Course Curriculum

M.Tech

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

2016

Department of Electronics and Communication Engineering

**JAYPEE UNIVERSITY OF ENGINEERING & TECHNOLOGY
A-B ROAD, RAGHOGARH, DT. GUNA-473226 MP, INDIA**

SYllabus of M. Tech. Courses

FIRST SEMESTER

2 Year M. Tech. Curricula for Electronics & Communication Engineering

M. Tech. (ECE), I year - I semester

S. No.	Sub Code	Subject	Core /Elective	L	T	P	Credits
1	14M11EC111	Advanced Communication System	Core	3	0	0	3
2	14M11EC114	VLSI Circuits & System Design	Core	3	0	0	3
3	14M11EC112	Advanced Satellite & Fiber Communication System	Core	3	0	0	3
4	14M11EC113	Advanced Telecommunication Networks	Core	3	0	0	3
5	14M17EC171	ECE Design and Simulation Lab-I	Core	0	0	4	2
6		**DE -I**	Elective	3	0	0	3
		Total		15	0	4	**17**

Course Description

Title of Course: Advanced Communication System   **Course Code: 14M11EC111**
L-T-P Scheme: 3-0-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of different types of coding.
Learning outcomes:

In the end of the course the student will be able to know elements of a communication system, baseband modulation & correlative coding, base band modulation & demodulation/detection, multicarrier modulation and spread spectrum communication

Course content:

Introduction: Elements of a communication system, Different types of signals, PSD, Random process, Ergodicity, Noise.

Source Coding: Formatting data, Quantization, Dithering, Source coding.

Baseband modulation & Correlative coding: Pulse modulation, Correlative coding.

Analog Communication systems (A.M.): Different types of AM & FM systems, Transmitters, Receivers and Antenna systems.

Phase Locked Loop: Theory and applications, Capture range, Lock range, order of Low pass filter, Loop dynamics.
Communication Link Analysis: Link Budget Analysis, Sources of signal loss & noise, Path loss, Link margin, System tradeoff.
Base band modulation & demodulation/detection: Base band modulation, Demodulation, Detection of binary signal in Gaussian noise.
Band pass modulation & demodulation: Coherent detection, non coherent detection, error performance for M- ray systems.
Multicarrier Modulation: Multicarrier modulation with overlapping sub channels, OFDM, Challenges in Multicarrier system.
Spread Spectrum Communication: DSSS, Cellular system, FHSS, CDMA, Wireless sensor networks, Cognitive Radio, Wavelets and their applications
Text Books:

1. Lathi, B.P, Modern Digital and Analog Communication Systems, Oxford University Press, 3rd edition, 2005.
2. Bernard Sklar, Digital Communication, II Edition, Pearson Education, 2001.

Reference Books:

1. B. Krishnamachari, Networking Wireless Sensors, Cambridge University Press, 2005.

Course Description

Title of Course: Advanced Satellite and Fiber Communication System   Course Code: 14M11EC112

L-T-P Scheme: 3-0-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of elements of satellite link design and optical fiber communication.

Learning outcomes:

In the end of the course the student will be able to know elements of a satellite communication system, link design transponder optical fiber communication.

Course content:

Elements of Satellite Communication: Satellite frequency bands, communication satellite systems, Kepler's laws, Satellite orbits, LEO, MEO, GEO, HEO, LOOK angles & visibility, Orbital effect in communication system performance.

Satellite Link Design: Basic transmission theory, EIRP, Antennas Gain patterns, Common antenna type, parabolic disc, atmospheric losses, system noise temperature & G/T ratio, UP link & down link analysis, frequency reused.

Satellite Transponder: Transponder model, Satellite front end, RF filtering of digital carriers, introduction to satellite single processing, transponder limiting & non-linear satellite amplifiers.

Optical Fiber Communication System: Basic optical laws and definitions, Optical fiber modes and configurations, N.A. Attenuation: Units, absorption, scattering losses radioactive losses, core and cladding losses. Material dispersion, wave guide dispersion, intermodel dispersion.

Optical Sources: Light Emitting Diodes: structure, light source materials. Laser Diodes: structure, threshold conditions, and modulations of Laser diodes. Light source linearity, reliability considerations.

Optical Detectors: Physical principles of photodiodes, photo detector noise, detectors response time, avalanche multiplication noise, temperature effect on avalanche gain.

