Department of Electronics & Communication Engineering
Curriculum of B. Tech (Electronics & Communication Engineering)
2020-2024

Department of Electronics and Communication Engineering, Sambalpur University Institute of Information Technology, Burla, Odisha,

Pin: 768019

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Semester-I
(Common to all branches)

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	MAC111	Mathematics-I	4	0	0	4	BS&H
2.	PHC112	Physics-I	3	1	0	3	BS&H
3.	CSC113	Programming in C	3	1	0	3	CSE
4.	EEC114	Basic Electrical Engineering	3	1	0	3	EEE
5.	HSC115	Communicative English	3	1	0	3	BS&H
6.	EEL116	Basic Electrical Lab	0	0	3	2	EEE
7.	CSL117	Programming in C Lab	0	0	3	2	CSE
8.	PHL118	Physics-I Lab	0	0	3	2	BS&H
		TOTAL				**22**	

Semester-II
(Common to all branches)

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	MAC121	Mathematics-II	4	0	0	4	BS&H
2.	PHC122	Physics-II	4	0	0	4	BS&H
2.	ECC123	Basic Electronics	3	1	0	3	ECE
3.	CSC124	Data Structures using C	3	1	0	3	CSE
4.	HSC125	Environmental Studies	3	1	0	Non Credit	BS&H
5.	ECL126	Basic Electronics Lab	0	0	3	2	ECE
6.	EDC127	Engineering Graphics Lab	0	0	3	2	BS&H
7.	CSL128	Data Structures using C Lab	0	0	3	2	CSE
		TOTAL				**20**	

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SEMESTER-III

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	MAC231	Mathematics-III	4	0	0	4	BS&H
2.	ECC232	Analog Electronics Circuit	3	1	0	3	ECE
3.	EEC233	Network Analysis and Synthesis	3	1	0	3	EEE
4.	ECC234	Digital Circuit and System	3	1	0	3	ECE
5.	ECC235	Electronic Measurement & Instrumentation	3	1	0	3	ECE
6.	ECC236	Signal and System	3	1	0	3	ECE
7.	ECL237	Digital Circuit Lab	0	0	3	2	ECE
8.	ECL238	Analog Electronics Lab	0	0	3	2	ECE
		TOTAL				**23**	

Semester-IV

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	MAC241	Mathematics-IV	4	0	0	4	BS&H
2.	ECC242	Microprocessor and Microcontroller	3	1	0	3	ECE
3.		**Open Elective-I**	3	1	0	3	BS&H
4..	ECC243	Analog Communication Techniques	3	1	0	3	ECE
5..	ECC244	Advance Electronic Circuit	3	1	0	3	ECE
6.	ECL247	Analog Communication Techniques Lab	0	0	3	2	ECE
7.	ECL248	Microprocessor and Microcontroller Lab	0	0	3	2	ECE
		TOTAL				**20**	

Open Elective-I:
1. Organization Behaviour(HSC243) 2. Life and Psychology

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Semester- V

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	ECC351	Digital Communication techniques	3	1	0	3	ECE
2.	ECC352	Electromagnetic Theory	3	1	0	3	ECE
3.		OE-II	3	1	0	3	BS&H
4.		OE-III	3	1	0	3	OE
5.	ECC353	Digital signal Processing	3	1	0	3	PE
6.	ECL356	Digital Communication Techniques Lab	0	0	3	2	ECE
7.	ECL357	Digital Signal Processing Lab	0	0	3	2	ECE
8.	EMOC359	MOOCS ONLINE COURSE 2 (12 Weeks)				3	Online MOOCS course
		TOTAL				22	

Open Elective
1. Computer Networks
2. Power Electronics
3. Database Management System
4. Computer Organization and Architecture
5. Engineering Economics and Costing

VI Semester

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	EEC361	Wireless Communication	3	1	0	3	EEE
2.		PE-I	3	1	0	3	ECE
3.	ECC362	VLSI Engineering	3	1	0	3	ECE
4.		OE-IV	3	1	0	3	OE
5..		PE-II	3	1	0	3	PE
6.	ECL366	Prototype Product Development Lab	0	0	3	2	ECE
7.	ECL367	VLSI Lab	0	0	3	2	ECE

8.	EMOC369	MOOCS ONLINE /Elective				3	Online MOOCS course
		TOTAL				22	

Open Elective
1. Computer Networks
2. Power Electronics
3. Database Management
4. Computer Organization and Architecture

Program Elective
1. Control Engineering-I
2. Embedded Systems
3. Information Theory and Coding
4. Electrical Machines

VII SEMESTER

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	ECC471	Optical and Satellite Communication	3	0	0	3	ECE
2.		PE-III	3	0	0	3	PE
3.		PE-IV	3	0	0	3	PE
4.		OE-V	3	0	0	3	PE
6.	ECL476	Communication System Lab	0	0	3	2	ECE
7.	ECP477	Minor Project	0	0	3	2	ECE
8.	ECC472	SEMINAR	0	0	3	2	ECE
		TOTAL				20	

VIII Semester

S .No	Course Codes	Course Titles	L	T	P	Credits	Subject Category
1.	ECP481	Major Project	0	0	3	8	ECE
2.		Radar and TV	3	0	0	3	PE
3.		Soft Computing	3	0	0	3	PE
4.		OE-VII	3	0	0	3	BS&H
5.	ECV485	Comprehensive Viva	0	0	0	2	ECE
		TOTAL				19	

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I	II	III	IV	V	VI	VII	VIII
22	20	23	26	23	23	24	19

Total Credit(1st to 8th semester)	**168**

List of Professional Electives

S. No	Course Codes	Course Titles	Credit
1.	ECE01	Information Theory and Coding	3
2.	ECE02	Wireless Communication	3
3.	ECE03	CAD VLSI	3
4.	ECE04	Microwave Engineering	3
5.	ECE05	Satellite Communication	3
6.	ECE06	Radar & TV	3
7.	ECE07	Mobile Communication	3
8.	ECE08	Virtual Instrumentation	3
9.	ECE09	IC Technology	3
10.	ECE10	Speech and Audio Processing	3
11.	ECE11	Adaptive Signal Processing	3
12.	ECE12	Antennas and Propagation	3
13.	ECE13	Bio - medical Instrumentation	3
14.	ECE14	Telephone Switching Network	3
15.	ECE15	Mixed Signal Design	3
16.	ECE16	Broadband Communication	3
17.	ECE17	Electrical Machines	3
18.	ECE18	Advanced Micro-controllers	3
19.	ECE19	Image and Video Processing	3

List of Open Electives

S. No	Course Codes	Course Titles	Credit
1.	CSC354	Computer Networks	3
2.	EEC352	Power Electronics	3

3	OPEE08	Digital Image Processing	3
4.	OPEE02	Optimization Techniques	3
5.	CSEE28	Advance Database	3
6.	CSEE16	Wireless Sensor Network	3
7.	CSEE06	Advance Computer Architecture	3
8.	EEC362	Control System Engineering-II	3
9.	OPEE15	Machine Learning	3
10.	CSEE11	Artificial Intelligence	3
11.	CSC353	Database Management System	3
12.		Probability and Stochastic Processes	3
13.	ECOE01	Principles of Communications /OR Communication Systems Engineering	3
14.	CSC235	Computer Organization & Architecture	3
Dept. of BS&H			
15.	HSC243	Organization Behaviour	3
16.	HSC355	Engineering Economics & Costing	3
17.		Life and Psychology	3
18.		Ecology and Environment	3
19.	HSC483	Entrepreneurial Management	3
20.		Society and Social Issues	3

N.B-

- **A student will be eligible to get B.Tech. degree only if he/she completes the course work including the MOOCs courses recommended by the department.**
- **The students can register for these courses through SWAYAM (Govt. of India) directly as per the courses offering in Odd/Even Semesters by them.**
- **SWAYAM will charges minimal fee per course and awards a certificate of completion. Students need to register for the course on payment of their own and submit the certificate to the institute.**
- **For registration to MOOCs, the students shall abide by the norms and policies proposed by SWAYAM.**

- For technical seminar, students shall choose a topic from the latest technological developments / research in Electronics and Communication Engineering or in allied fields in consultation with the faculty. They shall submit synopsis for the presentation in an approved format on the day of presentation.
- Project work and Comprehensive Viva-Voce shall be as per Academic & Examination Guidelines of SUIIT.

Programme Outcome

PO1	**Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions**
PO2	**Effective Communication: Will be able to speak, read, write and listen clearly in person and through electronic media in English and in one Indian language**
PO3	**Social Interaction (Interpersonal Relation): Elicit views of others, mediate disagreements and prepared to work in team.**
PO4	**Entrepreneurship capability: Demonstrate qualities to be prepared to become an entrepreneurship**
PO5	**Ethics: Recognize different value systems including your own, understand the moral dimension, and accept responsibility for them.**
PO6	**Environment and Sustainability: Understand the issues of environmental contexts and sustainable development**
PO7	**Life Long Learning: Acquire the ability to engage in independent and life long learning in the context of socio technological changes**

BASIC ELECTRONICS

Prerequisites: Basics of semiconductor Physics.
Objective: To learn fundamentals of diodes, BJTs, FETs, and use of BJTs & FETs in design of amplifiers and oscillators.

CO-1	Remember and understand the basic concepts/ Principles of Basic Electronics
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: INTRODUCTION TO ELECTRONICS [12 HOURS]
Electronic devices and their applications , signals, analog & digital signals, amplifiers. Linear wave shaping circuits: RC LPF, Integrator, RC HPF, Differentiator. Properties of semiconductor classification of solid, energy band in si, intrinsic & extrinsic semiconductors, current flow in semiconductors, Hall effect, diffusion current, drift current, mobility & resistivity.

MODULE II:SEMICONDUCTOR DIODES[12 HOURS]
p-n junction theory, V–I characteristics, load line analysis, equivalent circuit of diode, analysis of diode circuit, transition capacitance & diffusion capacitance. Application of diode circuit ; Rectifiers, clippers, clampers. Filter circuits, Special purpose diodes : Zener diode, LED, Photo diode, tunnel diode, varactor diode, Shockley diode. Basics of LASER.

MODULE III:BJTs AND FETs [12 HOURS]

BJT : structure & operation , different transistor configurations & their characteristics, DC analysis of BJT, Field effect transistors (FETs) : Types, structure & operation of JFET and MOSFET, Depletion mode & enhancement mode MOSFET, Device characteristics, MOSFET as a switch.

MODULE IV:FEEDBACK AMPLIFIERS & OSCILLATORS [12 HOURS]

General principles of feedback amplifier, .Oscillators : principles of oscillations, Barkhausen criteria for oscillation, types of oscillator circuits and their operations. Operational amplifiers (OP-AMPs)and applications : Ideal op-amp, inverting & non inverting amplifier, adder, integrator & differentiator. Active filters.

TEXT BOOKS:

1. Microelectronics Circuit:Theory and applications,Sedra and Smith,Oxford University Press.

REFERENCE BOOKS:

1. Integrated Electronics, Millman and Halkias, Mc. Graw Hill Publications.
2. Electronics Devices and Circuits, Sanjeev Gupta, Dhanpat Rai, Publications.
3. Digital Logic and Computer Design, Morris Mano, PHI, EEE
4. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education
5. Electronics Fundamentals and Applications, D Chattopadhyay and P. C Rakshit, New Age International Publications.

Total: 48 Hours

Basic Electronics Lab

CO-1	Remember and understand the basic concepts/ Principles of Basic Electronics Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Basic Knowledge-

1. To study Electronics Symbols.
2. To Study of Active Components such as (Transistors, Integrated Circuit, etc.)
3. To Study of Passive Components such as (Resistor, Capacitor, Diode, Inductor etc.).
4. To Study Electronic Devices such as (Multi-meter, Bread-Board, Power Supply, Digital Storage oscilloscope and Function Generator.)

Experiment List-

1. To Study the VI characteristics of PN Junction Diode in forward and reverse bias.
2. To Study the VI characteristics of Light Emitting Diode.
3. To Study the VI characteristics of Zener Diode in reverse bias.
4. To Study the Half Wave Rectifier with filter.
5. To Study the Full Wave Rectifier with filter.
6. To Study Zener Diode as Voltage Regulator.
7. To Study Diode Clipper Circuit.
8. Positive Clipper
9. Negative Clipper
10. Positive Biased Clipper
11. To Study Diode Clamper Circuit.
12. Positive Clamper

13. Negative Clamper
14. Positive Biased Clamper
15. To Study the Voltage Regulator using IC LM7805 and LM7809.
16. To Study Transistor Input Characteristics in Common Emitter Configuration.
17. To Study Transistor Output Characteristics in Common Emitter Configuration.

