2nd Year 4th semester

National Institute of Technology Raipur												
Course of Study and Scheme of Examination							B. Tech. 4th Semester				Branch: ECE	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
							MSE/MTR		ESE/ESVE			
			L	T	P		Theory	Prac.	Theory	Prac.		
1	EC104101EC	Electro-Magnetic Field Theory	3	1	0	20	30		50		100	4
2	EC104102EC	Digital Signal Processing	3	1	0	20	30		50		100	4
3	EC104103EC	Computer System Architecture	3	0	0	20	30		50		100	3
4	EC104104EC	Linear Integrated Circuits and Applications	3	0	0	20	30		50		100	3
5	EC104105EC	Analog Communication	3	1	0	20	30		50		100	4
6	MA104001MA	Mathematics IV	4	0	0	20	30		50		100	4
7	EC104401EC	DSP Laboratory	0	0	2	40		20		40	100	1
8	EC104402EC	Analog Communication Laboratory	0	0	2	40		20		40	100	1
9	EC104403EC	Computer System Architecture Laboratory	0	0	2	40		20		40	100	1
10	EC104404EC	Linear Integrated Circuits & Applications Laboratory	0	0	2	40		20		40	100	1
												26

Electro-Magnetic Field Theory

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	

EC104101EC

[Pre-requisites: MA10I001MA-Mathematics II]

Course Objectives

1. To understand and analyze electromagnetic fields using different mathematical and vectorial tools.
2. To find the solutions of wave equation in both lossless and lossy medium and visualize plane wave's propagation through it.
3. Analyze transmission lines and its different parameters using smith chart for impedance matching.
4. Understand antennas their characteristics and antenna radiations.

Course Content

UNIT I

Electrostatics and Magnetostatics: Review of electromagnetic fields, Gradient, divergence and curl, their physical interpretation, divergence and stroke's theorems, linear, homogenous and isotropic media. Electrostatic Field**:** Coulomb's law, Gauss's law and its applications, Poisson's equations. Magnetic Field: Ampere's law magnetic vector potential magnetic flux and it's calculation for different current distribution, boundary conditions. Electromagnetic Induction: Electromotive force, Lenz's law, Faraday's law, Energy stored in magnetic field.

UNIT II

Fields and waves: Displacement Current: Maxwell's Equations: Circuit Theory as Quasi-static Approximation: Poynting's theorem and Flow of power. Plane wave: Solution of Wave Equation for Loss less and lossy media; Phase Velocity, Dispersion: Group Velocity, Complex Propagation Constant, Intrinsic Impendence, Normal and Oblique Incidence of Plane Wave on a Perfect Conductor and polarization: Linear, Circular and elliptical.

UNIT III

Transmission lines: Complex Propagation constants, loss less transmission lines, distortion and distortion less condition, characteristics impedance, Reflection Coefficient, standing Wave Ratio, Transmission line parameters, Line Calculation for matched and General Terminations, Impedance Transformation buy quarter Wave line, Stub Matching, Smith Chart, Stub matching using Smith chart.

UNIT IV

Electromagnetic Radiation and Antenna Fundamentals: Review of Maxwell's equations: Retarded vector potential, Solution of wave equation in retarded case, Concept of radiation, Antenna equivalent circuits, Antenna characteristics: Radiation pattern, Beam solid angle, Radiation intensity, Directivity, Gain, Input impedance, Polarization, Bandwidth, Effective aperture, Antenna effective height, Antenna temperature.

Course Materials

Required Text: Text Books:

1. 'Elements of Electromagnetics', Matthew N.O. Sadiku, Oxford University Press.
2. "Engineering Electromagnetics", Hayt William, Tata McGraw Hill.
3. "Antennas and Wave propagation", A. R. Harish, M. Sachidanada, Oxford University Press.

Optional Materials: Reference Books

1. "Antennas", John D. Kraus, Tata McGraw-Hill.
2. "Antenna Theory Analysis and Design", Constantine A. Balanis, John Wiley and Sons.
3. "Principles and Applications of Electromagnetic fields", Plonsey R. and Collin R.E., Tata McGraw Hill.

Digital Signal Processing

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	EC104102EC

[Pre-requisites: EC103103EC-Signals and Systems]

Course Objectives

1. To understand the basics of discrete-time signal, sampling and Fourier transform.
2. To get knowledge of discrete Fourier transforms and their properties.
3. To learn different structures for realization of FIR and IIR systems along with quantization noise.
4. To design and implement FIR and IIR filters using different techniques.