Text Books:
1. P. Timothy and B. W.Charles, Satellite Communication, Willey Int. Pub, 2002.
2. D. Roddy, Satellite Communication., 3rd edition, MCG Hill Int, 2001.
3. G.Keiser , Optical Fibre Communication, McG Hill International Edition,2000.
4. Seniors J.M., Optical Fibre Communication and Applications, Prentice Hall of India, 2nd edition, 1992.

Reference Books:

1. Seniors J.M., Optical Fibre Communication and Applications, Prentice Hall of India, 2nd edition, 1992.

Course Description

Title of Course: Advanced Telecommunication Networks   **Course Code: 14M11EC113**

L-T-P Scheme: 3-0 -0   **Credit: 3**

Prerequisite: None

Objective:
Develop to understand the concept of communication switching and telecommunication networks.

Learning outcomes: At the end of the course the students will have knowledge of telecommunication network, switching and transmission, OSI seven layer model ATM and broadband networks.

Course content:

Introduction: Overview of Telecommunication Networks. Convergence of Telecommunication and Computer Networks.

Network Model Concepts: Switching and Transmission, Types of Information and Signals, Data Rate Considerations. Integration of Data and Voice, Characteristics of Voice Data and Video Signals.

Communication Switching: Circuit Switching- Space, Time and Hybrid Switching Techniques, Packet Switching and Comparison with Circuit Switching.

Telecommunication and other Networks: Features of Telephone, Computer and Broadcast Networks. Signaling types and purpose.

OSI Seven Layer Model: Description and Functions of Different Layers, Communication Protocols and Interfaces. Communication and network standards.
IEEE 802.XX Standards: Local area Networks- Topology, Media Parameters, Media Control and Standards. Metropolitan Area Networks.

Cell Switching, ATM and Broadband Networks: Broadband Network Requirements and Concept. Cell Switching and ATM (Asynchronous Transfer Module). BISDN (Broadband Integrated Services Digital Network).

Internet Telephony: Telephone Communication Using Packet Switching.

Network Performance: Performance Parameters like Data Rate/Bandwidth, Error Rate, Distance, Blocking, Traffic Definition, Queuing Analysis, Wireless Networks. Network Management. SDH (Synchronous Digital Hierarchy). Security Issues.

Text Books:
1. L.Garcia and Widjaja, Communication Networks, Tata Mcgraw Hill, 2000.
2. W. Stallings, Data and Computer Communications, 7 Ed, PHI, 2004.
3. S. Tannenbum, Computer Networks, 4 Ed, PHI, 2003.
4. S. Kasera and P. Sethi, ATM Networks, Tata Mcgraw Hill, 2001.

Reference Books:

1. D. E. Comer, Computer Networks and Internets, 2 Ed, Pearson Education, 1998.
2. J. Walrand, P. Varaiya, High Performance Communication Networks, 2 Ed, Elsevier, 2000.

Course Description

Title of Course: VLSI Circuit and System Design   **Course Code: 14M11EC114**

L-T Scheme: 3-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of MOS transistor and CMOS process flow.

Learning outcomes: At the end of the course the students will have knowledge of VLSI, CMOS process flow, Combinational MOS logic circuits and HDL based design.

Course content:

Building blocks of VLSI: Overview of VLSI, Complexities and Design, VLSI Simulation Steps and Tools.

MOS Transistor Theory: A review of MOS structure and operation, MOS I-V characteristics, MOSFET model for Circuit Simulation, Scaling and Small Geometry effects.

CMOS Process Flow: Basic steps, CMOS n-well process, Twin-Tub process, layout design rules.

MOS Inverter: Static and Dynamic Characteristic, Performance Estimation.

Combinational MOS logic circuits: Transmission gate, Dynamic logic, Timing issues in CMOS Digital Circuits, Semiconductor Memories, SRAM, DRAM, ROM analysis and design.

HDL based design: Language Fundamentals, Behavioral and RTL style of modeling, Data Flow style of description, Structural style, Test-Bench, Hazards and Fault Analysis.

Text Books:

1. S. M. Kang , Y. Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3rd Edition Tata McGraw-Hill Publication, 2003.
2. J. M. Rabaey, A. Chandrakasan, B. Nikolic, Digital Integrated Circuit: A design perspective, 2nd Edition Pearson Education, 2005.

Reference Books:

1. S. Sjoholm, L. Lindh, VHDL for Designers, Pearson Education Ltd., England, 1997.
2. N. Weste, David Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rd Edition Addison Wesley, 2004.

