To construct and verify pre emphasis and de-emphasis and plot the wave forms.

6.To analyze characteristics of Automatic volume control and Automatic frequency control.

7.To construct frequency multiplier circuit and to observe the waveform.

8.To design and analyze characteristics of FM modulator and AM Demodulator using PLL.

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CONTROL SYSTEMS

OBJECTIVES

1.To provide sound knowledge in the basic concepts of linear control theory and design of control system.
2.To understand the methods of representation of systems and getting their transfer function models.
3.To provide adequate knowledge in the time response of systems and steady state error analysis.
4.To give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems.
5.To understand the concept of stability of control system and methods of stability analysis.
6.To study the various ways of designing compensation for a control system.

Course Contents

Introduction to Control system

Terminology and classification of control system, examples of control system, Laplace Transform and its application, mathematical modeling of mechanical and electrical systems, differential equations, transfer function, block diagram representation and reduction, signal flow graph techniques.

Feedback characteristics of control systems

Open loop and closed loop systems, effect of feedback on control system and on external disturbances, linearization effect of feedback, regenerative feedback.

Time response analysis

Standard test signals, time response of 1st order system, time response of 2nd order system, steady-state errors and error constants, effects of additions of poles and zeros to open loop and closed loop system.

Time domain stability analysis

Concept of stability of linear systems, effects of location of poles on stability, necessary conditions for stability, Routh-Hurwitz stability criteria, relative stability analysis, Root Locus concept, guidelines for sketching Root-Locus.

Frequency response analysis

Correlation between time and frequency response, Polar plots, Bode Plots, all-pass and minimum-phase systems, log-magnitude versus Phase-Plots, closed-loop frequency response.

Frequency domain stability analysis

Nyquist stability criterion, assessment of relative stability using Nyquist plot and Bode plot (phase margin, gain margin and stability).

Approaches to system design

Design problem, types of compensation techniques, design of phase-lag, phase lead and phase lead-lag compensators in time and frequency domain, proportional, derivative, integral and PID compensation.

State space analysis

State space representation of systems, block diagram for state equation, transfer function decomposition, solution of state equation, transfer matrix, relationship between state equation and transfer function, controllability and observability.

Course Outcomes:

Students who are successful in this class will demonstrate at least the abilities to:
1.Demonstrate an understanding of the fundamentals of (feedback) control systems.
2.Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
3.Express and solve system equations in state-variable form (state variable models).
4.Determine the time and frequency-domain responses of first and second-order systems to step and sinusoidal (and to some extent, ramp) inputs.
5.Determine the (absolute) stability of a closed-loop control system
6.Apply root-locus technique to analyze and design control system.

Text books –

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Benjamin C. Kuo, Automatic Control systems, Wiley India Pvt. Ltd, 9th edition.
3. http://www.nptelvideos.in/2012/11/control-engineering.html

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REFERENCES

1.A. Anand Kumar, “ Control Systems” PHI, New Delhi, 2007

2.Norman S. Nise, Control System Engineering, Wiley India Pvt. Ltd.

3.R. Anandnatarajan, P. Ramesh Babu, “Control System Engineering” Scitech Publication (India) Pvt. Ltd. 2014

4.Distefano (schaum series) Control Systems TMH

5.M. Gopal, ‘Control Systems, Principles and Design’, Tata McGraw Hill, New Delhi, 2002.

6.Manik, Control System, Cengage Learnings.

7.Stefani shahian- Design of feedback control system oxford university press.

8.Salivahanan Control Systems engg. Pearson Education, New Delhi

9.K. Ogata, ‘Modern Control Engineering’, Pearson Education, New Delhi

10.B.S. Manke linear control system, khanna publishers.

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MATERIAL SCIENCE

Course Objectives and desired Learning Outcomes:

1.Predict approximate physical and mechanical behavior of a material based on the type of bonding present (covalent, ionic, metallic, and/or van der Waals) and the presence of any of the several types of defects common in condensed matter.
2.Use knowledge of the crystal structure (BCC, FCC, and HCP) of a metal to make general predictions about the metalís ability to plastically deform.
3.Calculate the extent of diffusion-driven composition changes based upon composition, time, and temperature.
4.Predict the equilibrium microstructure of a material comprised of two constituents (e.g., Fe and C or Al and Cu) given the binary phase diagram and thermal history of the material.
5.Select materials for different applications based on the constraints of the given applications.