SIGNALS AND SYSTEMS

Prerequisites: Basics of LAPLACE transform, Z transform, Fourier Transform
Objective: To learn the analysis of signals and LTI SYSTEMS in time and frequency domain.

CO-1	Remember and understand the basic concepts/ Principles of Signals and Systems
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module I[12 hours]

Introduction to Signals & Systems: Definition of signals, system, overview of specific systems: control systems, communication systems, automatic speech recognition systems, classification of signals, basic operations on signals, elementary signals: exponential, sinusoidal, unit impulse, unit step, properties of systems, systems viewed as interconnections of operations. **Linear Time Invariant Systems:** Discrete time LTI systems: the convolution sum, Continuous Time LTI systems: The convolution integral, properties of LTI systems, interconnection of LTI systems, differential and differenceequation representations of LTI systems, Block diagram representations, state variable descriptions of LTI systems.

Module II [12 hours]

Fourier representations of signals and linear Time-Invariant systems: complex sinusoids and frequency response of LTI systems, Discrete time periodic signals(DTFS), Continuous time periodic signals(FS), Discrete time non-periodic signals (DTFT), Continuous time Non-Periodic Signals(FT), properties of Fourier representations: linearity and symmetry properties, convolution property, differentiation and integration properties, time and frequency shift properties, Multiplication property, scaling property, parseval relationships, time bandwidth product, duality. **Sampling:** sampling theorem: representation of Continuous time signal by its samples, reconstruction of Continuous time signals from samples, the effect of under sampling: aliasing.

MODULE III [12 hours]

Representing signals by using Continuous time complex exponentials: The Laplace transform, ROC, Properties of Laplace Transform , inverse Laplace transform , analysis and characterization of LTI systems using Laplace Transform: causality, stability, system functions for interconnections of LTI systems. **Representing signals by using Discrete Time complex exponentials:** The z-transform, ROC, properties of ROC,properties of z-transform, analysis and characterization of LTI systems using z-transform:-causality, stability,system functions for interconnections of LTI systems, block Diagram representations for causal LTI systems.

MODULE IV [12 hours]

Design of Filters, passive filters, digital filters, linear distortion and equalization. Linear Feedback Systems: feedback, basic feedback concepts, effect of feedback on disturbance or noise, introduction to Routh Hurwitz criteria, Root Locus analysis of linear feedback systems and Nyquist stability criteria.

Text Books:

1. Signals and Systems, Alan S. Willsky, Alan V. Oppenheim, S. Hamid Nawab, PHI Learning, 2nd edition.
2. Signals and Systems, Simon Haykin, Barry Van Veen, Wiley India, 2nd edition
3. Schaum's outlines of 'Theory and problems of Signals and Systems", Hwei P. Hsu, McGraw Hill.

Reference Book:

1. Principles of Signal Processing & Linear Systems, B.P Lathi, Oxford University Press.

Total: 48 Hours

ANALOG ELECTRONICS CIRCUIT

Prerequisites: Prior knowledge of fundamental circuit analysis techniques and basic electronics backgrounds, including BJT, MOSFET and operational amplifier.

Objectives: To understand and analyze the different biasing techniques used in BJTs and FETs and analysis of amplifier circuits.

CO-1	Remember and understand the basic concepts/ Principles of Analog Electronics Circuit
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: DC ANALYSIS OF BJT [12 hours]

DC Analysis of BJT : Load line, Operating Point; Bias configurations: Fixed bias, Emitter stabilized bias, Voltage divider bias. DC bias with voltage feedback, bias stabilization.

DC biasing of FET :DCload line analysis, Static characteristics of JFET & MOSFET, Transfer characteristics of JFET & MOSFET. Bias configurations: Fixed bias, Self bias,& Voltage divider bias. JFET applications.

MODULE II: SMALL SIGNAL ANALYSIS OF BJT AND JFET [12 hours]

Small signal Modelling and analysis of BJT & MOSFET: The transistor re model, hybrid model, low frequency small signal analysis of CE, CB, CC configurations without feedback. CE fixed bias configuration, CE Emitter stabilized configuration with bypassed RE and un bypassed RE. CE voltage divider bias with bypassed RE and un bypassed RE. Emitter Follower configuration (CC), CB configuration.

Small signal modelling and analysis of JFET :C-S &C-D configuration.

MODULE III:SYSTEM APPROACH AND COMPOUND CONFIGURATIONS [12 hours]

System approach (Effects of RS and RL) : Two port system, individual and combined effects of RS and RL on CE, analysis of amplifiers using two port approach with RS and RL, CE fixed bias with RS and RL , CE Emitter stabilized bias with effect of RS and RL, Voltage divider bias using RS and RL. BJT frequency response : General frequency considerations, low frequency analysis of RC combinations in single stage BJT, low frequency response of single stage amplifier, high frequency modelling & high frequency analysis of single stage amplifier, Miller effect capacitance.

Compound configurations :cascade, cascode, and darlington connection, CMOS circuit, constant current source, current mirror circuit.

MODULE IV: Power amplifier AND VOLTAGE REGULATOR CIRCUITS [12 hours]

Power amplifier: Class A,B,C,AB, voltage regulators circuit, IC 723 general purpose regulator, introduction to SMPS, uninterruptable power supplies (UPS).

TEST BOOKS :

1. Microelectronics circuits, theory and applications by ADEL S. SEDRA and KENNETH C. SMITH, fifth edition. OXFORD INTERNATIONAL STUDENT EDITION

REFERENCE BOOKS :

1. Integrated Electronics, Millman and Halkias, Mc. Graw Hill Publications.
2. Electronics Devices and Circuits, Sanjeev Gupta, DhanpatRai, Publications.
3. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.
4. Electronics Fundamentals and Applications, DChattopadhyay and P. C Rakshit, New Age International Publications.

Analog Electronics Circuit Lab

Objective: To learn Op-amp based circuit design

CO-1	Remember and understand the basic concepts/ Analog Electronics Circuit Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Experiment List (Analog Electronics Circuit Lab) -

1. RC Coupled Amplifier.
2. OP-AMP as Inverting / Non-inverting.
3. OP-AMP as Summing / Differential Amplifier.
4. OP-AMP as Integrator / Differentiator.
5. Oscillators (Hartley, Colpitts, RC Phase Shift).
6. To Study the operation of Class A Power Amplifier.
7. To Study the operation of Class B Power Amplifier.
8. To Study the operation of Class C Power Amplifier.
9. Multivibrator (Astable, Monostable).

DIGITAL CIRCUIT AND SYSTEM

Prerequisites: Basic Electronics, Analog Electronics

Objectives: 1. To learn basics of digital electronics circuit.

2. Acquired knowledge about the basics of logic gates, boolean algebra, combinational and sequential circuits.

CO-1	Remember and understand the basic concepts/ Digital Circuit and System
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module – 1 [12 hours]

Review of NUMBER SYSTEM -binary, octal, decimal and hexadecimal number systems and conversions.1's complements, 2'complement, binary addition, subtraction, multiplication & division. Logic gates and boolean algebra: NAND & NOR Implementation, De Morgan's law, Duality theorem**,** Gate level Minimization. Digital Logic Gates for Multiple inputs. Boolean functions, Canonical & standard form; min terms & max term,. The Map Method, K Map for two, three, four variables. Product of Sum (POS), Sum of product (SOP) simplification, Don't care conditions.Error detection& correction: Parity Generator and Checker Circuit.

Module - 2 [12 hours]

Combinational Logic Circuits and Logic Families: Analysis & Design of Binary Half Adder & Full Adder circuit, CarryLookAheadadder. Half and Full-subtractor circuit, Decoders, Decoder for Seven segment display, decoder for binary to grey and grey to binary code. Encoders, Priority encoders, Multiplexers and Demultiplexers, Magnitude Comparator.Digital Integrated logic Circuits (Logic Families): RTL, DTL, TTL, ECL, MOS & C-MOS Logic circuits.,

Module -3 [12 hours]

Sequential Logic Circuit : Sequential Circuit, Latches, Flip-flop (S-R, J-K,D,T,M/S), edge triggering and level triggering. **Register &Counters:** Universal Shift Register (SISO, SIPO, PISO, PIPO),

Synchronous Counter, Ripple counter, Modulo-n Counter, Up-Down Counter, Asynchronous Counter, , Ring Counters. Analysis of Clocked Sequential circuits.Analog to digital converter (ADC) & Digital to analog converters (DAC).

Module -4 [12 hours]

Memory & Programmable Logic: Classification of memories–ROM, ROM organization, PROM, EPROM, EEPROM, EAPROM,RAM, RAMorganization.
ProgrammableLogic Devices, Programmable LogicArray(PLA), ProgrammableArray Logic(PAL), Field ProgrammableGate Arrays(FPGA).

TEXT BOOKS:

1. Digital Design, 3rd edition by M. Morris Mano, PHI

REFERENCE BOOKS

2. Digital Fundamentals – Floyd & Jain, Pearson education
3. Digital Principles & Applications – Malvino, Leach & Saha, 6th Edition, Tata Mc Graw Hill
4. Switching Theory & Digital Electronics – V. K. Jain, Khanna Publishers

Digital Circuit Lab

Prerequisites: Knowledge of basic logic gates.

Objectives: Identify different logic gate ICs, their specifications and truth tables.

- To learn and Understand the working of different combinational and sequential logic circuits.

CO-1	Remember and understand the basic concepts/ Principles of Digital Circuit Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Experiment List (Digital Circuit Lab) -

I. Verification of Logic Gates.
II. Realization of Gates Using NAND Gate.
III. Realization of Gates Using NOR Gate.
IV. Half and Full Adder using Gates.
V. Encoder / Decoder (4:2 / 2:4).
VI. Multiplexer / De-multiplexer (2:1 / 1:2).
VII. Flip-Flop (RS, T, D, JK).
VIII. BCD to Seven Segment Display.
IX. Shift Register (2-Bit).
X. Counters

ANALOG COMMUNICATION SYSTEMS

Prerequisites: A fundamental study on signal system, fourier series, fourier transforms and advanced electronic circuits is needed to be studied prior to the study of analog communication system.
Objective: The objective of the course is to provide a knowledge on basic understanding and mathematical modelling of the communication techniques.

CO-1	Remember and understand the basic concepts/ Principles of Analog Communication Systems
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: AMPLITUDE AND ANGLE MODULATION [12 hours]
Amplitude modulation: Block diagram of Electrical communication system, Radio communication, Need for modulation, Types of Amplitude modulation, AM, DSB SC, SSB SC,VSB, Power and BW requirements, Generation of AM, DSB SC, SSB SC, Demodulation of AM : Diode detector, Product demodulation for DSB SC & SSB SC.
Angle Modulation: Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM, FM modulators and FM demodulators, Armstrong method of generation, necessity of pre-emphasis and de-emphasis.
MODULE II:([12 hours]
Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM, Time Divison Multiplexing, Frequency Divison Multiplexing, Asynchronous Multiplexing.
MODULE III: [12 hours]
MATHEMATICAL REPRESENTATION OF NOISE: Some Sources of Noise, Frequency-domain Representation of Noise ,Superposition of Noises, Linear Filtering of Noise.
MODULE IV: [12 hours]
NOISE IN AMPLITUDE MODULATION SYSTEM : Framework for Amplitude Demodulation, Single Sideband Suppressed Carrier(SSB-SC), Double Sideband Suppressed Carrier(DSB-SC), Double Sideband With Carrier(DSB-C).
NOISE IN FREQUENCY MODULATION SYSTEM : An FM Receiving System, Calculation of Signal to Noise Ratio, Comparison of FM and AM, Pre-emphasis and De-emphasis and SNR Improvement, Noise in Phase Modulation and Multiplexing Issues, Threshold in Frequency Modulation, Calculation of Threshold in an FM Discriminator, The FM Demodulator using Feedback(FMFB).

TEXT BOOKS:
1. Communication Systems, Simon Haykin, John Wiley.
2. Principles of Communications – H. Taub and D. Schilling, Gouthamsaha, TMH.

REFERENCE BOOKS:
1. Communication Systems Analog and Digital – R.P. Singh and S D Sapre, TMH, 2nd Edition, 2008.
2. Electronic &Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.

3. Modern Digital and Analog communication Systems – B.P Lathi, Oxford 3rd edition

Analog Communication Lab

CO-1	Remember and understand the basic concepts/ Principles of Analog Communication Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1. Generation of AM wave and demodulation.
2. Generation of PAM wave and demodulation
3. Generation of PWM wave and demodulation
4.Generation of PPM wave and demodulation
5. Generation of FM wave and demodulation
6. Generate PPM wave using IC555.
7. Study of PLL.
8. Frequency Division Multiplexing
9. Time Division Multiplexing
10. DSB -AM modulation
11. SSB-AM modulations
12. Study of sampling, nyquist theorem.