Course Content

Unit-I

Introduction: Review of discrete-time signal and system analysis; Advantages and typical applications of DSP, Review of Fourier transform and DTFT, Sampling and discrete-time processing of continuous time signals.

Unit-2

Discrete Fourier Transform: Discrete Fourier series and their properties, Sampling the Z-transform, Discrete Fourier Transform (DFT), Properties of DFT, Circular and linear convolution using DFT, FFT algorithms: Decimation in time, decimation in frequency, Goertzel algorithms.

Unit-3

Discrete Time System Implementation: Structures for FIR systems: Direct form, Cascade form, Lattice, Structures for IIR systems: Direct form, Signal flow graph and transposed structures, Cascade form, Parallel form, Lattice and ladder structures, Quantization and rounding-off effects in digital filters.

Unit-4

Digital Filter Design Techniques: IIR and FIR filters, filter design specifications; Design of digital IIR filters: Impulse invariant, and bilinear transformation techniques for Butterworth and Chebyshev filters; Design of FIR filters: Windowing, frequency sampling filter design, optimum approximations of FIR filters.

Course Materials

Required Text: Text Books:

2. Discrete Time Signal Processing, Oppenheim, A.V. and Schafer, R.W. with Buck, J.R Prentice, Hall of India.
3. Digital Signal Processing: Principles, Algorithm and Applications, Proakis, J.G. and Manolakis, D.G., Pearson Education.
4. Digital Signal Processing: A Practical Approach, Ifeachor, E.C. and Jervis, B.W., Pearson Education.

Optional Materials: Reference Books

1. Digital signal processing – Fundamentals and applications, Li Tan, Elsevier Inc., 2008.
2. C algorithms for real time DSP, P M Embraer, Prentice Hall Inc., USA 1995.
3. Digital signal processing laboratory, B P Kumar, CRC Press, USA 2005.

Computer System Architecture

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-0-0, (3)	CORE	EC104103EC

[Pre-requisites: EC103104EC-Digital Logic Design]

Course Objectives

1. To understand Structure and functions of different units of a computer system and its Instructions
2. To understand the Organization of Processor including Data-path, ALU and Control Unit
3. To understand Memory organization and mapping of cache
4. To understand various input/output systems of the computer system.

Course Content

Unit – I

Introduction: Functions and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer. Representation of Instructions Representation of Instructions: Machine instructions, Operands, Addressing: Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

Unit – II

Processing Unit: Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit , Operations of a control unit, Hardwired control unit, Microprogrammed control unit.

Unit – III

Memory Subsystem: Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Hardware support for memory management.

Unit – IV

Input/Output Subsystem: Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Course Materials

Required Text: Text Books:

1. Computer Architecture and Organization, John P Hayes, McGraw-Hill International Editions, Computer Science Series.
2. Computer System Architecture, Morris Mano, Prentice-Hall India, Eastern Economy Edition.

Optional Materials: Reference Books

1. Computer Organization, Carl Hamacher, Zvonko Vranesic & Safwat Zaky, Mc Graw Hill.
2. Computer Organization and Design, Pal Choudhuri P., Prentice-Hall India.
3. Computer Organization and Design, Patterson D.A. & Hennessy J.L., Morgan Kaufmann Publishers.
4. Computer Organization and Architecture, William Stallings, Pearson Education.

Linear Integrated Circuits and Applications

[4thSemester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-0-0, (3)	CORE	EC104104EC

[Pre-requisites: EC103102EC-Microelectronics Devices & Circuits]

Course Objectives

1. To understand the basics of operational amplifiers, analyze differential amplifiers and study frequency compensation.
2. To study applications of operational amplifiers-Linear circuits, nonlinear circuits, and active filter design.
3. To understand signal generators and A-D and D-A converters.
4. To understand the basics of phase-locked-loops and voltage regulators.

Course Content

UNIT I

Operational Amplifiers: Basic and ideal operational amplifier; Block Schematic of OPAMP, Differential Amplifier: DC & AC analysis of transistorized differential amplifier; Analysis of IC 741 op-amp; Open Loop & Closed Loop Configuration of OPAMP; Input & Output impedance of closed loop OPAMP; Input Offset-error compensation, Maximum Ratings; Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, frequency response, stability, Frequency compensation: Lag & Lead compensation.

