FIFTH SEMESTER

Digital Signal Processing (EL20511)

Objectives:

- To describe signals mathematically and understand how to perform mathematical operations on signals.
- It will provide knowledge of Digital filter.
- To discuss word length issues ,multi rate signal processing and application.

Syllabus:

UNIT- I: Basic elements of digital signal Processing:
Concept of frequency in continuous time and discrete time signals –Sampling theorem – Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution and correlation.

UNIT- II: Introduction to DFT:
Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation.

UNIT- III Structure of IIR:
System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain.

UNIT - IV: Symmetric & Anti-symmetric FIR filters:
Linear phase filter – Windowing techniques – rectangular, triangular, Blackman and Kaiser windows – Frequency sampling techniques – Structure for FIR systems.

UNIT-V: Finite word length effects in FIR and IIR digital filters:
Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Polyphasedecompositions.Application of DSP – Model of Speech Wave Form – Vocoder.

Text Books:
1.Oppenheim A V and Sehafer R W, “Discrete Time Signal Processing”, Prentice Hall (1989).
2. Proakis J G and Manolakis D G, “Digital Signal Processing”, Pearson Education India.

References books:

1.Oppenheim A V, Willsky A S and Young I T, "Signal & Systems", Prentice Hall, (1983).
2. Ifeachor and Jervis, "Digital Signal Processing", Pearson Education India.
3.DeFatta D J, Lucas J G and Hodgkiss W S, "Digital Signal Processing", J Wiley and Sons, Singapore, 1988
4. Sanjit K Mitra "Digital Signal Processing" TMH

Course Outcomes:

After the completion of the course the student will be able to :

- Illustrate digital signals, systems and their significance.
- Analyse the digital signals using various digital transforms DFT, FFT etc.
- Design and develop the basic digital system.
- Interpret the finite word length effects on functioning of digital filters.

POs / COs	a	b	c	D	e	f	g	h	i	j	k
1	✓	✓	✓	✓	✓	✓					✓
2	✓	✓	✓	✓	✓	✓				✓	✓
3	✓	✓	✓	✓	✓	✓			✓		✓
4	✓	✓	✓	✓	✓	✓			✓		✓

Computer Systems Architecture (EL20512)

Objectives:

- To understand the organization of various digital components used to design a computer
- To study the way through which the hardware of components connected together to form a computer system.
- To understand concept of multiprocessing used in modern computers

Syllabus:

Unit I:Processor Basics:
(a) Register transfer and micro operations- Register transfer, bus and memory transfer, arithmetic micro operation and logic micro operation, shift micro operation, arithmetic logic shift unit, related examples.
(b) Computer organization and design- CPU organization, fundamental and features, Instruction codes, computer registers, computer instruction, timing and control, instruction cycle, memory reference instruction, input-output and interrupt, Design of basic computer.

Unit II: Computational algorithms:
(a) Data representation- Basic format, fixed and floating point representation
Addition and subtraction algorithm: addition and subtraction with signed magnitude data, addition and subtraction with signed 2's complement data (hardware implementation and hardware algorithm), carry save adder (CSA),
(b) Multiplication algorithms: Booths multiplication algorithm, Division algorithm, divide overflow algorithm
(c) Floating point arithmetic operations: addition, subtraction, multiplication, division algorithm and implementation. Decimal arithmetic unit and operations.

Unit III: Central processor unit design:
(a) Basic concept, Micro programmed controls:- control memory, address sequencing, micro program example, design of control unit, hard-wired control
(b) Central processing unit: general register organization, stack organization, instruction format, addressing modes, data transfer and manipulation, program control, reduced instruction set, multiplier control unit.
(c) Pipeline and Vector processing: Parallel processing and pipelining; various pipelines e.g. arithmetic instructions, RISC, vector processing, Array processors.

Unit IV: Memory organization:
(a) Hierarchical memory structure: memory hierarchy, optimization of memory hierarchy, main memory, addressing schemes of main memory, Auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.
(b) Memory allocation and management: classification of memory policies, optimal load control, memory management policies, memory management hardware.

Unit V: System organization:
(a) Input-output organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, I/O processor, serial communication, direct memory access(DMA),multiprocessors.
(b) Programming the basic computer: machine language, assembly language, assembler, program loops, programming arithmetic and logic operations and I/O programming.

Text Book:
1. "Computer system architecture ", M. M. Mano, TMH Publications.