ELECTRONIC MEASUREMENT & INSTRUMENTATION

Pre-requisites: Knowledge of measuring instruments

Course Objectives:

- To learn different types of measuring instruments and their characteristics.
- To learn about Data Acquisition System

CO-1	Remember and understand the basic concepts/ Principles of Electronic Measurement & Instrumentation
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I (12 Hours)

Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. Bridge Measurement: DC bridges-wheatstone bridge, AC bridges –Kelvin, Hay, Maxwell, Schering and Wien bridges, Wagner ground Connection. Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True-RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter.

Module-II (12 Hours)
Oscilloscopes: Digital Technique,Probes and Transducers, Specification of an Oscilloscope. Oscilloscope measurement
Techniques, Special Oscilloscopes –Storage Oscilloscope, Sampling Oscilloscope. Signal Generators: Sine wave generator, Frequency –Synthesized Signal Generator, Sweep frequency Generator. Pulse and square wave generators. Function Generators.

Module-III [12 hours]
Signal Analysis: Wave Analyzer, Spectrum Analyzer.
Frequency Counters: Simple Frequency Counter; Measurement errors; extending frequencyrange of counters
Transducers: Types, Strain Gages, Displacement Transducers.

Module-IV [12 hours]
Digital Data Acquisition System: Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. An Introduction to Computer-Controlled TestSystems.IEEE-488 GPIB Bus

Text Books:
1. Modern Electronics Instrumentation & Measurement Techniques, by Albert D.Helsfrick and WilliamD.Cooper, Pearson Education. Selected portion from Ch.1, 5-13.
2. Elements of Electronics Instrumentation and Measurement-3rd Edition by Joshph J.Carr.PearsonEducation. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25.

Reference Books :
3. Electronics Instruments and Instrumentation Technology –Anand, PHI
4. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990.

MICROPROCESSOR AND MICRO CONTROLLER

Prerequisites: Digital Electronics
Objectives: To learn fundamental concepts of Intels 8085, 8086 microprocessor, 8051 microcontroller architectural features.

CO-1	Remember and understand the basic concepts/ Principles of Microprocessor and Microcontroller
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: 8085 AND 8086MICROPROCESSORS [12 hours]
8085 Microprocessor: Architecture, Pin diagram, Physical memory organization, Interrupts of 8085.

MODULE II 8086 MICROPROCESSORS [12 hours]
8086 Microprocessor: Architecture, signal descriptions, common function signals, Minimum and Maximum mode signals, addressing modes, interrupt structure.

MODULE III: I/O INTERFACING(12 Hours)
Interfacing with 8086 Interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254.

Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.

MODULE IV 8051 Micro-controller [12 hours]

Overview of 8051 microcontroller, Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, Interrupts, timer/Counter and serial communication.

TEXT BOOKS:

1. Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, Penram International Publishing
2. Advance Microprocessor and Peripherals, By, A.K. Roy and K.M. Bhurchandi, Tata McGraw-Hill Education
3. Mazidi and Mazidi, The 8051 Micro controller and Embedded Systems, pearson Education.

REFERENCE BOOKS:

1. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, andApplications , by Walter A. Triebel&Avtar Singh,
2. Micro processors and Interfacing, D. V. Hall, TMGH.
   The 8051 microcontroller , Kenneth. J. Ayala. Cengage learning.
3. Microcontrollers and application, Ajay. V. Deshmukh, TMGH.
4. Micro Computer System 8086/8088 Family Architecture. Programming and Design - By Liu and GA Gibson, PHI.

Advance Electronic Circuit

Prerequisites: Basic Electronics Circuits, Analog Electronic Circuits
Objectives: To learn advance concepts of Analog Electronics Circuits

CO-1	Remember and understand the basic concepts/ Principles of Advance Electronic Circuit
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module 1 (12 Hours)

Review of Selected Topics in Electronic Circuits, Active Filters: First & Second order low pass/high pass, band pass, band reject, and all pass filters. Universal active filter design, Comparators, Sawtooth wave generator using OP Amps, Waveform Conversion, Instrumentation Amplifier. Wideband amplifiers: Frequency response, Transient response of transistor stage, shunt compensation of a

transistor stage in cascade, Rise time of cascaded compensated stages, low frequency compensation. Tuned Amplifiers: Single tuned, Double tuned, Staggered tuned.

Module 2 (12 Hours)

Bistable Multivibrator: Stable States of a binary, Fixed Biased and Self-biased Transistor binary, Commutating Capacitors, Symmetrical and Unsymmetrical triggering, Direct connected binary, Schmitt trigger Circuit, Emitter coupled Binary. The Monostable Multivibrator: Collector coupled Monostable Multi, Waveforms, Emitter-coupled Monostable Multi, triggering of Monostable Multi. AstableMultivibrator: Emitter Coupled, Collector Coupled, Waveforms.

Module 3 (12 Hours)

Negative resistance devices and Negative Resistance Switching Circuits: Tunnel diode, UJT operation and characteristics, Application of UJT to generate Sawtooth waveform, Tunnel diode monostable, astable, bistable and comparator circuits.

Module 4 (12 Hours)

Analysis of Voltage time base generator, Current time base generator, Pulse Transformer and Blocking Oscillator, IC 555 Timer Circuit and Applications, Voltage Controlled Oscillator, Phase Locked Loop.

Text Book:

1. Pulse, Digital and Switching Waveforms – Jacob Millman, Herbert Taub, M. Prakash Rao, 2nd Ed, The McGraw-Hill Companies (Selected portions from Chapters 4, 5, 10, 11, 12, 13, 14 and 15).

2. Electronic Principles- A.Malvino, D.Bates, 7thEd, The McGraw-Hill Companies. (Selected Portions from Chapters 21, 22, 23 for Module 1 and 4 only)

Reference Book:

1. OP-Amps and Linear Integrated Circuits-Ramakant A .Gayakwad (PHI Learning Pvt. Ltd.)

2. Pulse, Switching and Digital Circuits-D.A. Bell (Oxford Publishing).

3. Pulse and Digital Circuits by A. Anand Kumar, PHI Learning Pvt. Ltd

MICROPROCESSOR & MICROCONTROLLER LAB

Objective: introduction to 8085 microprocessor (architecture, addressing modes, instruction set)

CO-1	Remember and understand the basic concepts/ Principles of Microprocessor and Microcontroller Lab
CO-2	Analyse the various concepts to understand them through case studies

CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

* introduction to 8085 microprocessor (architecture, addressing modes, instruction set)
1. Additionof two 8-bit numbers, result is 8-bits and 16-bits.
2. Subtraction of two 8-bit numbers using sub instruction and without using sub instruction.
3. Addition of two 16-bit numbers.
4. (i) decimal addition of two 8-bit numbers.
   (ii) decimal addition of two 16-bit numbers.
5. (i) find the multiplication of two 8-bit numbers.
   (ii)find the divison of two 8-bit numbers.
5. (i) 1's and 2's complement of an 8-bit number.
   (ii) 1's and 2's complement of a 16-bit number.
6. (i) find the largest number in an array of 8-bit numbers.
   (ii) find the smallest number in the array of 8-bit numbers.
7. (i) arrange the array of 8-bit numbers in ascending order.
   (ii) arrange the array of 8-bit numbers in descending order.
8. Find the square of an 8-bit number using look-up table.
9. Find the factorial of an 8-bit number.
10. Move a block of data from one section of memory to another section of memory.
11. Fibonacci series.
12. (i) binary to bcd code conversion.
    (ii) bcd to binary code conversions.
13. Speed control of dc motor.
14. (i) square wave generator.
    (ii) sawtooth wave generator.
15. Analog to digital conversions.
16. Microcontroller- addition, subtraction, division,multiplication

ELECTROMAGNETIC THEORY

Pre-requisite: Basic idea of derivatives and integrations, vector calculus, coordinate transformations and wave characteristics.

Objective:

1. To teach the students about electromagnetic wave, its propagation in different media and application in communication.
2. To learn electromagnetic wave generation, propagation in different media, wave attenuation, impedance, reflection, transmission and the role of EM wave in communication.

CO-1	Remember and understand the basic concepts/ Principles of Electromagnetic

	Theory
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE 1: VECTOR CALCULUS AND ELECTROSTATIC FIELDS(12Hours)

Vector Calculus: Differential length, Area & volume, Line surface and volume Integrals, Del operator. Gradient of a scalar. Divergence of a vector & divergence theorem, curl of a vector & Stoke's theorem, Laplacian of a scalar.

Electrostatic Fields: Coulomb's Law and Field Intensity Electric Fields due to continuous charge distributions, Electric Flux Density. Gauss's Law - Maxwell's Equation, Applications of Gauss's Law, Electric Potential, Relationship between E and V - Maxwell's Equation An Electric Dipole& Flux Lines, Energy Density in Electrostatic Fields.

MODULE 2: ELECTROSTATIC BOUNDARY - VALUE PROBLEMS (12Hours)

Possion's& Laplace's Equations, Uniquenesstheorem, General procedures for solving possion's or Laplace's Equation, Resistance,Capacitance,

Magnatostatic Fields:Biot-Savart's Law, Ampere's circuit law-Maxwell Equation, applications of Ampere's law,Magnetic Flux Density-Maxwell's equations. Maxwell's equation for static fields, MagneticScalar and Vector potentials Derivation of Biot-Savart's Law Ampere's Law.

MODULE 3: ELECTROMAGNETIC WAVE PROPAGATION (12 Hours)

Wave Propagation in Free Space: Infinite Plane Current Sheet, Magnetic Field Adjacent to theCurrent Sheet, Successive Solution of Maxwells's Equations, Wave Equation and Solution,Uniform Plane Waves, Poynting Vector and Energy Storage.Transverse Electric Waves in a Parallel-Plate Waveguide, Dispersion and Group Velocity, RectangularWaveguide and Cavity Resonator

MODULE 4: WAVE PROPAGATION IN MATERIAL MEDIA (12 Hours)

Conductors and Dielectrics, Magnetic Materials.WaveEquation and Solution, Uniform Plane Waves in Dielectrics and Conductors, BoundaryConditions, Reflection and Transmission of Uniform Plane Waves.

TEXT BOOKS:

1. Principles of Electromagnetics, S C Mahapatra, S Mahapatra, Tata McGraw hillpublications.
2. Principles of Electromagnetics, Mathew N O sadiku, OXFORDUniversity Press.

REFERENCE BOOKS:

1. Engineering Electromagnetics, 7th Edition, William H. Hayt, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Electromagnetic Field Theory Fundamentals, B.S. Guru and H.R. Hiziroglu, PWS Publishing Company, a division of Thomson Learning Inc.

Department of Electronics & Communication Engineering
Curriculum of B. Tech (Electronics & Communication Engineering)
2020-2024

DIGITAL COMMUNICATION

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Pre-requisite: A brief study on analog communication techniques, transmission channels and effective noises, are required.

Objective: The objective of the course is to provide a complete knowledge of baseband and passband digital communication techniques and their implementation in the communication network.

CO-1	Remember and understand the basic concepts/ Principles of Digital Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: SIGNALS AND SAMPLING((12Hours)

Sampling Theorem, sampling of base band and pass band Signal, Signal Reconstruction, Practical Difficulties, The Treachery of Aliasing, The Anti-aliasing Filter, Application of Sampling Theorem.

MODULE II: PULSE MODULATION (12 Hours)

Pulse Code Modulation: Quantization of Signals, Uniform and Non-Uniform Quantization, The Compander,

The encoder. Transmission Bandwidth and output SNR, Digital multiplexer, Synchronizing and Signaling.

Differential PCM, Delta Modulation, Adaptive Delta Modulation, Output SNR, Comparison with PCM. Noise in PCM and DM: Calculation of Quantization Noise Power, Output Signal Power, and the Thermal Noise Power, Output SNR of PCM using different modulation techniques. Output SNR of DM.

MODULE III: DIGITAL TRANSMISSION (12 Hours)

Principles of Digital Data Transmission: A Digital Communication System, Line Coding-Various line codes.Polar Signaling, ON-OFF Signaling, Bipolar Signaling, Pulse Shaping: Nyquist Criterion for zeroISI,Scrambling, Regenerative Repeater-Preamplifier, Equalizer, Eye diagram, Timing Extraction, Timing Jitter, ABase-band Signal Receiver, Peak Signal to RMS Noise output voltage ratio, Tine Optimum Filter, White Noise,The Matched Filter- Probability of Error of the Matched Filter, Coherent Reception.