Course Description

Title of Course: Detection and Estimation Theory   **Course Code: 14M14EC131**

L-T Scheme: 3-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of detection and estimation of signals.

Learning outcomes: At the end of the course the students will have knowledge of probability and stochastic processes, detection of signals, detection and estimation of parameters.

Course content:

Review of Probability and Stochastic Processes: Stochastic Models & Stochastic Processes? Review of probability: joint and conditional probability, Bayes Theorem, Random variables, distribution & density functions, correlation and covariance of random variables, Review of stochastic Processes, Stationary processes; Gauss-Markov Models, Likelihood and Sufficiency.

Concept of Detection: Binary hypothesis testing, decision criteria; Bayes, minimax and Neymann- Pearson tests; Composite hypothesis testing.

Detection of Signals: Detection of known signal in white noise and colored noise; Detection of signals with unknown parameters, Detection in discrete time: Models and detector structures; detection in Gaussian noise: Detection of stochastic signals, Performance Evaluation of signal Detection Procedures.

Concept of Estimation:

Basic estimation of parameters using Pseudo Inverse, weighted least square estimate, MMSE, MAP and ML estimates, Cost functions & minimization of Bayes' risk, Invariance of estimates, Estimation of nonrandom parameters; Properties of Estimators, Linear Mean-Square Estimation.

Estimation of signals: Wiener filtering problem – smoothing, filtering & prediction, construction of Wiener filter by pre-whitening. Kalman filter. Wiener – Kolgomorov filtering.

Detection and Estimation of Parameters: Nonparametric Detection, Locally Optimal Detection, Robust Detection and Estimation,Detection and Parameter Estimation in Radar Systems: Radar Target Models, Target Detection, Parameter Estimation in Radar Systems.

Text Books:

1. Poor, H. Vincent, An Introduction to Signal Detection and Estimation, Second Ed., Springer 1998.
2. Srinath, M.D., P.K. Rajasekaran, and R. Viswanathan, Introduction to Statistical Signal Processing with Applications, Pearson Education, 2003.

Reference Books:

1. Papoulis, A., and Pillai, Probability, Random Variables and Stochastic Processes, McGraw Hill International, Singapore, 2002.

Course Description

Title of Course: Microwave Theory and Circuits   **Course Code: 14M14EC132**

L-T-P scheme: 3-0-0   **Credit: 3**

Prerequisite

Students must have good understanding of the following courses, Electromagnetic Engineering and R.F. & Microwave Engineering.

Objective:

To develop ability to design and analyze microwave circuits, introduce with fundamental microwave measurement techniques, develop ability to measure the microwave parameters.

Learning Outcomes:

The students shall acquire the generic skills to design and implement microwave circuits and also acquires the knowledge of measurement methods for measuring microwave parameters.

Course Content:

Transmission lines for microwave circuits; waveguides, stripline, microstrip, slot line; microwave circuit design principles; passive circuits; impedance transformers, filters, hybrids, isolators etc., active circuits using semiconductor devices and tubes, detection and measurement of microwave signals. Passive Devices and matching, Measurement of Q factor, Impendence, Power, Noise figure, S-parameters, dielectric constant and permeability, Network analyzers, Spectrum analyzers and TDR.

Teaching Methodology:

Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples. Tutorials will have conceptual and numerical questions that would aid in strengthening the designing and analysis of microwave circuits.

Text Books:
1. Devid M. Pozar, "Microwave Engineering", Wiley-India.
2. Max Sucher and Jerome Fox, Moe Wind, "Handbook of Microwave Measurements" Polytechnic Press of the Polytechnic Institute of Brooklyn; distributed by Interscience Publishers, New York, 1963.

Reference Books:
1. R.E. Collin: Foundations for Microwave Engineering, 2nd edition, John Wiley & Sons.
2. Peter A. Rizzi: Microwave Engineering: Passive Circuits, Prentice Hall.
3. Richard Collier and Douglas Skinner: Microwave Measurements, 3rd edition. IET Electrical Measurement Series.
4. G.H. Bryant: Principles of Microwave Measurements, Peter Peregrinus Publication on the behalf of IEE Electrical Measurement Series.
5. I. J. Bahl, P. Bhartia: Microwave Solid State Circuit Design, Wiley.
6. Kai Chang: Microwave Solid-State Circuits and Applications, Wiley 1994.

Course Description

Title of Course: Speech Processing   **Course Code: 14M14EC133**
L-T-P scheme: 3-0-0   **Credit: 3**

Prerequisite
Students must have basic concepts of various transforms, Digital Communication and Digital signal processing.