Reference Books
1."Computer Architecture and organization", J.P.Hays, second edition McGraw Hill
2. "Computer organization and Architecture ", William Stallings, Prentice- Hall of India
3. "Computer organization " Carlhamcher, ZvonkoVranesic&Safwataky,McGraw Hill.

Course outcome(CO's):

After the completion of the course the student will be able to :

- Illustrate the use of basic building blocks for computer organization.
- Apply different processing methods for determining different attributes of CPU.
- Categorize memory devices based on their property and application.
- Develop concepts for designing high performance computing platform.

PO's / CO's	a	b	c	d	e	f	g	h	i	j	k
1	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
4	✓	✓	✓	✓	✓				✓	✓	✓

Analog Electronics (EL20515)

Objectives:

- To learn the fundamental concepts of amplification of AC & DC signals.
- To learn the basics of IC fabrication

Syllabus:

UNIT I: Transients at high frequency
The hybrid π common emitter transistor model, hybrid n-conductance, hybrid π - capacitance, CE short circuit gain with resistive load, the gain bandwidth product, emitter follower at high frequency.

UNIT II: Large Scale Analysis
Class-A large signal amplifiers, harmonic distortion, higher order harmonic generation, transformer coupled audio power amplifier, efficiency, push-pull amplifier, class-B amplifiers, and class-AB operation.

UNIT III: Multistage Amplifier
Classification of amplifier, distortion in amplifier frequency, response of an amplifier, low frequency response of RC coupled amplifier, band pass of cascaded stage, high frequency response of two cascaded CE transistor stages, multistage CE amplifier, High frequency response of two cascaded CE transistor stages, Darlington configuration.

UNIT IV: Operational Amplifier
Operational amplifier architecture, basic operational amplifier, inverting operational amplifier, non inverting operational amplifier, differential amplifier, offset error voltage and current, measurement of amplifier parameters, CMRR, slewing rate, basic operational amplifier applications, differential DC bridge amplifier, Multivibrators.

UNIT V: Integrated Circuit Fabrication
Overview of IC Technology, unit steps used in IC fabrication, wafer cleaning, photolithiography, wet and dry itching, oxidation, diffusion, ion-implantation techniques for deposition of poly-silicon, silicon, silicon pnitride and silicon dioxide, metallization and passivation.

Text Books:
1. "Electronic Circuit Discrete And Integrated", Belove, PHI Pbs.
2. "Integrated Electronics", Millman and Halkias, PHI Pbs.

Reference Books:
1. "Microelectronics", Millman, WielyPbs.
2. Gaikwad, "Linear Integrated Circuits"

Course Outcomes:

After the completion of the course the student will be able to:

- Work professionally in electronic systems areas including the design and analysis of such systems.
- Identifyand apply different configurations of power amplifiers, transistors (low & high frequency) and their applications.
- Explain and differentiate between single stage and multistage amplifiers.
- Analyse and evaluate the need of feedback in amplifiers, oscillators and their applications.
- Judge and decide different applications of analog electronics.

PO's / CO's	a	b	c	d	e	f	G	h	i	j	k
1	✓	✓	✓	✓	✓					✓	✓
2	✓	✓	✓	✓						✓	✓
3	✓	✓	✓	✓						✓	✓
4	✓	✓	✓	✓						✓	✓
5	✓	✓	✓	✓	✓					✓	✓

AnalogElctronics Lab (EL20515)
B.TECH. (Electrical Engineering)
VthSemester

LIST OF EXPERIMENTS

1. To study IC741 as an adder circuit.
2. To study IC741 as an average circuit.
3. To study IC741 as a Subtractor circuit.
4. To Study Differentiator Circuit using OP-AMP.
5. To Study Differentiator Circuit using OP-AMP.
6. To Study IC741 as non-inverting amplifier circuit.
7. To Study IC741 as inverting amplifier circuit.
8. To Study astablemultivibrator and observe collector and base waveforms and measure frequency of output.
9. To test two stage R-C coupled amplifier and find out individual gain of each stage and also overall gain of two stages in cascade.
10. To Study Zener regulation and observe load and line regulation circuit.
11. To Study and Test current series regulator and observe and plot load & Line regulation characteristics.
12. To Study IC741 as a Schmitt trigger circuit.
13. To Study direct coupled Class A amplifier circuit.
14. To Study Complementary Symmetry Class B amplifier circuit.
15. To Study IC741 as Comparator circuit.