MODULE IV: DIGITAL MODULATION (12 Hours)

Digital Modulation Technique: Generation, Transmission, Reception, Spectrum and Geometrical representation in the signal space of OOK,BPSK, BFSK, Differentially- Encoded PSK. QPSK, Minimum Shifting Keying (M$K), M-ary PSK, M-ary FSK,QAM. Use of Signal Space to calculate probability of Error for BPSKandBFSK, Shannon's Channel Capacity Theorem, Bandwidth and SNR Trade off.

TEXT BOOKS:

1. Principles of Communication Systems by Taub&Schiling, 2nd Edition, Tata McGraw Hill. Selected portionfrom Chapter 5,6, II, and 12.
2. Communication System by Simon Haykin, 4th Edition, John Wiley & Sons, Inc.
3. Modern Digital and Analogue Communication Systems by B.P.Lathi, 3rd Edition, Oxford University Press.Selected Portion from Ch.2, 3, 6, 7, 13, and 14.

REFERENCE BOOKS:

4. Communication System, Analogue and Digital, R.P.Singh& S.D. Sapre, TMH.
5. Digital and Analogue Communication System, Leon W.Couch-II, 6th Edition, Pearson.
6. Analog& Digital Communications, H. P. HSU, Sohoum Series
7. Digital Communication: Fundamentals and Applications, Bernard Sklar, Second edition, Prentice Hall
8.Analog & Digital Communication, By Sanjay Sharma, S K Kataria& Sons

DIGITAL SIGNAL PROCESSING

Prerequisites: Linear algebra, complex numbers, trigonometry, calculus, signal and systems.

Objective: This course aims to introduce the concepts of digital signal processing and the basic analytical methods, and to show how they are applied to design filters for given applications. Study of key DSP operations such as convolution, filtering, and discrete Fourier transforms, Digital filter design and spectral analysis.

CO-1	Remember and understand the basic concepts/ Principles of Digital Signal Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: DISCRETE-TIME SIGNALS AND SYSTEMS((12Hours))
Discrete-Time Signals: Some Elementary Discrete-Time signals, Classification of Discrete-Time Signals, Simple Manipulation; Discrete-Time Systems : Input-Output Description, Block Diagram Representation, Classification, Interconnection; Analysis of Discrete-Time LTI Systems: Techniques, Response of LTI Systems, Discrete-Time Systems Described by Difference Equations; Implementation of Discrete-Time Systems; Correlation of Discrete-Time Signals: Cross correlation and Autocorrelation Sequences.

MODULE II: Z-TRANSFORM AND APPLICATION TO LTI SYSTEMS((12Hours)
The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The

Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain.

The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT, IDFT.

MODULE III:DFT AND FFT(12 Hours)

Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation, IFFT.

MODULE IV:IMPLEMENTATION OF DISCRETE-TIME SYSTEMS(12Hours)

Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures.

Causality and Its Implications, Characteristics of Practical Frequency-Selective Filters; Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance.

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications,J. G. Proakis and D. G. Manolakis, Pearson.

REFERENCE BOOKS:

1. Digital Signal Processing, by P. Ramesh Babu, Scitech Pub., India

Digital Communication Lab

CO-1	Remember and understand the basic concepts/ Principles of Digital Communication Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Experiment List:

1. Study of Signal Sampling and Reconstruction Techniques.
2. Amplitude-Shift Keying Generation and Demodulation.
3. Frequency-Shift Keying Generation and Demodulation.
4. Phase Locked Loop Generation and Demodulation.

5. Phase-Shift Keying Generation & Demodulation.
6. Differential Phase-Shift Keying Generation & Demodulation.
7. Pulse Code Modulation and Demodulation.
8. Delta Modulation and Adaptive Delta Modulation.
9. Frequency Division Multiplexing and De-multiplexing with sinusoidal input and audio input.
10. Time Division Multiplexing and De-multiplexing.
11. Simulation of Line Coding Schemes.
12. Simulation of PAM, PWM, PPM.

Digital Signal Processing Lab

Prerequisite: Basic programming skills.
Objective: Use of Scilab for filter design , spectral analysis of discrete time signals.

CO-1	Remember and understand the basic concepts/ Digital Signal Processing Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1. Generation of Discrete time signal sequences.

2. Discrete Time convolution

3. Discrete time correlation

4. Design of FIR filters

4. Design of IIR filters

5. Study of various windows-rectangular, hamming, hanning, triangular.

6. Design of FIR Differentiator

7. Design of Hilbert Transformers

8. Discrete Fourier Transformation

9. Inverse Discrete fourier transformation

10. Time shift, Time scaling , Time reversal

11. Sampling Theorem

CONTROL SYSTEMS ENGINEERING -I

CO-1	Remember and understand the basic concepts/ Principles of Control System Engineering-I
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I : (10 Hours)

Introduction to Control Systems : Basic Concepts of Control Systems, Open loop and closed loop systems, Mathematical Models of Physical Systems: **Differential Equations of Physical Systems**: Mechanical Translational Systems, Rotational systems, Electrical Systems, Analogy between Mechanical and electrical quantities, Servo Mechanism/Tracking System Derivation of Transfer functions, Block Diagram Algebra, Signal flow Graphs, Mason's Gain Formula. Feedback characteristics of Control Systems: Effect of negative feedback on sensitivity, bandwidth, Disturbance, linearizing effect of feedback, Regenerative feedback. Control Components : Servomotors, A.C. Tachometer, Synchros, Stepper Motors.

Module-II : (10 Hours)

Time response Analysis : Standard Test Signals : Time response of first order systems to unit step and unit ramp inputs. Time Response of Second order systems to unit step input, Time Response specifications, Steady State Errors and Static Error Constants of different types of systems. Generalised error series and Generalized error coefficients

, Module-III : (8 Hours)

concept of stability: Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, Application of the Routh stability criterion to linear feedback system, Releative stability by shifting the origin in s-plane. Root locus Technique: Root locus concepts, Rules of Construction of Root locus, Determination of Roots from Root locus for a specified open loop gain, Root contours, Systems with transportation lag. Effect of addition of open loop poles and zeros .

Module-IV : (12 Hours)

Frequency Response Analysis : Frequency domain specifications, correlation between Time and Frequency Response with respect to second order system, Polar plots, Bode plot. Determination of Gain Margin and Phase Margin from Bode plot. Stability in frequency domain : Principle of argument, Nyquist stability criterion, Application of Nyquist stability criterion for linear feedback system. Closed

loop frequency response : Constant M -circles, Constant N-Circles, Nichol's chart. Controllers : Concept of Proportional, Derivative and Integral Control actions, P, PD, PI, PID controllers. Zeigler-Nichols method of tuning PID controllers.

Text Books :

1. Modern Control Engineering by K. Ogata, 5 th edition PHI.
2. Control Systems Engg. by I.J. Nagrath and M.Gopal, 5th Edition, New Age International Publishers (2010).
3. Linear Control Systems by B.S. Manke, (2005), Khanna Publishers

Reference Books :

1. Design of Feedback Control Systems by R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Fourth Edition (2009), Oxford University Press
. 2. Control Systems (Principles and Design) by M.Gopal 3rd edition (2008), TMH.
3. Analysis of Linear Control Systems by R.L. Narasimham, I.K. International Publications
4. Control Systems Engineering by S.P. Eugene Xavier and J. Josheph Cyril Babu, 1 st Edition (2004), S. Chand Co. Ltd.

EMBEDDED SYSTEMS

Prerequisites: Digital Electronics, Microprocessor and Microcontroller.
Objective: To learn fundamentals of embedded system design.

CO-1	Remember and understand the basic concepts/ Principles of Embedded Systems
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: (12 Hours)

Overview of Embedded Systems: Embedded System, Categories and Requirements of Embedded Systems, Challenges and Issues in Embedded System Development, Applications of Embedded Systems in various domains.

MODULE II: (12 Hours)

Embedded Design cycle: Embedded Hardware & Software Design & Development Process & Environment: Hardware Architecture, Interfacing Processor, Memories, I/O and Communication Interface Standards, Embedded Operating systems, Types of Embedded Operating systems.

MODULE III: (12 Hours)

Microcontroller: 8/16/32 Bit (8051/ AVR/PIC/ARM/MSP 430) Microcontrollers and an overview of their Architecture, Instruction set, Interface & Applications. Programming Concepts and Embedded Programming in C for Device Drivers for interfacing LCD, ADC, sensors, stepper motor, key board, DAC, memory.

Embedded System-on Programmable Chip (**SOPC):** FPGA based soft & hard processor, Embedded Software development on FPGA

MODULE IV:(12 Hours)

Embedded real time operating systems: Typical real time applications, Hard Vs Soft real-time systems, A reference model of Real Time Systems: Inter-process Communication and Synchronization of Processes, Tasks and Threads- Multiple Process in an Application, Problem of Sharing data by multiple tasks & routines, Scheduling, Commonly used Approaches to Real Time Scheduling Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective release time and Deadlines, Offline Vs Online Scheduling.

Embedded systems case studies.

TEXT BOOKS:

1. Embedded Systems Architecture, Programming and Design, Second Edition, Raj Kamal, Tata Mc-Graw Hill
2. The 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi, Mazidi, McKinlay, Second Edition, Pearson Education.
3. PIC Microcontroller and Embedded Systems using assembly and C for PIC18, Mazidi, MCKINLAY, CAUSEY, Pearson Education.
4. ARM Systems Developers Guides- Design & Optimizing System Software - Andrew N. Sloss, Dominic Symes, Chris Wright, 2004, Elsevier.
5. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The publisher, Paul Temme, 2003.

REFERENCE BOOKS:

XI. Introduction to Embedded Systems, Shibu K V, Tata Mc-Graw Hill.
XII. PIC Microcontroller by H.W Huang, Delmar CENGAGE Learning, 2007.
XIII. J B Peatman, Design with PIC Microcontrollers, Prentice Hall.
XIV. Dr.K.V.K.K.Prasad, 'Embedded/Real-Time Operating System',Dreamtech Press(for Units I,II &III).
XV. Daniel W. Lewis, "Fundamentals of Embedded Software where C and Assembly meet", PHI, 2002.
XVI. SteaveFurber, "ARM system – on – chip architecture" Addison Wesley, 2000.

VLSI ENGINEERING

Prerequisites: Knowledge of IC design , SPICE Modelling and digital basics .
Objective: To learn fundamentals of embedded system design.-To learn different types of VLSI Design methodologies ,VLSI design Styles and fabrication process of MOS transistors.
- To learn about MOS inverter, combinational and sequential logic circuits using MOS.

- To learn VHDL programming.

CO-1	Remember and understand the basic concepts/ Principles of VLSI Engineering
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: INTRODUCTION TO VLSI(12 Hours)
Introduction, historical perspective, VLSI Design methodologies, VLSI Design flow, Design hierarchy, Design styles, CAD Technology. Fabrication of MOSFETS, Fabrication processes, NMOS Fabrication, CMOS n-well process, Layout Design rules, Full Custom Mask Layout Design, MOS Transistor, Review of structure and operation of MOSFET (n-MOS enhancement type), CMOS, MOSFET V-I characteristics, MOSFET scaling and small geometry effects, MOSFET capacitances, Modelling of MOS transistors using SPICE- Basic concept.

MODULE II: MOS INVERTERS(12 Hours)
Basic NMOS inverters, characteristics, inverters with resistive load and with n-type MOSFET LOAD, CMOS Inverter and characteristics. MOS Inverters: switching characteristics and interconnect effects : Delay time definitions and calculation, inverter design with delay constraints, estimation of parasitic switching power dissipation of CMOS inverters.

MODULE III: COMBINATIONAL AND SEQUENTIAL MOS LOGIC CIRCUITS(12 Hours)
Combinational MOS logic circuits: CMOS logic circuits, complex logic circuits, pass transistor logic. Sequential MOS logic circuits: introduction, SR latch, clocked latch & flip-flop circuits, CMOS D latch and edge triggered flip-flop. Dynamic logic circuits: Dynamic logic, basic principles, high performance dynamics CMOS circuits, Dynamic RAM, Static RAM, Flash memory.

MODULE IV:INTRODUCTION TO VHDL(12 Hours)
Introduction to VHDL, Behavioural modelling, sequential processing, Data types, IEEE std logic, VHDL operators, arrays, Modules, packages, libraries. VHDL description of combinational logic circuits, VHDL description of sequential logic circuits. Modelling of flip-flops, registers, and counters using VHDL. VHDL code for serial adder, and binary multiplier.

TEXT BOOKS:

1. CMOS Digital Integrated Circuits – Analysis & Design – Sung -Mo Kang &YussufLeblebici, TMH.
2. Basic VLSI Design by Douglas A Pucknell and Kamran Eshraghian, PHI, 3rd edition.
3. VHDL Programming by example – Perry TMH.