COURSE CONTENT

Atomic structure, molecules and general bonding principles, crystal system and structure , Miller indices, Bravais lattice, Bragg's law, crystal structure for metallic elements, structural imperfections, dielectric parameters, polarsation, static dielectric constant of solids, ferroelectric materials, piezoelectricity, compex dielectric constant, dipolar relaxation, Debye equation , dielectric loss, insulating materials and their properties, composite materials

Magnetism: fundamental concepts pertaining to magnetic fields, magnetic dipole movement of current loops, orbital magnetic dipole movement and angular momentum of simple atomic model, classification of magnetic materials, spin magnetic moment, paramagnetism, ferromagnetism, spontaneous magnetization and Curie-Weiss law, ferromagnetic domains, magnetic anisotropy, magnetostriction, antiferromagnetism, ferrites and its applications, magnetic resonance

Conductors: introduction, atomic interpretation of Ohm's law, relaxation time, collision time, mean free path , electron scattering, resistivity of metals, Linde's rule, Joule's law, thermal conductivity of metals, high conductivity materials, high resistivity materials, solder and electrical contact materials, carbon brushes, fuses, superconductivity-The free electron model, thermodynamics and properties of superconductors, meissner effect, classification of superconductors

Semiconductors: chemical bonds in Ge and Si, carrier density, extrinsic semiconductor, n-type , p-type semiconductor, Hall effect, mechanism of current flow, drift current, diffusion current, Einstein relation, materials for fabrication of semiconductor devices, fabrication technology , continuity equation, capacitance of junction barrier, junction transistors, thermistor, variastors Optical properties of materials: introduction, electromagnetic radiation spectrum, refractive index, reflection, Birefringence, Translucency, colourcentres, dispersion, absorption, excitons, photoelectric emission, electroluminescence , photoconductivity, photoelectric cells, lasers, ruby lasers, Nd-YAG laser, carbon dioxide laser, optical fibres, fibre materials, mechanism of refractive index variations, fabrication of fibre, fibre cables, solar cell, fuel cell, MHD generators.

TEXT BOOKS:-

1.Banerjee-Electrical & Electronics Material ,PHI.
2.S. O. Kasap- Principle of Electronics Material &Device,TMH.
3.Jones- Material Science for Electrical & Electronics Engineering , Oxford.
4.V.Raghvan Material science & engineering, PHI.

REFERENCE:-

1.J.Allison Electronics Engineering, Material &Device,TMH.
2.Gilmore: Material Science, Cengage Learnings.
3.Gupta & Gupta Advance Electrical & Electronics Material,Wieley India.
4.James F.Shackelford-Introduction Material Science for Engineering Pearson.
5.V.Rajendran - Material science,TMH.

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SYSTEMS ENGINEERING

COURSE OBJECTIVE

This course in systems engineering examines the principles and process of creating effective systems to meet application demands. The course is organized as a progression through the systems engineering processes of analysis, design, implementation, and deployment with consideration of verification and validation throughout.

COURSE CONTENT

What is System Engineering, Origin, Examples of Systems requiring systems engineering,Systems Engineer Career Development Model, Perspectives of Systems Engineering, Systems Domains, Systems Engineering Fields, SystemEngineering Approaches.
Structure of Complex Systems, System Building Blocks and Interfaces, Hierarchy of Complex Systems, System Building Blocks, The System Environment, Interfaces and Interactions, Complexity in Modern Systems.
Concept Development and Exploration, Originating a New System, Operations Analysis, Functional Analysis, Feasibility, System Operational Requirements, Implementation of Concept Exploration.
Engineering Development, Reducing Program Risks, Requirements Analysis, Functional Analysis and Design, Prototype Development as a Risk Mitigation Technique, Development Testing, Risk Reduction.
Integration and Evaluation, Integrating, Testing, And Evaluating The Total System, Test Planning And Preparation, System Integration, Developmental System Testing, Operational Test And Evaluation, Engineering For Production, Transition From Development To Production, Production Operations.

COURSE OUTCOME

After successful completion of the course, students would be able to Plan and manage the systems engineering process and examine systems from many perspectives (such as software, hardware, product, etc.) Students can distinguish critical functions, diagnose problems, and apply descoping strategies and judge the complexity of production and deployment issues.

EVALUATION
Evaluation will be a continuous and integral process comprising classroom and external assessment.

REFERENCES:
1.Alexander Kossiakoff, William N Sweet, "System Engineering Principles and Practice, Wiley India
2.Blanchard Fabrycky, Systems engineering and analysis, Pearson
3.Dennis M. Buede, William D.Miller, "The Engineering Design of Systems: Models & Methods" Wiley India
4.JeffreyL Whitten, Lonnie D Bentley, "System Analysis and Design Methods"
5.Richard Stevens, Peter Brook," System Engineering – Coping with complexity, Prentice Hall

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