Objective:
 To develop to understand the concept of speech production, various processing and analysis of speech signal.

Learning Outcomes:
The students will be able to understand and implement the various models of speech processing, identification and verification of speech signal.

Course Content:
Speech production: Mechanism of speech production, Acoustic phonetics – Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM – Auditory perception: psycho acoustics. Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function. Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder, Channel Vocoder - Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic vocoders. Basic Principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm, Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP. Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification – Voice response system – Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis – VOIP.

Teaching Methodology:
Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples.

Text Books:
1. Thomas F, Quatieri, Discrete-Time Speech Signal Processing, Prentice Hall /
2. B. Gold and N. Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc., Singapore, 2004

Reference Books:
1. L.R.Rabiner and R.W.Schaffer – Digital Processing of Speech signals – Prentice Hall-1979
2. L.R. Rabiner and B. H. Juang, Fundamentals of Speech Recognition, Prentice Hall,1993.
3. J.R. Deller, J.H.L. Hansen and J.G. Proakis, Discrete Time Processing of Speech Signals, John Wiley, IEEE Press, 1999.

Course Description

Title of Course: ECE Design and Simulation Lab-I   **Course Code: 14M17EC171**
L-T-P Scheme: 0-0-4   **Credit: 2**

Prerequisite: None

Objective: To learn the fundamental & simulation of analog and digital circuits.

Learning outcomes:
At the end of course, the students shall be able to know analog and digital circuits

Course content:

List of Experiments

Experiment No: 1

> **Activity-1:** To draw the forward and reverse bias characteristic curves of PN Junction diode and to find- out the cut-in and reverse break-down voltage.

> **Activity-2:** To Determine different branch currents for a given circuit and to compare the simulated results with the calculated results.

> **Activity-3:** Find-out the variation between voltage across R_1 and supply voltage V_1.

> **Activity-4:** To draw the forward and reverse bias characteristic curves of Zener diode. Also to expose the cut-in and reverse break-down voltage.

> **Activity-5:** To simulate a Zener diode voltage regulator circuit for a specified range of input DC Voltage and load resistance, also find-out V_L, V_R, I_Z and P_Z. Also compare the simulated results with the calculated ones.

> **Activity-6:** To draw the variation of Load Voltage (V_L) with the variation in DC Supply voltage (V_1) and comment on Source voltage regulation.

> **Activity-7:** To draw the variation of Load Voltage (V_L) with the variation in Load Resistance (R_L) and comment on load voltage regulation.

Experiment No: 2

> **Activity-1:** To draw the base and collector (Input & Output) characteristics of Common-Emitter NPN Transistor (Q1N2222), (For Input Characteristics Take V_{CE}=1, 5, 10, 15, 20 Volts and for Output Characteristics Take V_{BB}=0.5, 0.7, 1, 1.5, 2, 2.5, 3 and 3.5 Volts)

> **Activity-2:** Find-out $V_{CE\,Sat}$, I_{CEO}, $V_{BE\,Cutin}$ using the above waveforms.

> **Activity-3:** Simulate a voltage divider bias circuit using the NPN transistor (Q2N2222) and Find-out different node voltages V_C, V_E, V_B and through currents I_B, I_C and I_E. Compare the simulated results with the calculated results.

> **Activity-4:** Analyze the variation between I_C and V_{BE} by varying the value of R_2 and find-out the stability factor S (V_{BE}) = ΔIc / ΔV_{BE} .

Activity-5: Compare the stability factor S (V_{BE}) of the given fixed bias circuit with the voltage divider bias circuit as given in above activities and comment on results.

Experiment No: 3

Activity-1: Draw the transfer& drain characteristics for the JFET (J2N4393) using a given circuit.

Activity-2: Find out I_{DSS} and V_P using drawn curves.

Activity-3: Find out the differential node voltages and current (I_{DQ}, V_{GSQ}, V_D, V_S, V_{DS}, V_{DG}) for given voltage divider circuit.

Activity-4: Analyze and compare the simulated results for the different biasing configuration circuits.

Experiment No: 4

Activity-1: For the given voltage divider bias circuit examine the effect of C_S, C_C, C_E and combination of all indicated capacitors on the low frequency response using Q2N2222.Plot the responses. Also perform the mathematical corroboration in the support of the results obtained.