REFERENCE BOOKS:

1. Digital Integrated Circuits : A Design Perspective – Rabey et.al. Pearson Education.
2. VLSI Design Techniques for analog and digital circuits – Geiger et. Al. McGraw Hill.

Embedded Systems Lab

Objective: To learn 8051 based system design

CO-1	Remember and understand the basic concepts/ Principles of Embedded Systems

	Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1. 8051 microcontroller programming
2. ADC interfacing
3. DAC interfacing
4. seven segment display interfacing
5. LCD interfacing
6. LED interfacing
7. Generation of 1 KHZ square wave

VLSI LAB

CO-1	Remember and understand the basic concepts/ Principles of VLSI Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1. VHDL IMPLEMENTATION OF LOGIC GATES (AND, OR, NOT, NOR, NAND, EXOR, EX-NOR).
2. VHDL IMPLEMENTATION OF LOGIC GATES USING UNIVERSAL GATES (NOR, NAND).
3. VHDL IMPLEMENTATION OF HALF ADDER.
4. VHDL IMPLEMEMNTATION OF FULL ADDER.
5. VHDL IMPLEMEMNTATION OF BINARY-TO-GRAY AND GRAY-TO-BINARY CODE CONVERTER.
6. VHDL IMPLEMENTATION OF MULTIPLEXER & DEMULTIPLEXER.
7. VHDL IMPLEMENTATION OF DECODER & ENCODER.
8. VHDL IMPLEMENTATION OF COMPARATOR.
9. VHDL IMPLEMENTATION OF ALU.
10. VHDL IMPLEMENTATION OF N-BIT ADDER.
11. VHDL IMPLEMENTATION OF J-K, D, T FLIP-FLOPS.

12. VHDL IMPLEMENTATION OF SISO, PIPO SHIFT REGISTER.
13. VHDL IMPLEMENTATION OF COUNTER.
14. VHDL IMPLEMENTATION 1-BIT MEMORY.

OPTICAL COMMUNICATION

CO-1	Remember and understand the basic concepts/ Principles Optical Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: (12Hours)
Overview of Optical fiber Communication, Optical fibers Structures and Wave guiding, Signal degradation in optical fibers, Optical Sources, Photo detectors, Optical receiver Operations.

MODULE II: (12Hours)
Optical Networks: Network concepts, Topologies, SONET/SDH, High speed light wave links, Optical Add Drop Multiplexing.

MODULE III: (12Hours)
Digital Links. Wavelength Division Multiplexing: concepts and components. Design issues in WDM Optical Network, Optical switching, WDM network examples.

MODULE IV: (12Hours)
Wavelength Routing Algorithms, Next generation Optical Internet Networks, IP over ATM, IP over SONET, Overlay and Integrated models for IP/WDM networks.

REFERENCE BOOKS:

1. Optical Fiber Communication by Gerd Keiser TMH, 4/e.
2. WDM Optical Networks: Concepts Design, and Algorithms by C. Siva Ram Murthy and Mohan Gurusamy, PHI, EEE.

OPTICAL COMMUNICATION LAB

CO-1	Remember and understand the basic concepts/ Principles of Optical Communication Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Experiments based on theory

List of Program Electives

INFORMATION THEORY AND CODING

Credit: 3 L-T-P:3-0-0 Course Code: ECE01

Prerequisite: Basics of probability theory.

Objective: To impart the knowledge of various error detection and correction coding techniques used in signal transmission**.**

CO-1	Remember and understand the basic concepts/ Principles of Information Theory and Coding
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I:INFORMATION THEORY AND SOURCE CODING(12 Hours)

Introduction to Information Theory, Uncertainty and Information, Mutual Information and Entropy,Source Coding, Huffman Coding, Shannon-Fano-Elias Coding, Arithmetic Coding, Lempel-ZivAlgorithm, Run Length Encoding, Channel Capacity, Channel Coding, Information Capacity Theorem,The Shannon Limit.

MODULE II:ERROR CONTROL CODING (CHANNEL CODING)(12 Hours)

Error Correcting Codes, Matrix Description of Linear Block Codes, Equivalent Codes, Parity CheckMatrix, Syndrome Decoding, Perfect codes, Hamming Codes, Cyclic Codes, Brust Error Correction,Fire Codes, Golay Codes

MODULE III:BCH, CONVOLUTION AND TRELLIS(12Hours)

Bose-ChaudhriHocquenghem (BCH) codes, Decoding of BCH codes, Reed-Solomon Codes,Convolution Codes, Polynomial description , Turbo Codes , Turbo Decoding, Introduction to TCM,Performance Evaluation forAEGN Channel.

MODULE IV:COMPRESSION TECHNIQUES, AUDIO AND VIDEO CODING(12 Hours)

Principle of Data Compression, Text Compression, Image Compression (GIF, TIFF,JPEG), Image Audio Coders, Video Compression, MPEG Video Standards (MPEG 1,2,3 and MP-3 Standard Sounds.

TEXT BOOKS

1. Information Theory, Coding and Cryptography, Ranjan Bose 2nd Edition, The McGraw-Hill.

REFERENCE BOOKS:

13. Information theory and Coding, Norman Abramson, McGraw-Hill electronic Seriesr.
14. Information Coding Techniques, Dr. J. S. Chitode, Technical Publication.

WIRELESS COMMUNICATIONS

Credit: 3 L-T-P:3-0-0 Course Code: ECE02

Prerequisite: Basics of analog and digital communication and antenna fundamentals.
Objective: To impart the new concepts in wireless communications.

CO-1	Remember and understand the basic concepts/ Principles of Wireless Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

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MODULE I:(12Hours)
Evolution of mobile radio communication, mobile radio telephony in entire world, examples of wireless communication system, 2G cellular networks, 3G wireless networks, WLL, LMDS, WLAN, PAN.

MODULE II:(12 Hours)
Frequency reuse, channel assignment strategies, hand off strategy, interference & system capacity, trunking& grade of service, improving coverage & capacity in cellular system, introduction to radio wave propagation, three basic propagation mechanisms, reflection, ground reflection model (tworay), Okumura model, Hata model.

MODULE III:(12 Hours)
Small scale multipath propagation, Types of small scale fading, Rayleigh &Rician Distribution,AM,FM, PM, linear modulation techniques, constant envelope modulation, hybrid modulation, spread spectrum modulation.

MODULE IV:(12Hours)

Equalization, training an adaptive equalizer, diversity technique, Rake receiver, multiple access, FDMA, TDMA, CDMA, capacity of cellular system.

TEXT BOOKS:

1. Wireless Communication, T. S. Rappaport, PHI
2. Mobile Communication , Jochen Schiller, Institute of Informatics, Freuie Universitat Berlin, 2nd edition, Pearson

CAD VLSI

Credit: 3 L-T-P:3-0-0 Course Code: ECE03

Prerequisite: Knowledge of IC design , Basics of VLSI ..
Objective: -To learn different types of VLSI Design methodologies ,VLSI design Automation tools, Design rules.
- To learn about different design steps to design a VLSI chip.

CO-1	Remember and understand the basic concepts/ Principles of CAD VLSI
CO-2	Analyse the various concepts to understand them through case studies

CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I VLSI Design Methodologies (12 lectures)

Introduction to VLSI Design methodologies, Review of Data structures and algorithms, Review of VLSI Design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, general purpose methods for combinatorial optimization.

MODULE II Design Rules(12 lectures)

Layout Compaction, Design rules, problem formulation, algorithms for constraint graph compaction, placement and partitioning, Circuit representation, Placement algorithms, partitioning

MODULE III Floor Planning and Simulation(12 lectures)

Floor planning concepts, shape functions and floor plan sizing, Types of local routing problems, Area routing, channel routing, global routing.

Simulation, Gate-level modelling and simulation, Switch-level modelling and simulation, Binary Decision Diagrams, Two Level Logic Synthesis.

MODULE IV Modelling And Synthesis(12lectures)

High level Synthesis, Hardware models, Internal representation, Allocation assignment and scheduling, Simple scheduling algorithm, Assignment problem, High level transformations.

Text Books

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons,2002.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002

MICROWAVE ENGINEERING

Credit: 3 L-T-P:3-0-0 Course Code:ECE04

Prerequisite: Basics of electromagnetic theory

Objective: To familiar the students with the wave guides, active and passive microwave devices and components used in microwave engineering. Also to impart knowledge of Microwave oscillators and amplifiers.

CO-1	Remember and understand the basic concepts/ Principles Microwave Engineering
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I.(12 hours)

MICROWAVE TRANSMISSION LINES and WAVE GUIDES: Introduction, Microwave Spectrum and Bands, Applications of Microwaves.RECTANGULAR WAVEGUIDES – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide.

CIRCULAR WAVEGUIDES: Introduction, Nature of Fields, Characteristic Equation, Dominant and Degenerate Modes. Impossibility of TEM mode.
Cavity Resonators– Introduction, Rectangular and Cylindrical Cavities, Dominant Modes and Resonant Frequencies, Q factor and Coupling Coefficients.

Module-II.(12 hours)

WAVEGUIDE COMPONENTS AND APPLICATIONS : Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads.
Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types. Waveguide Multiport Junctions – E plane and H plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2 Hole, Bethe Hole types. Ferrites– Composition and Characteristics, Faraday Rotation; Ferrite Components – Gyrator, Isolator, Circulator. Scattering Matrix– Significance, Formulation and Properties. S Matrix Calculations for – 2 port Junction, E plane and H plane Tees, Magic Tee, Directional Coupler, Circulator and Isolator.

Module-III.(12 hours)

MICROWAVE TUBES – I: Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications.
O-TYPE TUBES : 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for o/p Power and Efficiency. Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency.
HELIX TWTS: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations.

M-TYPE TUBES : Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation,

Module-IV.(12 hours)

MICROWAVE SOLID STATE DEVICES: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes. Avalanche Transit Time Devices – Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics.
MICROWAVE MEASUREMENTS: Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, VSWR, Cavity Q. Impedance Measurements.

TEXT BOOKS:

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI.

2. Elements of Microwave Engineering – R. Chatterjee, Affiliated East-West Press Pvt. Ltd.

REFERENCE BOOKS:

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition.
2. Microwave Circuits and Passive Devices, M.L. Sisodia and G.S.Raghuvanshi,Wiley Eastern Ltd.,
3. Microwave Engineering Passive Circuits – Peter A. Rizzi, PHI, 1999.
4. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th ed., 1955.New Delhi, 1988.
5. Microwave Principles – Herbert J. Reich, J.G. Ska

SATELLITE COMMUNICATION

Credit: 3 L-T-P:3-0-0 Course Code: ECE05

Prerequisite: Basics of digital communication, Antennas and wave propagation.
Objective: To explore the orbital mechanics, space craft sub-systems, satellite link design.

CO-1	Remember and understand the basic concepts/ Principles of Satellite Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module - I (12 Hours)
Introduction to state of satellite communication: Orbital mechanics and parameters,
Look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system (AOCS), TT&C, Description of spacecraft System - Transponders, Equipment reliability and space qualification. Satellite Link Design: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

Module -II (12 Hours)
Analog telephone and television transmission: Energy dispersal, digital transmission Multiple Access: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA. Spread Spectrum Transmission and Reception. DAMA, SCPC-DA and SPADE, Random access, Application of Satellite communication: Network distribution and direct broad casting TV, GPS satellites.

Module - III (12 Hours)
Propagation effects on satellite: Earth paths and influence on link design: Quantifying Attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects, Satellite Antennas: Types of antenna and relationships, Basic Antennas Theory - linear, rectangular & circular aperture. Gain, pointing loss.

Module-IV(12 hours)

Earth station Technology: Earth station design, Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas, Design of small earth station antennas: Front fed paraboloid reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station

Text Books:

1. Satellite Communication by T. Pratt, C. Bostian. 2nd Edition, John Wiley Co.

Reference Books:

1. Digital Communication with Satellite and Fiber Optic Application, Harlod Kolimbins, PHI
2.Satellite Communication by Robert M. Gagliardi, CBS Publishers
3. Digital Satellite Communications, Tri T. Ha, Mc Graw Hill

RADAR & TV ENGINEERING

Credit: 3 L-T-P:3-0-0 Course Code: ECE06

Prerequisite: Basics of analog and digital circuits, Analog and Digital communication, Antennas and wave propagation.

Objective: To impart the new concepts in wireless communications.