Course Outcomes (COs):

After the completion of the course the student will be able to:

- Develop and design various application-oriented OP-AMP circuits.
- Identify and design different configuration of power amplifiers for low and high frequency applications.
- Design and develop single and multistage amplifiers.
- Design and fabricate different types of oscillator, signal conditioning and feedback circuit for their various applications.
- Design and fabricate voltage regulator circuit.

POs / COs	a	b	c	d	e	f	g	h	i	j	k
1	✓	✓	✓	✓	✓	✓				✓	✓
2	✓	✓	✓	✓	✓	✓				✓	✓
3	✓	✓	✓	✓	✓	✓				✓	✓
4	✓	✓	✓	✓	✓	✓				✓	✓
5	✓	✓	✓	✓	✓	✓				✓	✓

AnalogAnd Digital Communication (EL20513)

Objectives:

- The subject deals with various methods of analysis for continuous time and discrete time systems in time domain and frequency domain.
- To learn the basics of different types of modulation (Amplitude, phase & frequency) and coding of signals.

Syllabus:

UNIT I: **Systems and Signal Analysis:**
Frequency domain representation of finite energy signals and periodic signals - energy spectral density and power spectral density - convolution theorem - response of linear time invariant system - sampling and reconstruction - Nyquist sampling theorem -Quantising of Analog Signals- random processes - ensemble and time averages - Stationarity - correlation theory for wide sense stationary processes - wiener-Khinchin-Einstein theorem - properties of Gaussian random processes - white noise - response of LTI system to white Gaussian noise

UNIT II: **Analog Signal Transmission :**
Amplitude modulation - spectrum - power relations - modulator and demodulator circuits - AM transmitter block diagram - tuned radio frequency and superheterodyne receivers - calculation of signal to noise ratio for envelope detection and coherent detection of AM - principle of single side band suppressed carrier modulation -

UNIT III:AnalogSignal Transmission (cont...):
Frequency modulation - deviation - modulation index - spectrum of FM signal - relationship between phase modulation and FM - JFET reactance modulator - FM transmitter block diagram - foster Sceley discriminator - SNR calculation - pre-emphasis and de-emphasis

UNIT IV: **Base band Data Transmission and Digital Carrier Modulation Schemes:**
Analog modulation scheme - PAM - PWM - PPM - digital pulse modulation scheme - PCM - DPCM and delta modulation - base band data transmission - base band transmission model - additive white gaussian noise channel - matched filter receiver - inter symbol interference - basic ideas of pulse shaping - equalization - synchronization - scrambling and line coding - digital pass band transmission - elements of digital pass band transmission - pass band transmission model - coherent binary modulation schemes: ASK - PSK and FSK - multilevel signalling schemes - average probability of error - bit error rate - concept of an optimal receiver

UNIT V:Elements of information theory and Error Control Coding:
Measure of information - Shanon's source coding and channel coding theorems - discrete memoryless channel - Shanon-Hartley theorem - error control strategies - principles of forward error correction and ARQ - linear block codes and syndrome decoding - Binary Cyclic Codes - Burst Error Correcting Codes - Convolutional Codes - Performance of Codes.

Text books:

1.K. Sam Shanmugam.: .Digital and Analog Communication Systems., John Wiley andSons,1985
2.Taub and Schilling: .Principles of Communication Systems., McGraw Hill, 1995

Reference books:

1. Lathi B.P.: .Modern Digital and Analog Communication Systems., 3rd Edition, Oxford University Press, 1998.
2.Simon Haykin: .Communication Systems.
3. Andy Bateman: .Digital Communication: Design for The Real world., Addison Wesley, 1998.
4. Kennedy “Analog and digital communication”

Course Outcomes:

After the completion of the course the student will be able to :

- Recall the properties of different signal
- Discover modulation techniques both in time and frequency domains.
- Examine the conversion methods from analog system to digital system.
- Compare all the types of coding.
- Develop a clear insight into the relations between the input and output ac signals in various stages of a transmitter and a receiver of AM & FM systems.

PO's / CO's	a	b	c	d	e	f	g	h	i	j	k
1	√	√	√	√	√	√			√		√
2	√	√	√	√	√	√			√		√
3	√	√	√	√	√	√			√		√
4	√	√	√	√	√	√			√		√
5	√	√	√	√	√	√			√		√

Power Electronics (EL20514)

Objectives:

- To introduce students the basic theory of thyristor family members, their constructional detail, their characteristics and applications.
- To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications.
- To introduce the students the AC-DC motor control using Power Electronics Devices.
- To familiarize the students the operation of Switch Mode Power Supply, Uninterrupted Power Supply & Battery Charging Circuits.