Activity-2: Examine the effect of C_{BC}, C_{BE} &C_{CE} on high frequency response of above amplifier. Plot the various responses. Also perform the mathematical corroboration in the support of the results obtained.

Activity-3: Draw the complete frequency responses of a given BJT-amplifier configuration for the given frequency range of 0-100MHz and also locate the low and high cutoff frequencies (f_L& f_H).

Experiment No: 5

Activity-1: For the given JFET-voltage divider circuits, examine the effect of C_G, C_S, C_C individually and jointly on the given low frequency range of 0-100KHz, using J2N4393. Mathematically show that the results are close correspondence with the simulated graphs.

Activity-2: Examine the combined effect of C_{DG} (2pF), C_{GS} (4pF) and C_{DS} (0.5pF) C_{WI} (5 pF), C_{WO} (6pF) on high frequency response of above amplifier and draw the complete frequency response of the given amplifier circuit for the frequency range of 0-100MHz and come across the low and high cutoff frequencies (f_L& f_H).

Experiment No: 6

Activity-1: Simulate the 4-Stage, RC-Coupled BJT-amplifier circuit using the individual amplifier's gain of 20. Also verify that the variation in lower and higher 3-dB cut-off frequencies follow the relation $f'_{1n} = f_1/\sqrt{2^{\frac{1}{n}} - 1}$ and$f'_{2n} = f_2\sqrt{2^{\frac{1}{n}} - 1}$ respectively. Where f_1 and f_2 are lower and upper cutoff frequencies of a single stage amplifier and "n" is the total number of stages used.

Activity-2: Repeat the activity-1 for getting the same gain while using only two stages with gain of 40 dB each. Analyze the results obtained in activity-1 and 2 and suggest the best possible configuration to use for optimum performance in terms of gain and bandwidth.

Experiment No: 7

Activity-1: Simulate an inverting summing-amplifier/summer while using IC-741 as shown in figure-7.1. Also suggest some modifications to the simulated circuit to design and simulate scaling adder, direct adder, and

average value calculator circuits. Comments on the modifications made along with the mathematical formulations. Also analyze and discuss the effect of selecting the larger values of resistances instead of smaller ones while keeping the ratios constant.

Activity-2: Analyze the circuit as given in following figure-7.2, using IC-741 in inverting mode for its operation and functioning. Also simulate for few sets of input data and mathematical formulations in support of your analysis.

Activity-3: Design and simulate a differentiator circuit using IC-741 as given in figure-7.3 and other required components, while the input wave shape is given in figure-7.4. Draw the output voltage waveform and do the frequency response analysis for proper functioning of the circuit in desired range of frequencies.

Activity-4: if the circuit is modified as in figure-7.5, then analyze and discuss the effect on performance of the circuit with the help of frequency response and IP/OP waveforms.

Experiment No: 8

Activity-1: Design and Simulate a first order LPF using IC-741 having cutoff frequency of f_L=10 KHz and DC gain of 11.

Activity-2: Design and Simulate a first order HPF using IC-741 having cutoff frequency of f_H=4 KHz and DC gain of 2.

Activity-3: After cascading HPF and LPF filters find out the frequency response, cutoff frequencies (f_L and f_H) and BW for the resultant filter.

Activity-4: Analyze the effect of increasing the order of the filter from 1st to 3rd on frequency response, cutoff frequencies and bandwidth. Also give mathematical support in your analysis.

Experiment No: 9

Activity-1: Design and simulate a second order Butterworth active high-pass filters for a given cutoff frequency of 10kHz and Pass-band DC gain of 2.

Activity-2: Design and simulate a second order Butterworth active low-pass filters for a given cutoff frequency of 10kHz and Pass-band DC gain of 2.

Activity-3: Design and simulate a second order Butterworth active Band-pass and Band-stop filters using the methodology adopted in Experiment-8-activity-3. Also locate the cutoff frequencies and roll-off factor for the frequency responses of the designed filters respectively. Discuss the advantages and disadvantages of using second order filters over the first order counterparts.

Experiment No: 10

Activity-1: Design and Simulate an OP-AMP based RC phase shift oscillator producing the frequency f_0=400Hz.

Activity-2: Design and Simulate an OP-AMP based Wien-bridge oscillator producing the frequency of f_0=….. Hz.

Experiment No: 11

    Activity-1: Design and Simulate a 555-Timer based a-stable multi-vibrator which is generating the frequency of 40 kHz 40% duty cycle. Discuss about the circuit components which controls the frequency and duty cycle of timer. Also suggest a suitable circuit for generating the frequency between 10-50 kHz with 10-50% duty cycle. Is it possible to get exactly 50% duty cycle? If not then analyze and suggest the modification in the present circuit.