CO-1	Remember and understand the basic concepts/ Principles of Radar & TV
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE - I (12 hours)

Basic Television System And Scanning Principles: Block diagram of TV transmitter & receiver, Sound and picture transmission, scanning process, transmission & reception of video signal, brightness perception & photometric quantities, aspect ratio & rectangular scanning, persistence of vision & flicker, Kell factor, vertical and horizontal resolution, interlaced scanning, Composite Video Signal, Horizontal and Vertical Synchronous and Blanking Standard Signal, TV pick up tubes, Vidicon, CCD.

Module - II (12 hours)

Color and Digital TV Technology: mixing of colors and colors perception, chromaticity diagram, color TV signals & transmission, NTSC & PAL system, color TV receiver & specification, Fully digital TV system, Digital TV signal & transmission, digitized video parameters, digital TV receiver, fundamentals of Flat panel displays, Plasma displays, Liquid crystal displays, and Large screen

displays.

Module - III (12hours)

Introduction to Radar: Basic radar, radar block diagram, radar frequencies & applications, Radar Indicators.**RADAR Equation:** Detection of signal in noise, receiver noise and SNR, probability of detection and false alarm, integration of radar pulses, radar cross section of targets, PRF, system losses.

Module - IV (12hours)

MTI, CW, FMCW RADAR: Introduction, delay line cancellers, Doppler filter banks, limitation of MTI, Staggered PRF, Pulse Doppler radar, Tacking by RADAR, mono pulse, sequential lobing, & conical scan of targets.

Text Books:

1. Television and video Engineering by A. M Dhake, 2nd edition, Tata McGraw Hill.
2. Introduction to RADAR systems by Merrill I. Skolnik, 3rd edition, Tata McGraw Hill.

Reference Books:

1. Modern Television Practice-Principles, Technology and Servicing, by R R Gulati.
2. Basic Television & Video systems, Bernard Grob, Charles E Hernfon, 6th edition, McGRAW HILL.
3. RADAR Principles, Technology, Application by Byron Edde, 1st edition, Pearson, 2004.
4.Understanding RADAR system by Simon Kingsley, Shaun Quegan, Standard publication.
5. Principles of RADAR by J. C. Toomay, PHI, 2nd edition, 2004.

MOBILE COMMUNICATION

Credit: 3 L-T-P:3-0-0 Course Code: ECE07

Prerequisite: Basics of analog and digital communication and antenna fundamentals.

Objective: To impart the basic concepts how mobile communication is done and various modulation techniques are used for signal transmission. Also how to increase system capacity by using various multiple access techniques.

CO-1	Remember and understand the basic concepts/ Principles of Mobile Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I.(12 hours)

A brief introduction to Mobile Telephony, Technologies and Choices.Cellular Concept – System Design: Fundamentals: Frequency reuse, Channel Assignment, Handoff Strategies, Interferences and System Capacity, Trunking and Grade of Service; Improving coverage and capacity in Cellular Systems

– Cell Splitting, Sectoring, Repeaters and Range Extension, Microcell &Picocell Zone Concept. Antennas for Base Station and hand held Cellular phone.

Module-II.(12 hours)

Mobile Radio Propagation : Large –Scale path loss, Ground Reflection Model , Diffraction, Scattering. Outdoor propagation Model – Okumura Model; Indoor Propagation Model: Partition loses, Log distance Path loss Model. Small Scale Fading and Multipath, DopperShift .Types of Small Scale Fading and their effect on received signal.

Module-III.(12 hours)

Digital Modulation : ASK,FSK,QPSK,л/4-QPSK, MSK and GMSK. Spread Spectrum Techniques – DS-SS and FH-SS. Multiple access,FDMA, TDMA, CDMA, capacity of cellular system.

Module-IV.(12 hours)

Equalization, training an adaptive equalizer, diversity technique, Rake receiver,
Global System for Mobile (GSM): features, architecture, channel types, Frame Structure in GSM. Signal processing in GSM , CDMA Architecture.

TEXT BOOKS:

1. Wireless Communication, 2nd Edition by Theodore S. Rappaport , Pearson Publication.
2. Mobile Communication Engg., 2nd Edition by William C. Y. Lee McGraw Hill International Edition.

REFERENCE BOOKS:

1. Mobile Cellular Communications, 2nd Edition by William C. Y. Lee McGraw Hill International Edition.
2. Mobile Communication, 2nd Edition by Jocken Schiller, Pearson Education.
3. Wideband Wireless Digital Communication by Andreas F. Molisch Editor Pearson Education.

VIRTUAL INSTRUMENTATION

Credit: 3 L-T-P:3-0-0 Course Code: ECE08

CO-1	Remember and understand the basic concepts/ Principles of Virtual Instrumentation
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I:(12Hours)

Introduction to basic instrumentation system Overview of instrumentation system and internals, Origin of signals and the various types of signal acquiring devices such as sensors and transducers : Bending and stress Strain gauge Bridges Various types of sensors.

MODULE II:(12Hours)
The concepts of signal conditioning : Scaling, Offset, Filter, Control System basics: Feedback control concepts, Controller structure and parameters, Transfer Function System Stability.

MODULE III:(12Hours)
Introduction to Virtual Instrumentation System: Concepts ,Architecture , Distributed VI, Advantages, G' Language concepts: Introduction , LabVIEW basics, LabVIEW environment , What Advantages Does This Bring to the Developer? LabVIEW Component Oriented Design(LCOD): Components & Design ,
LCOD Implementation, LCOD Complementary Techniques: State Machines, Graphical User Interface (GUI) Design and Prototyping, Abstraction in the Code, Detail Outside the Code, Error Handling, Pre- and Post conditions: Check What Comes In and What Goes Out & Reuse.

MODULE IV:(12Hours)
Hardware aspects : Acquisition in LabVIEW, DAQ Hardware, DAQ components, Using DAQ assistant, Case Studies and Student seminars.

TEXT BOOKS:
1. LabVIEW based Advanced Instrumentation by S. Sumati& P. Surekha, Springer publishers.

REFERENCE BOOKS:
1. A Software Engineering Approach to LabVIEW™, Jon Conway, Steve Watts, Prentice Hall PTR.
2. LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Third Edition, Jeffrey Travis, Jim Kring, Prentice Hall.
3. Learning with LabVIEW 7 Express by Robert H.Bishop.Pearson Prentice Hall. 2005

IC TECHNOLOGY

Credit: 3 L-T-P:3-0-0 Course Code: ECE09

Prerequisite: Knowledge of IC design , Basics of VLSI
Objective:-To learn about fabrication of ICs.
- To learn about different process involved to fabricate an IC.

CO-1	Remember and understand the basic concepts/ Principles of IC Technology
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE-I (12Hours)
Introduction: Introduction to IC Technology: Basic fabrication steps and their Importance. Environment of IC Technology: Concepts of Clean room and safety requirements,

MODULE-II(12Hours)
Processes used in fabrication of modern integrated circuits: Process steps for crystal growth, Concepts of Wafer cleaning processes and wet chemical etching techniques.
Impurity Incorporation: Solid State diffusion modelling and technology; Ion Implantation modelling, technology and damage annealing, characterization of Impurity profiles Oxidation: Kinetics of Silicon

dioxide growth both for thick, thin and ultra thin films, Oxidation technologies in VLSI and ULSI, Characterization of oxide films, High k and low k dielectrics for ULSI.

MODULE-III (12Hours)

Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation. Chemical Vapour Deposition Techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon: modelling and technology.

MODULE-IV (12Hours)

Metal Film Deposition: Evaporation and sputtering techniques, Failure mechanisms in metal interconnects Multi-level metallization schemes. Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

TEXT BOOKS:

1. S.M.Sze (2nd Edition)"VLSI Technology", McGraw Hill Companies Inc,2003
2. C.Y. Chang and S.M. Sze, "ULSI Technology", McGraw Hill Companies Inc, 1996.

REFERENCES TEXT BOOKS:

1. Stephena, Campbell,"The Science and Engineering of Microelectronic Fabrication", Second Edition, Oxford University Press, 2005.
2. James D.Plummer, Michael D.Deal, "Silicon VLSI Technology" Pearson Education

Speech and audio processing

Credit: 3 L-T-P:3-0-0 Course Code: ECE10

CO-1	Remember and understand the basic concepts/ Principles of Speech and audio processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Speech Communication: Introduction, discrete-time speech signal processing, speech communication, review of signals and linear systems.Speech Production and acoustic phonetics: Anatomy and physiology of speech organs, speech sounds andclassification, International Phonetic Alphabet (IPA), Articulatory Phonetics: Manner of articulation and place ofarticulation, vowel triangle, Acoustic Phonetics: spectrograms, wide-band and narrow-band spectrograms, acoustic characteristics of speech sounds, coarticulation and prosody.

Module-II(12Hours)

Time-domain models for speech processing: Introduction to short-time speech analysis, windowing, short-time energy and average magnitude, short-time Zero-Crossing Rate (ZCR), speech vs. silence discrimination using energy and zero crossings, short-time autocorrelation function, short-time Average Magnitude Difference Function(AMDF), Short-time Fourier analysis: Short-time Fouriertransform (STFT), spectral displays, time-frequency resolution tradeoffs, Linear filtering interpretation, short-time synthesis, filter bank summation method.

Module-III(12Hours)
Linear Predictive Analysis: Basic principles of Linear predictive analysis,autocorrelation method and covariance method, computation of gain for the model, prediction error signal, frequency domain interpretation of LP analysis, frequency domain interpretation of mean-squared prediction error, applications of LPC parameters.

Module-IV(12Hours)
Homomorphic Signal Processing: Concept of Homomorphic processing, Homomorphic systems for convolution, properties of complex cepstrum, Homomorphic filtering, complex cepstrum of voiced speech, complex cepstrum of unvoiced speech, Mel-scale cepstrum
Speech Coding: Fundamentals of coding, liner prediction and harmonic noise models in speech coding, modeling excitation for voiced and unvoiced speech, Code-Excited linear prediction coding
Reference Books:
1.Speech Communication: Human and machine, D.O'Shaughnessy, Uniiversity Press
2.Digital Processing of Speech Signals, L. Rabiner and R. Schafer, Pearson Education
3.Discrete-time Speech Signal Processing, T. Quatieri,
Pearson Education

ADAPTIVE SIGNAL PROCESSING

Credit: 3 L-T-P:3-0-0 Course Code: ECE11

Prerequisite: Basics of digital signal processing and statistics.

Objective: To help the students to understand and solve complex problems in power spectrum estimations and signal processing. Also how the adaptive filters are used to deal with random signal propagating through wireless medium.

CO-1	Remember and understand the basic concepts/ Principles of Adaptive Signal Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Multirate Digital Signal Processing:Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by rational factorI/D, Filter Design and Implementation for sampling-rate, Multistage implementation of sampling rate conversion, Sampling rate conversion of Band pass signal,

Application of multi rate signal processing: design of phase shifters, Implementation of narrowband lowpass filters. Implementation of Digital filter banks. Filter Bank and Sub-band Filters and its applications.

Module-II(12Hours)

Linear prediction and Optimum Linear Filters:Innovations Representation of a stationary random process, Forward and Backward Linear Prediction, Solution of the normal equations, Properties of the linear prediction-error filters, AR lattice and ARMA lattice- ladderfilters, Wiener filter for filtering and Prediction: FIR Wiener Filter, Orthogonality Principle in linear mean-square estimation.

Module-III(12Hours)

Power Spectrum Estimation:Estimation of spectra from finite-duration observation of signals, Non parametric method for power spectrum estimation: Bartlett method, Blackman and Turkey method, parametric method for power estimation: Yuke-Walker method, Burg method, MA model and ARMA model.

Module-IV(12 Hours)

Adaptive Signal Processing:Basics of Wiener filtering, Widrow-Hopf Equation, Least mean square algorithm, Recursive least square algorithm, variants of LMS algorithm: FX-LMS, Fast LMS, N-LMS, PN-LMS. Design of Adaptive FIR & IIR filters, Application of adaptive signal processing: Adaptive linear combiner, System identification, Channel equalization, adaptive noise cancellation, adaptive line enhancer.

Text Books:

1. Digital Signal Processing, Third Edition, J.G. Proakis and D.G. Manolakis, Prentice Hall.
2. Adaptive Signal Processing, B. Widrow and Stern,

Reference Books:

1. Digital Signal Processing, by Sanjit K Mitra, new edition, TMH.
2. Digital Signal Processing, by Salivahanan, new edition, TMH.

ANTENNAS AND PROPAGATION

Credit: 3 L-T-P:3-0-0 Course Code: ECE12

Pre-requisite

Electromagnetic field theory, Maxwell equations, Vector calculus, Coordinate transformations.

Objective

To teach the students about the concept of antenna and its characteristics.