Syllabus:

UNIT I: Power Electronics Devices

Characteristics of power devices – characteristics of SCR, diac, triac, SCS, GTO, PUJT – power Transistors – power FETs – LASCR – two transistor model of SCR – Protection of thyristors Against over voltage – over current, dv/dt and di/dt.

UNIT II :Triggering Techniques
Turn on circuits for SCR – triggering with single pulse and train of pulses – synchronizing with Supply – triggering with microprocessor – forced commutation – different techniques – series And parallel operations of SCRs.

UNIT III:Controlled Rectifiers
Converters – single phase – three phases – half controlled and fully controlled rectifiers – Waveforms of load voltage and line current under constant load current – effect of transformer Leakage inductance – dual converter.

UNIT IV:Inverters
Voltage and current source inverters, resonant, Series inverter, PWM inverter. AC and DC Choppers – DC to DC converters – Buck, boost and buck – boost.

UNIT V:Industrial Applications
DC motor drives – Induction and synchronous motor drives – switched reluctance and brushless motor drives – Battery charger – SMPS – UPS – induction and dielectric heating.

Text Books :
1. MuhamedH.Rashid : Power Electronics Circuits, Devices and Applications, 3rd Edn. 2004 PHI.
2. Singh and Kanchandani : Power Electronics, TMH, 1998.

Reference Books:
1. Sen : Power Electronics, TMH, 1987.
2. Dubey :Thyristorised power controllers, Wiley Eastern 1986.
3. Vithayathil : Power Electronics – Principles and applications McGraw-Hill, 1995.
4. Lander : Power Electronics, 3rd Edition, McGraw-Hill, 1994.

Course Outcomes:

After the completion of the course the student will be able to:

- Recall knowledge of various applications of semiconductor switches by understanding their static and dynamic characteristics and various protections.
- Experiment with the significance of various commutation circuits and their consequence on device stress.
- Categorise the performance characteristics of controlled AC-DC converters for R, RL &RLE load and their operation under continuous/discontinuous mode of conduction.
- Conclude basic knowledge on DC-DC converters
- Interpret the principle of DC-AC conversion and the different types of single/three phase inverter circuits.
- Design different applications of converters such as: four quadrant operation of DC motor, Various DC/AC Drives.

PO's / CO's	a	b	c	d	e	f	g	h	i	j	k
1	√	√	√	√	√	√			√	√	√
2	√	√	√	√	√	√			√	√	√
3	√	√	√	√	√	√			√	√	√
4	√	√	√	√	√	√			√	√	√
5	√	√	√	√	√	√			√	√	√
6	√	√	√	√	√	√			√	√	√

Power Electronics Lab(EL20521)
B.TECH. (Electrical Engineering) VthSemester

LIST OF EXPERIMENTS

1. To study of V-I Characteristics of SCR, GTO, DIAC, TRIAC, IGBT.
2. To study of different Triggering techniques.
3. To study of single phase half wave controlled Converter.
4. To study of single phase half controlled Converter.
5. To study of single phase full wave controlled Converter.
6. To study of Various Commutation Circuits.
7. To study of DC-DC converter.
8. To study of single phase Uncontrolled/Controlled Inverter.
9. To study of three phase Uncontrolled/Controlled Inverter.
10. To study of PWM Inverter.

Course Outcomes (COs):

After the completion of the laboratory course the student will be able to

- Recall knowledge of various applications of semiconductor switches by understanding their static and dynamic characteristics and various protections.
- Experiment with the significance of various commutation circuits and their consequence on device stress.
- Categorise the performance characteristics of controlled AC-DC converters for R, RL & RLE load and their operation under continuous/discontinuous mode of conduction.
- Conclude basic knowledge on DC-DC converters
- Interpret the principle of DC-AC conversion and the different types of single/three phase inverter circuits.

COs \ POs	a	b	c	d	e	f	g	h	i	j	k
1	✓	✓	✓	✓	✓	✓					✓
2	✓	✓	✓	✓	✓	✓					✓
3	✓	✓	✓	✓	✓	✓					✓
4	✓	✓	✓	✓	✓	✓					✓
5	✓	✓	✓	✓	✓	✓					✓

Control System Engineering (EL20516)

Objectives:

- Introduce the mathematical foundations of feedback control systems.
- Develop new skills and analytical tools for analysing systems in both time and frequency domain.
- Impart knowledge regarding the controller design techniques for improving system response.