UNIT II

Applications of OPAMP: Linear Circuits- Summing amplifier, Difference amplifier, V to I and I to V converter, Instrumentation amplifier, Bridge amplifier, Integrator, Differentiator. Nonlinear Circuits- Comparators, Schmitt trigger, Precision rectifiers, Peak detector, Log & Anti-log Amplifiers. Active Filter Design: Transfer function, design and applications of LPF, HPF, BPF, BRF/BSF and APF.

UNIT III

Signal Generators: Square Wave Generator, Timer IC 555: Functional Diagram, Monostable and Astable operation and Applications. D-A and *A-D Converters*: D/A Converter using Binary Weighted Resistor Network and R-2R Ladder Network ; Parallel Comparator type A/D Converter, Successive Approximation A/D Converter.

UNIT IV

PLL: Basics of PLL, functional block diagram, principle of operation and its various applications; Introduction to IC 565, Sinusoidal oscillators: criterion for oscillation. Voltage Regulators: Voltage regulator characteristics, Regulator Performance parameters, Types of Voltage regulator, Shunt & Series Regulator using OPAMP, Current Limiting Circuit, Foldback Limiting.

Course Materials

Required Text: Text Books:

1. Design with Operational Amplifiers and Analog Integrated circuits by Sergio Franco, McGraw-Hill.
2. OP-AMP and Integrated Circuits by Ramakant Gaikwad, Pearson Education.
3. Linear Integrated Circuits by S. Salivahanan & Bhaaskaran, McGraw-Hill.
4. Operational Amplifiers and Linear ICs by David A. Bell, Oxford.

Optional Materials: Reference Books

1. Integrated Electronics by Millman & Halkias, TMH Publishing Co.
2. Operational Amplifiers and Linear Integrated Circuits by Coughlin Driscoll, Pearson Education.
3. Linear Integrated Circuits D. Roy Choudhary, Shail Jain, New Age International.

Analog Communication

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	EC104105EC

[Pre-requisites: NA]

Course Objectives

1. To understand the basics of communication and design of various Amplitude Modulation Systems
2. To understand the basics and design of various Angle Modulation Systems.
3. To understand the basics of PLL and various Receiver Systems.
4. To understand the basics of noise and its analysis for various modulation systems.

Course Content

UNIT I

Amplitude Modulation: Basic Model of communication systems, Baseband and Carrier Communication, Amplitude Modulation, Time and frequency domain analysis, Single tone modulation, Generation of AM signals, Square law modulator, Switching modulator, Demodulation of AM signals, Coherent detector, Square law detector, Envelop detector, Double sideband suppressed carrier (DSB-SC) modulation, Generation of DSB-SC signals, Balanced modulator, Ring modulator, Demodulation of DSB-SC signals, Quadrature carrier multiplexing (QAM), Single sideband (SSB) modulation, Generation and demodulation of SSB signals, Vestigial sideband (VSB) modulation, Applications of different AM Systems.

UNIT II

Angle Modulation: introduction, Instantaneous frequency, Phase modulation, Frequency modulation, Spectrum of angle modulated signals, Narrow-band FM (NBFM), Wide-band FM (WBFM), Power of angle modulated signal and effective bandwidth, Direct and Indirect methods for generation of FM signals, Demodulation of FM signals.

UNIT III

Demodulators: Phase-Locked Loop (PLL) for carrier acquisition in AM signals, PLL for FM demodulation, Tuned radio frequency (TRF) receiver, Superheterodyne AM receiver, Receiver Parameters and Characteristics, SSB receivers, FM receivers.

UNIT IV

Noise: Atmospheric noise, Thermal noise, Shot noise, Frequency domain representation of noise, Spectral components of noise, Power spectral density of noise, Noise bandwidth, Quadrature components of noise, Noise Figure and equivalent noise temperature of cascaded systems, Narrow-band noise representation. Signal to noise ratio, Noise in DSB system, Noise in SSB system, Noise in AM system, Noise in FM system, Pre-emphasis and de-emphasis, Threshold effect in FM.

Course Materials

Required Text: Text Books:

1. Modern Digital and Analog Communication Systems - B.P. Lathi, Oxford.
2. Analog Communication – P Ramakrishna Rao, MH.
3. Principle of Communication Systems – Taub & Schilling, TMH.

Optional Materials: Reference Books

1. Electronic Communication Systems – George Kennedy, TMH.
2. Communication Systems - Simon Haykin, Wiley Publications.
3. Analog and Digital Communication - -Schaum's outlines, TMH.