CO-1	Remember and understand the basic concepts/ Principles of Antenna and Propagation
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I.(12 hours)

Introduction, basic antenna parameters,Radiation pattern, radiation power density,radiation intensity, directivity, beam efficiency,aperture concept, effective height, polarization,input impedance, gain ,radiation efficiency, beam width, bandwidth, beam efficiency, FRIIS, transmission equation, Basic concepts of Maxwell's equation, vector potential, wave equation, near field and far fieldradiation, dual equations for electric andmagnetic current sources.

Module-II.(12 hours)

Linear wire antennas: Infinitesimal dipole its radiation field, radiation, resistance, radiation sphere, ear field, far fielddirectivity, small dipole, finite length dipole, halfwave length dipole, linear elements near or oninfinite perfect conductors, ground effects andtheir application, Folded dipole, sleeve dipoleand their applicationsLoop Antenna:Small loop comparison of small loop with shortdipole, radiation pattern its parameters and theirapplication.

Module-III.(12 hours)

Arrays:Linear arrays, planner arrays and circular arrays.Array of two isotropic point sources, nonisotropic sources, principle of patternmultiplication linear arrays of n elements,broadside, Endfire radiation pattern, directivity,Beamwidth and null directions, arrayfactor. Antenna analysis usingDolph-Tschebyscheff.Frequency Independent Antennas:Log periodic and Helical antennas.Microstrip antennas:Rectangular & circular patch applications andfeed network. Reflector antennas: Plane reflector, corner reflector, procedures,Radiation mechanisms Dielectric waveguide,dielectric resonator, dielectric horn antenna.

Module-IV.(12 hours)

Antenna Measurement: Antenna Ranges, Radiation Pattern, Gain anddirectivity, Polarization. Radio wave propagation Ground wave propagation, Ionospheric propagation, Propagation losses.

TEXT BOOKS:

1. Antenna Theory analysis and design,Costantine A. Balanis, John Wiley publication
2. Electromagnetic, Jordan Balmann, Prentice Hall of India publication

REFERENCE BOOKS:

1. Antennas-John D. Kraus, Tata McGraw Hill publication
2. Harish A. R., Antenna and wave propagation, Oxford University Press.

BIOMEDICAL INSTRUMENTATION

Credit: 3 L-T-P:3-0-0 Course Code: ECE13

CO-1	Remember and understand the basic concepts/ Principles of Biomedical Instrumentation
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: (12 Hours)

Basic concepts of medical instrumentation, Generalized Medical instrumentation system - characterizing medical instruments, Terminology, measurement systems, signals and noise, electric circuits Review of measurement devices, displacement transducers, ohmmeters and bridge circuits, measurement of temperature ,potentiometer circuits.

Use of statistical methods for measurements: Statistics and instruments, statistical processing of signals, principles of signals fundamentals of time and frequency domain analysis. Analog and digital signals and converters - data processing systems, data acquisition and storage systems - recording and display systems.

MODULE-II (12 Hours)

Transducer for biomedical application, mechanical measurements, measurement of force, pressure transducers, direct measurement of blood pressure, indirect measurement of blood pressure , sensing heart sounds measurement of flow, thermal flow measurement, measurement of volume and flow, electromagnetic flow. Sensors, doppler flow measurement plethysmography, electrical Impedance of biological tissue.

Review of concept of electrical impedance: impedance bridge circuits determining biological events by electrical impedance. Biopotentials and their measurement: measurement of biopotentials.

Review of physics of electric fields: Biological origin of electrical Potentials, electrochemical electrodes, biopotential electrodes, Microelectrodes, biopotential amplifiers, Examples of biopotential electrodes and signals.

Review of operational amplifier circuits , the Instrumentation amplifier.

MODULE-III (12 Hours)

The electrocardiograph, the electromygraph, noise and interference in biopotential measurement, cardiotachometers. Biomedical signal processing, filtering, averaging, integrating.

Sensors and clinical lab instrumentation: Optical sensing: review of Physics of light, light detecting devices, elementary biomedical Applications: electrochemical sensors, nearest equation, potentiometric sensors, measurement of pH, measurement of co2. Aperometric sensors: Measurement of oxygen.

Clinical lab Instrumentation : blood gas measurement, Bioanalytical sensors: glucose sensors, chemical sensors, colorimetric sensing - the pulse oximeter.

MODULE-IV (12 Hours)

Instrumentation in molecular and cell biology, measurement of Pulmonary variables, measurement of lung volumes, measurement of air Flow, breathing and apnea monitoring,

Instrumentation for biomaterials Studies: tissue characterization, visco elastic properties,Biocompatibility instrumentation in molecular biology: DNA sequencing Technologies, molecular diagnostics , polymerase chain reactors. Blotting techniques.

Instrumentation in cellular biology: fluoresnce assisted cell sorting, recombination techniques, bioreactors.

Instrumentation in critical care medicine: cardiac monitoring, Neonatal Intensive care: fetal monitoring

REFERENCE BOOKS:

1. Bio- instrumentation, John.G. Webster, John Wiley and Sons, 2004.
2. Bio- instrumentation and Bio-sensors, Wiley ISTE, 2012.

Telephone Switching And Networks

Credit: 3 L-T-P:3-0-0 Course Code: ECE14

Pre-requisite Basic telephone communication system and network topologies.
ObjectiveThe objective of the course is to provide a knowledge on digital telephone network, advanced technologies used in the telephone switching system and the network switching.

CO-1	Remember and understand the basic concepts/ Principles of Telephone Switching and Networks
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Introduction: Evolution, simple telephone communication, basics of switching systems, telecommunication networks. Electronic space division switching: Stored program control, centralized and distributed SPC, software architecture, application software, enhanced software, two and three stage networks.

Module-II(12 Hours)

Time Division Switching: Basic time division space switching, basic time division time switching, time multiplexed space and time switching, combination switching, three-stage combination switching.

Module-III(12 Hours)

Traffic Engineering: Network traffic load and parameters, Grade of service, modeling switching systems, incoming traffic and Service Time Characterization. Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, signaling techniques.

Module-IV(12 Hours)

Computer and Data Networks: Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, LAN, MAN, an overview of data network standards. Integrated Service Digital Network: Motivation, new services, transmission channels, signaling, service characterization, broad band ISDN, voice data integration.

Text Books:

1. Telecommunication Switching Systems and Networks by Thiagarajan Viswanathan, PHI.

Reference Books:

1. Telecommunication Switching Systems and Networks by P.Gnanasivam,New age International.
2. W. Stallings, Data and Computer Communications, PHI, New Delhi, 2006

3. Data Communications and Networking - by Behrouz A Forouzan

Mixed Signal Design

Credit: 3 L-T-P:3-0-0 Course Code: ECE15

CO-1	Remember and understand the basic concepts/ Principles of Mixed Signal Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Switched Capacitor filters: Introduction to Analog and Discrete Time signal processing, sampling theory, Nyqist and over sampling rates, Analog filters, analog amplifiers, lock in amplifiers, analog integrated and discrete time switched capacitor filters, non idealities in switched capacitor filters, architectures for switched capacitor filters and their applications and design. Switched capacitor amplifiers.

Module-II(12Hours)

Data converters: Basics of data converters, Types of data converters, types of ADCs, Successive approximation, dual slope, Flash type, pipelined ADCs, hybrid ADCs, high resolution ADCs, parallel path ADCs like time-interleaved and multi-channel converters.

Module-III(12Hours)

Types of DACs and their architectures, binary weighted DACs. Performance metrics of data converters, SNR, SFDR, SNDR. Background and foreground techniques to improve performance of data converters, Green data converters (low power design).

Module-IV(12Hours)

Frequency synthesizers and synchronization:Analog PLLs, Digital PLLs design and architectures, Delay locked loops design and architectures. Direct Digital Synthesis.

Reference Books:

1.CMOS mixed-signal circuit design by R. Jacob Baker Wiley India, IEEE press, reprint 2008
2.Switched-Current Signal Processing and A/D Conversion Circuits: Design and Implementation, R. Jacob Baker, Wiley India IEEE press 2008.
3.Mixed Signal Systems: a guide to CMOS circuit design, Andrzej Handkiewicz, IEEE computer Society Press.
4.Mixed Signal and DSP Design techniques, EngineeringAnalog Devices Inc, Engineering Analog Devices Inc, Walt Kester, Publisher Newnes.
5.Digital Frequency Synthesis Demystified, Bar-Giora Goldberg, Elsevier. Published by Newnes

BROADBAND COMMUNICATION

Department of Electronics & Communication Engineering
Curriculum of B. Tech (Electronics & Communication Engineering)
2020-2024

Credit: 3 L-T-P:3-0-0 Course Code: ECE16

Pre-requisite
A brief study on computer networking and data transmission is needed

Objective
The objective of the course is to provide a complete knowledge of efficient and secure data transmission over a computer network.

CO-1	Remember and understand the basic concepts/ Principles of Broad band Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I (12 Hours)

FUNDAMENTALS CONCEPTS:-Components & Network architecture of Broadband communication system. Cable broadband data network architecture, Importance & Future of broadband telecommunication. **INTERNET BASED NETWORK**:- Internet protocol suite, IPv6,applications & services, voice over IP, Internet security. **INTRANET & EXTRANET**:- Overview, Intranet Technology, Extranet Technology,. Topology model, Intranet & Extranet applications.

Module-II.(12 hours)

NETWORKING TECHNOLOGIES:- X.25 Technology, Frame realy, Frame realy vs.x.25, Frame realy applications, Fiber channel Technology & topologies, classes of services, Benefits and applications. **SONET-** Signal frame components, topologies advantages applications, and disadvantages, Introduction to SDH.

Module-III.(12 hours)

Virtual Private Network:-Introduction, types, general architecture, advantages & disadvantages of VPN, VPN security issues. **ISDN & BISDN- ISDN:-** ISDN Devices & Interfaces, services, Architecture, applications. **BISDN-** Interfaces & Terminals, protocol architecture applications of BISON.

ATM technology: - Introduction, Network, Service classes, applications, advantages & disadvantages. **Digital Subscriber line** :- DSL system technology Future of DSL systems & Broadband systems, XDSL standards (ASDL, HDSL,VDSL,SDSL)**Cable Modem systems** :- Cable modem technology, External & Internal modem, comparison between Broadband DSL and Cable modem Technology.

Module-IV.(12 hours)

Wireless LAN: Physical layer & Topology, Technologies, Applications. **Wireless ATM** : Overview & Architecture of ATM. Wireless PAN, Wimax **Network Management & Security: -** Network management architecture, protocol, simple Network Management protocol (SNMP)**Network Security**:- Requirement, Network Threats cryptography, Firewalls, Access control Methods.

TEXT BOOKS:

1. Broadband Communication System by AKUJUOBI & SADIKU (PHI)

REFERENCE BOOKS:

1. Broadband Communication by Balaji Kumar.

ELECTRICAL MACHINES

Credit: 3 L-T-P:3-0-0 Course Code: ECE17

CO-1	Remember and understand the basic concepts/ Principles of Electrical machines
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I.(12 hours)

Electrical machine types – Magnetic circuits – Inductance – Statically and Dynamically induced EMF, Torque – Hysteresis- Core losses - AC operation of magnetic circuits. Transformers: Construction , principle of operation , equivalent circuit, losses, testing, efficiency and voltage regulation, auto transformer, three phase connections, parallel operation of transformers, tap changing. Electromechanical energy conversion: Energy in magnetic systems, field energy, coenergy and mechanical force, singly and multiply excited systems.

Basic concepts in rotating machines: Generated voltages in ac and dc machines, mmf of distributed windings – magnetic fields in rotating machines, rotating mmf waves, torque in ac and dc machines. DC machines: Construction – EMF and torque, circuit model, armature reaction, commutation, methods of excitation, characteristics of generators, characteristics of motor, starting and speed control. testing and efficiency, parallel operation.

Module-II.(12 hours)

Synchronous generator : Constructional details, Types of rotors, emf equation, Synchronous reactance, Armature reaction, Voltage regulation, EMF, MMF, ZPF and A.S.A methods, Synchronizing and parallel operation, Synchronizing torque, Change of excitation and mechanical input, Two reaction theory, Determination of direct and quadrature axis synchronous reactance using slip test ,Operating characteristics, Capability curves. Synchronous motor: Principle of operation, Torque equation, Operation on infinite bus bars, V-curves, Power input and power developed equations, Starting methods, Current loci for constant power input, constant excitation and constant power developed.

Module-III.(12 hours)

Single phase induction motors and special machines: Constructional details of single phase induction motor, Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test ,Performance analysis, Starting methods of single-phase induction motors Shaded pole induction motor, Linear reluctance motor , Repulsion motor, Hysteresis motor, AC series motor.