Syllabus:

UNIT-1: General Control Systems:
Introduction, open- and closed-loop control, Transfer function, Mathematical modelling of various physical systems, e.g., electrical, mechanical, hydraulic, pneumatic, thermal, etc., feedback and feed-forward control systems.

(a) Block diagrams and reduction techniques.
(b) Signal flow-graph analysis.

UNIT-2: Time Domain Analysis & Design:
Steady-state and transient analysis of first and second order systems, steady-state errors, error constants, performance specifications in time domain, Types of feedback control system,Proportional Integral and derivative control, PID controller, Design specifications and considerations of second-order systems, Performance indices.

UNIT-3: Stability and frequency Domain Analysis:
Stability: concept, necessary conditions, Routh-Hurwitz stability criterion, relative stability analysis.

(a) Polar plots, Bode plots, Experimental determination of transfer function, Design considerations.
(b) Stability in frequency domain: Hurwtiz stability criterion and Relative stability assessment, Gain Margin and Phase Margin, Systems with transportation lag, Closed-loop frequency response, Nichol's chart, Sensitivity analysis in frequency domain.

UNIT-4: Design using Root Locus:
Root locus plots, Rules for constructing Root loci, Root locus analysis with and without transportation lag, Root contour plots.

(a) Compensation using root locus: Cascade lag, cascade lead, cascade lag-lead network.
(b) Compensation using Bode plots: Lag, lead and lag-lead networks.

UNIT-5: State variable Analysis:
Concepts of state and state variable, System dynamics representation by differential equations, state equations and transfer functions.

(a) Eigen values and their invariance, Eigen Vectors, Diagonalization, Similarity transformations, Transfer function decomposition.
(b) Cayley-Hamilton theorem, Computation of state transition matrix by different methods, Solution of state equations, controllability and observability.

Books: Text:
(1) Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition, 1995.
(2) Ogata. K, "Modern Control Engineering", Prentice Hall of India, 5th Edition, 2010.

Reference Books:
(1) J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.

Course Outcomes:

After the completion of the course the student will be able to:

- Apply fundamental principles of closed loop system and appreciate the use of feedback to improve system performance.
- Analyse continuous systems mathematically through the use of Laplace functions and state equations.
- Interpret any physical system in both transfer functions and state equations form.
- Design controllers to improve the performance of continuous controlled system in both time and frequency domains.
- Infer knowledge to succeed in any competitive examination as well as develop the lifelong learning process.

Cos / POs	a	b	c	d	e	f	g	h	i	j	k
1	✓	✓	✓						✓	✓	✓
2	✓	✓		✓		✓					✓
3	✓	✓		✓		✓				✓	✓
4	✓	✓		✓	✓	✓		✓	✓		✓
5	✓	✓						✓			✓

Control System Engineering Lab (EL20523)
B.TECH. (Electrical Engineering) VthSemester

LIST OF EXPERIMENTS

1. To study time response of linear system simulator.
2. Study of the transient and frequency response of second order network.
3. Study of the operation of Synchro Transmitter and Synchro Receiver.
4. To study the digital control of a system using 8 bit microprocessor. Examine the effect on response of system for (a) Time delay (b) Variation in the parameter of PID controller.
5. Study of lead-lag network.
6. Study of the characteristics of magnetic amplifier for series connection.
7. To obtain the transfer function of a second order system (RLC Circuit) using frequency response experimental data.
8. To study the characteristics of a small ac servomotor and determine its transfer function.
9. Analyse the effect of different controlling actions (P, PI and PID) on the time response of a closed loop position control of DC Servomotor in both analog and digital mode.
10. Controller design and analysis for a multiple input multiple output system.

Course Outcomes (COs):

After the completion of the course the student will be able to :

- Make use of measuring instruments (DSO, power supply, frequency analyzer, function generator etc.) for analyzing systems in both time and frequency domain.
- Formulate the steps involved in designing controllers for feedback control systems.
- Evaluate the performance of analog and digital controllers in improving the system response.
- Justify the utility of feedback control in real world settings.

COs \ POs	a	b	c	d	e	f	g	h	i	j	k
1	✓	✓	✓	✓		✓			✓	✓	
2	✓	✓	✓	✓		✓				✓	
3	✓	✓	✓	✓		✓				✓	
4	✓	✓	✓	✓		✓			✓	✓	