Mathematics IV

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mathematics	4-0-0, (4)	EPR	MA104001MA

[Pre-requisites: MA10I001MA-Mathematics-I, MA10I001MA-Mathematics-II]

Course Objectives

The objective of this subject is to expose student to understand the importance of probability theory and stochastic process in science and engineering.

1. Introduce the concepts of probability theory and random variables having probability distributions.
2. Introduce the multivariate random variables with their joint probability distributions as well as weak law of large numbers, strong law of large numbers, and central limit theorem.
3. Introduce the concepts of stochastic process, Markov process and Markov chain with their properties.
4. Introduce the spectral characteristics of random processes.

Course Content

UNIT I

PROBABILITY AND RANDOM VARIABLES**:** Classical and relative-frequency-base definitions of probability, Axiomatic definition of probability, Conditional probability, Independent events, Baye's rule, Random variables, Distribution function, Probability mass and density functions, Expectation, Moments, Moment generating function, Characteristic function, Chebyshev's inequality, Special distributions: Binomial, Geometric, Negative Binomial, Poisson, Uniform, Exponential, Normal.

UNIT II

FUNCTIONS OF RANDOM VARIABLES: Vector random variables, Joint probability distributions and their properties, Conditional distribution and density, Statistical independence, Transformation of multiple random variables, Distribution and density of a sum of random variables, Jointly Gaussian random variables, Correlation, Covariance, Weak law of large numbers, Strong law of large numbers, Central limit theorem.

UNIT III

RANDOM PROCESSES: The random process concept, Stationarity and Independence, Correlation functions, Measurement of correlation functions, Markov process and Markov chain, Binomial random process, Gaussian random process, Poisson random process, Complex random process.

UNIT IV

SPECTRAL CHARACTERISTICS OF RANDOM PROCESSES: Power density spectrum and its properties, Relationship between power spectrum and autocorrelation function, Cross-power density spectrum and its properties, Relationship between cross-power spectrum and cross-correlation function, Power spectrum for discrete-time processes and sequences, Some noise definitions and other topics, power spectrum of complex processes.

Course Materials

Required Text: Text books

1. Probability, Random Variables and Random Signal Principles by Peyton Z. Peebles, Jr., McGraw Hill.
2. Probability Theory and Random Processes by P Ramesh Babu, McGraw Hill.
3. Probability and Random Processes by Scott Miller and Donald Childers, Elsevier.

Optional Materials: Reference Books

1. Probability and Random Processes by S. Palaniammal, PHI Learning Private Limited.
2. Stochastic Processes by J. Medhi, New Age International Publishers.
3. Probability Theory and Stochastic Processes by B. Prabhakara Rao and T.S.R. Murthy, BP Publications.

DSP Laboratory

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	0-0-2, (1)	CORE	EC104401EC

Course Objectives

1. To understand the basics of discrete-time signal, sampling and Fourier transform.
2. To get knowledge of discrete Fourier transforms and their properties.
3. To learn different structures for realization of FIR and IIR systems along with quantization noise.
4. To design and implement FIR and IIR filters using different techniques.

List of Experiments

a. Using MATLAB

1. Generation of Basic signal using DSP
2. Elementary sequence in DSP for analysis purpose and operation.
3. Plot the function in the form of FFT, DFT and Z-Transform
4. Operate different filter function such as Low and High pass filter
5. Operate different filter function such as Notch and Band pass filter
6. Operate the functions for Finite impulse (FIR) response filter
7. Operate the functions for Infinite impulse (IIR) response filter

b. Using Speedy 33 kit

8. Generation of Basic elementary signal and check the output with analog connection.
9. Perform basic filter design for High and Low pass using IIR filter.
10. Perform basic filter design for High and Low pass using FIR filter.
11. Perform for basic signal properties i.e. correlation and convolution.

c. Using TMS320C6713 Kit

12. Generate sign wave using the CC studio coding.
13. Impulse responses of first order filter using the CC studio coding.
14. Impulse responses of second order filter using the CC studio coding.
15. Study of the linear convolution of the given sequence.
16. Study of circular convolution of given sequence.

Course Materials

Required Text: Text Books:

1. Oppenheim, A.V. and Schafer, R.W. with Buck, J.R., “Discrete Time Signal Processing”, Prentice-Hall of India.
2. Proakis, J.G. and Manolakis, D.G., “Digital Signal Processing: Principles, Algorithm and Applications”, Pearson Education.
3. Ifeachor, E.C. and Jervis, B.W., “Digital Signal Processing: A Practical Approach”, Pearson Education.