Module-IV.(12 hours)

Three phase induction motor: Constructional details, Types of rotors, Principle of operation, Slip, Equivalent circuit, Slip-torque characteristics, Condition for maximum torque, Losses and efficiency, Load test, No load and blocked rotor tests , Circle diagram, Separation of no load losses, Double cage rotors, Induction generator, Synchronous induction motor. Starting and speed control of three phase induction motor: Need for starting, Types of starters, Rotor resistance, Auto-transformer and Star-delta starters, Speed control, Change of voltage, torque, number of poles and slip Cascaded connection, Slip power recovery scheme.

TEXT BOOKS:

1. Electrical Machines I. J. Nagrath & D.C. Kothari Tata Mac Grew Hill
2. A text book of Electrical Technology and Principles by B.L Theraja, S.Chand Publications.

REFERENCE BOOKS:

1. Generalized Theory of Electrical Machines - Dr. P. S. Bimbhra, Publisher, Khanna.
2. Electrical Machines, by J B Gupta Publisher, S.K. Kataria, 1994.

ADVANCED MICROCONTROLLERS

Credit: 3 L-T-P:3-0-0 Course Code: ECE18

CO-1	Remember and understand the basic concepts/ Principles of Advanced Microcontrollers
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: AVR MICROCONTROLLER ARCHITECTURE (12 Hours)

Architecture, memory organization, addressing modes, instruction set, programming techniques, Assembly language & C programming, Development Tools, Cross Compilers, Hardware Design Issues.

Peripheral of AVR Microcontroller: I/O Memory, EEPROM, I/O Ports, SRAM, Timer, UART,Interrupt Structure, Serial Communication with PC, ADC/DAC Interfacing.

MODULE **II: ARM ARCHITECTURE AND PROGRAMMING(12 Hours)**

RISC Machine: Architectural Inheritance, Core & Architectures, Registers, Pipeline, Interrupts, ARM organization, ARM processor family, Co-processors.

Instruction set, Thumb instruction set, Instruction cycle timings, The ARM Programmer's model, ARM Development tools, ARM Assembly Language Programming andC-compiler programming.

MODULE III: ARM APPLICATION DEVELOPMENT(12 Hours)

Introduction to DSP on ARM, FIR Filter, IIR Filter, Discrete fourier transform, Exception Handling, Interrupts, Interrupt handling schemes, Firmware and bootloader, Example: Standalone, Embedded Operating Systems, Fundamental Components, Example Simple little Operating System

MODULE IV:DESIGN WITH ARM MICROCONTROLLERS(12 Hours)

Integrated development environment – Standard I/O Libraries - User Peripheral Devices – Application of ARM processor: Wireless Sensor Networks, Robotics.

TEXT BOOKS:

1. Avr Microcontroller and Embedded Systems: Using Assembly and C, Janice Mazidi, SarmadNaimi, Muhammad Ali Mazidi, Prentice Hall.
2. Developer's Guide Designing and Optimizing System Software', Elsevier.
3. Trevor Martin, 'The Insider's Guide To The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd.

REFERENCE BOOKS:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System
2. Steve Furber, 'ARM system on chip architecture', Addision Wesley
3. Dananjay V. Gadre 'Programming and Customizing the AVR microcontroller', McGraw Hill.
4. ARM Architecture Reference Manual
5. LPC213x User Manual.

IMAGE AND VIDEO PROCESSING

Credit: 3 L-T-P:3-0-0 Course Code: ECE19

Pre-requisite

A fundamental study on matrix convention, probability theory, statistical principles and basic digital processing techniques are needed to be learned.

Objective

The objective of the course is to comprehend the digital image and video processing techniques to incorporate the ideas into the visual analysis systems.

CO-1	Remember and understand the basic concepts/ Principles of Image and Video Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image –Basic relationship between pixels Image Transforms: 2 –D Discrete FourierTransform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods:

Module-II(12Hours)

Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation
concepts, point, line and Edge detection, Thresholding, region based segmentation Image

Module-III(12Hours)
Compression Image compression fundamentals –coding Redundancy, spatial and temporal redundancy. Compression models: Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , waveletcoding.

Module_IV (12Hours)
JPEG standards Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations 2-D Motion Estimation:
Optical flow, general methodologies, pixel based motion estimation, Block
matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motionestimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TEXT BOOKS
1. Gonzaleze and Woods ,"Digital Image Processing ", 3rdedition , Pearson
2. Yao wang, Joem Ostarmann and Ya –quin Zhang, "Video processing and communication ",1stedition , PHI

REFERENCE TEXT BOOK
1. M. Tekalp ,"Digital video Processing", Prentice Hall International

SIMULATION TEXT BOOKS
1.Relf, Christopher G.,"Image acquisition and processing with LabVIEW",
CRC press
2.Aner ozdemi R,"Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms",John Wiley & Sons
3.Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image ProcessingA Practical Approach with Examples in Matlab",John Wiley &Sons.

DIGITAL IMAGE PROCESSING

Credit: 3 L-T-P:3-0-0 Course Code: OPEE08

Prerequisites: A fundamental study on matrix convention, probability theory and statistical principles are needed to be learned.
Objective: The objective of the course is to understand a digital image and different processing techniques for the better analysis of an image.

CO-1	Remember and understand the basic concepts/ Principles of Digital Image Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT – I: DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS (12Hours)
Elements of visual perception: Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Image sampling and quantization Basic relationship between pixels:

Basic geometric transformations-Introduction to Fourier Transform and DFT : Properties of 2D Fourier Transform , FFT, Separable Image Transforms ,Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.Perspective Projection, Spatial Domain Filtering, sampling and quantization.

UNIT – II: IMAGE ENHANCEMENT TECHNIQUES(12Hours)
Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters,Laplacian filters, Frequency domain filters : Smoothing, Sharpening filters,Homomorphic filtering.

UNIT – III: IMAGE RESTORATIONAND IMAGE COMPRESSION(12Hours)
Model of Image Degradation/restoration process: Noise models, Inverse filtering, Least mean square filtering, Constrained least mean square filtering, Blind image restoration, Pseudo inverse, Singular value decomposition.

Lossless compression: Variable length coding: LZW coding, Bit plane coding- predictive coding, DPCM.
Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization

UNIT – IV: IMAGE SEGMENTATION AND REPRESENTATION (12Hours)
Edge detection: Thresholding, Region Based segmentation, Boundary representation: chair codes, Polygonal approximation, Boundary segments: boundary descriptors: Simple descriptors, Fourier descriptors, Regional descriptors, Simple descriptors, Texture

TEXT BOOKS:

1. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing, By Anil K Jain
2. Digital Image Processing, By William K Pratt, John Willey (2001)
3. Image Processing Analysis and Machine Vision, By MillmanSonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniy (1999).
4. Digital Image Processing and Applications, By, B. Chanda, D. DuttaMagundar, Prentice Hall of India, 2000.

CONTROL SYSTEM ENGINEERING – II (EEC362)

CO-1	Remember and understand the basic concepts/ Principles of Control System Engineering-II
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module -I : (12 Hours)

State Variable Analysis & Design: Concepts of State, State Variables and State Model (of continuous time systems): State Model of Linear Systems, State Model for Single-Input-Single-Output Linear Systems, Linearization of the State Equation. State Models for Linear Continuous – Time Systems: State-Space Representation Using Physical Variables, State – space Representation Using Phase Variables, Phase variable formulations for transfer function with poles and zeros, State – space Representation using Canonical Variables, Derivation of Transfer Function for State Model. Diagonalization: Eigenvalues and Eigenvectors, Generalized Eigenvectors. Solution of State Equations: Properties of the State Transition Matrix, Computation of State Transition Matrix, Computation by Techniques Based on the Cayley-Hamilton Theorem, Sylvester's Expansion theorm. Concepts of Controllability and Observability: Controllability, Observability, Effect of Polezero Cancellation in Transfer Function. Pole Placement by State Feedback,

Module-II : (12 Hours) Discrete - Time Control Systems : Introduction: Discrete Time Control Systems and Continuous Time Control Systems, Sampling Process. Digital Control Systems: Sample and Hold, Analog to digital conversion, Digital to analog conversion. The Z-transform: Discrete-Time Signals, The Z-transform, Z-transform of Elementary functions, Important properties and Theorms of the Z-transform. The inverse Z-transform, ZTransform method for solving Difference Equations. Z-Plane Analysis of Discrete Time Control Systems: Impulse sampling & Data Hold, Reconstruction of Original signals from sampled signals: Sampling theorm, Aliasing Effect.

Module-III : (12 Hours) Pulse Transfer function: Starred Laplace Transform of the signal involving Both ordinary and starred Laplace Transforms; General procedures for obtaining pulse Transfer functions, Pulse Transfer function of open loop and closed loop systems. Mapping between the s-plane and the z-plane, Stability analysis of closed loop systems in the z-plane: Stability analysis by use of the Bilinear Transformation and Routh stability critgion, Jury stability Test.

Module -IV : (12 Hours) Nonlinear Systems : Introduction : Behaviour of Non linear Systems, Investigation of nonlinear systems. Common Physical Non Linearities: Saturation, Friction, Backlash, Relay, The Phase Plane Method: Basic Concepts, Singular Points: Nodal Point, Saddle Point, Focus Point, Centre or Vortex Point, Stability of Non Linear Systems: Limit Cycles, Construction of Phase Trajectories, The Describing Function Method: Basic Concepts: Derivation of Describing Functions: Dead-zone and Saturation, Relay with Dead-zone and Hysteresis, Backlash. Stability Analysis by Describing Function Method: Relay with Dead Zone, Relay with Hysteresis, Jump Resonance. Liapunov's Stability Analysis: Introduction, Liapunov's Stability Critrion: Basic Stability Theories.

Text : 1. Discrete-Time Control System, by K.Ogata, 2nd edition (2009), PHI.

2. Control Systems Engineering, by I.J. Nagrath and M.Gopal., 5th Edition (2007 / 2009), New Age International (P) Ltd. Publishers.

Reference :

1. Design of Feedback Control Systems by Stefani, Shahian, Savant, Hostetter, Fourth Edition (2009), Oxford University Press.

2. Modern Control Systems by K.Ogata, 5th Edition (2010), PHI.

3. Modern Control Systems by Richard C. Dorf. And Robert, H.Bishop, 11th Edition (2008), Pearson Education Inc. Publication.

4. Control Systems (Principles & Design) by M.Gopal, 3rd Edition (2008), Tata Mc.Graw Hill Publishing Company Ltd.

5. Control Systems Engineering by Norman S.Nise, 4th Edition (2008), Wiley India (P) Ltd

PRINCIPLES OF COMMUNICATIONS

Credit: 3 L-T-P:3-0-0 Course Code:ECOE01

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Pre-requisite:A fundamental study on signal system and advanced electronic circuits is needed to be studied prior to the study of Principle of communication.

Objective: The objective of the course is to provide a knowledge on basic and advanced communication systems

CO-1	Remember and understand the basic concepts/ Principles of Communications
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: AMPLITUDE AND ANGLE MODULATION (12Hours)

Amplitude modulation: Block diagram of Electrical communication system, Radio communication, Need for modulation, Types of Amplitude modulation and demodulation.

Angle Modulation: Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Comparison of FM & PM, FM modulators and FM demodulators, necessity of pre-emphasis and de-emphasis.

MODULE II:(12Hours)

Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, PWM and PPM, Time Divison Multiplexing, Frequency Divison Multiplexing.

Digital Communication: Advantages, Block diagram of PCM, Quantization.

MODULE III:(12 Hours)

Digital Modulation: ASK, FSK, PSK, and DPSK, QPSK modulation and demodulation, M-ary modulation techniques.

Information Theory and Coding: Discrete messages and information content, source coding, Shanon ‘s theorem, channel capacity, Block codes- coding and decoding, burst error correction(BRC), Convolutional coding, decoding convolutional code.

MODULE IV:(12Hours)

Spread Spectrum Modulation: Use of spread spectrum, direct sequence spread spectrum, frequency hopping spread spectrum, Pseudo random sequences – generation and characteristics..

Advanced Communication Systems: Telephone switching, Computer communication, Optical communications, Mobile telephone communication- the Cellular concept, Satellite communications, RADAR systems.

TEXT BOOKS:

1. Communication Systems, Simon Haykin, John Wiley.
2. Principles of Communications – H. Taub and D. Schilling, Gouthamsaha, TMH.

REFERENCE BOOKS:

3. Communication Systems Analog and Digital – R.P. Singh and S D Sapre, TMH, 2nd Edition, 2008.
4. Digital and Analog Communication Systems – K Sam Shanmugam,WSE,2006.
5. Electronic &Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
6. Modern Digital and Analog communication Systems – B.P Lathi, Oxford 3rd edition.