Analog Communication Laboratory

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	0-0-2, (1)	CORE	EC104402EC

Course Objectives

1. To understand the basics of communication and design of various Amplitude Modulation Systems
2. To understand the basics and design of various Angle Modulation Systems.
3. To understand the basics of PLL and various Receiver Systems.
4. To understand the basics of noise and its analysis for various modulation systems.

List of Experiments

1. Study of Amplitude modulation technique using Training kit.
2. Study and verify Amplitude de-modulation technique using a) diode detector, b) Product detector, c) Envelop detector.
3. Study of the effect of Band pass and Low pass filter in Amplitude modulation and De-modulation technique.
4. Study of DSB-SC and SSB-SC generation.
5. Study of the DSB-SC reception using Envelop and Diode detector.
6. Study of the SSB-SC reception using Product detector.
7. Study of the Voice transmission using DSB/SSB transmission.
8. Study for frequency modulation using Varactor Modulator.
9. Observe and measure the frequency deviation and modulation index of FM.
10. Study of Pre-emphasis circuit in FM at Transmitter side.
11. Study of De-emphasis circuit in FM at Receiver side.
12. Observe the effect of pre-emphasis and De-emphasis circuit using different modulator.
13. Study of FM modulation via Phase modulation and vice-versa.
14. Study of phase modulation and De-modulation.
15. Study of effect of noise: a) Observe the effect of noise on various analog system, b) calculate SNR, c)Effect of low pass filter on noisy signal.
16. Study of the Pulse amplitude modulation and demodulation

Course Materials

Required Text: Text Books:

1. Modern Digital and Analog Communication Systems - B.P. Lathi, Oxford.
2. Analog Communication – P Ramakrishna Rao, MH.
3. Principle of Communication Systems – Taub & Schilling, TMH.

Computer System Architecture Laboratory

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	0-0-2, (1)	CORE	EC104403EC

Course Objectives

1. To grasp the basic conceptual designs of computer system architecture.
2. To understand and Design cost-effective computer systems.
3. To learn how to quantitatively test different designs and provide quantitative reasons in evaluating different designs.
4. To be able to express design problems in the development of processors or other components that meet design criteria and goals.

List of Experiments

1. Study and Design of Ripple Carry Adder.
2. Study and Design of Carry Look ahead Adder.
3. Study and Design of Wallace Tree Adder.
4. Study and Design of SISO, SIPO, PISO, and PIPO Shift Registers.
5. Study and Design of various Counters such as Up-down Counter, Ring Counter, Johnson Counter, and Mod Counter.
6. Study and Design of Combinational Multipliers
7. Study and Design of Booth's Multiplier
8. Study and Design of Arithmetic Logic Unit
9. Study and Design of a Random-Access Memory (RAM) Cell
10. Study and Design of Associative Cache Memory
11. Study and Design of Direct Mapped Cache Memory

Course Materials

Required Text: Text Books:

1. Computer Architecture and Organization, John P Hayes, McGraw-Hill International Editions, Computer Science Series.
2. Computer System Architecture, Morris Mano, Prentice-Hall India, Eastern Economy Edition.

Linear Integrated Circuits & Applications Laboratory

[4th Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	0-0-2, (1)	CORE	EC104404EC

Course Objectives

1. To understand the principle of working of different type of operation amplifiers.
2. To understand and analyze the different applications of operations amplifiers.
3. To understand the principle of Timer IC 555.

List of Experiments

1. Study of working of Operation Amplifier as Inverting and Non-inverting configuration.
2. Study of application of Operation Amplifier as Adder and subtractor circuit.
3. Study of application of Operation Amplifier as Differentiator circuit.
4. Study of application of Operation Amplifier as Integrator circuit.
5. Study of application of Operation Amplifier as Instrumentation Amplifier.
6. Study of application of Operation Amplifier as first order Low pass Filter.
7. Study of application of Operation Amplifier as first order High pass Filter.
8. Study of application of Operation Amplifier as All pass Filter.
9. Study of application of Operation Amplifier as inverting & non-inverting Schmitt Trigger.
10. Study of working of timer IC 555 as Astable Multivibrator.
11. Study of working of timer IC 555 as Monostable Multivibrator.
12. Study of application of Operation Amplifier as Shunt and Series Voltage Regulators.

Course Materials

Required Text: Text Books:

1. Design with Operational Amplifiers and Analog Integrated circuits by Serrgio Franco, Tata McGRAW – Hill.
2. OP-AMP and Integrated Circuits by Ramakant Gaikwad, Pearson Education.