    Activity-2: Design and simulate a mono-stable with time period of 1.25ms and bi-stable multi-vibrator circuits as shown in figure-11 (a) and (b) respectively, using 555-Timer IC.

Experiment No: 12

    Activity-1: Design and simulate a pulse amplitude modulator circuit using the NPN transistor as shown in the following given figure-13.1 to get the waveforms. Take the modulating sinusoidal signal of frequency f_m=100 Hz and 2.5V_{pp} while the carrier signal is sinusoidal signal of frequency of 10 kHz, 0-6V_{pp}. Also analyze and discuss about the given circuit.

    Activity-2 Repeat the simulation experiment for f_c/f_m=1, 2, 3, 4, 5, 10 and 50.

    Activity-3 Also design and simulate 555-Timer based pulse amplitude modulation circuit and discuss the contrast between the two methodologies (Advantages and disadvantages of one over other).

Experiment No: 13

    Activity-1: Design and simulate a balanced amplitude modulator circuit using the IC-1496 as shown in the following given figure-12.1 to get the modulated waveforms are shown in figure-12.2. Take the modulating sinusoidal signal of frequency f_m=1 kHz and 2V_{pp} while the carrier signal is sinusoidal signal of frequency of 600 kHz, 1V_{pp}.

    Activity-2: Analyze the depth of modulation by varying the amplitude of modulating signal while keeping the frequency of modulating and carrier signal constant.

Experiment No: 14

    Simulation of various digital logic circuits (NOT, AND, OR, NAND, NOR, XOR, XNOR) and simulation of various combinational circuits.

Text Books:

1. J. Milliman and C.C.Halkias: Integrated Electronics, Mc Graw Hill
2. Bolleystead, Electronic Devices and Circuits –
3. Ramakant A.Gayakwad: Op-Amps and Linear Integrated Circuits, P.H.I.

Reference Books:
1. Morris Mano, Digital Logic and Computer Design, PHI
2. Taub and Schilling, Digital Integrated Electronics, McGraw Hill, Int. Ed.

SECOND SEMESTER

M. Tech. (ECE), I year - II semester

S. No.	Sub Code	Subject	Core /Elective	L	T	P	Credits
1	14M11EC211	Advanced Digital Signal Processing	Core	3	0	0	3
2	14M11EC212	Advanced Wireless and mobile communication	Core	3	0	0	3
3	14M11EC213	Information and Coding Theory	Core	3	0	0	3
4	14M11CI214	Multimedia Systems	Core	3	0	0	3
5	14M17EC271	ECE Design and Simulation Lab -II	Core	0	0	4	2
6		**DE-II**	Elective	3	0	0	3
		Total		**15**	**0**	**4**	**17**

Course Description

Title of Course: Advanced Digital Signal Processing   **Course Code: 14M11EC211**

L-T-P Scheme: 3-0-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of digital signal processing and designing of filters.

Learning outcomes: At the end of the course the students will have knowledge of digital signal processing, multirate signal processing and spectral analysis.

Course content:

Review of Digital Signal Processing: Review of discrete–time sequences and systems, Linear Shift Invariant (LSI) systems. Causality and Stability Criterion, FIR & IIR representations, Z-Transform, Digital structures, Fast Fourier Transform, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) algorithms using decimation in time and decimation in frequency techniques, Chirp Z- Transform, Hilbert Transform and applications.

Digital Filter design: FIR filters design. IIR filter design from analog filters, digital filter design based on least square method.

Multirate Digital Signal Processing: Decimation & Interpolation, Sampling rate conversion, Filter design and implementation for sampling rate conversion, applications of multirate signal processing.

Adaptive Filters: Introduction. Application of adaptive filters, Adaptive Direct-form FIR filters Adaptive Lattice-Ladder filters.

Spectral Analysis and Power Spectrum Estimation: Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non stationary signals, Nonparametric and parametric methods of power spectrum estimation, Eigen analysis algorithms for spectral estimation.

Text Books:

1. J.G.Proakis & D.G.Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", PHI.

2. John G. Proakis, Charles M. Rader, Fuyun Ling, Chrysostomos L. Nikias, Mark Moonen and Ian K. Proudler, Algorithms for Statistical Signal Processing, Pearson Education Inc., 2002.

Reference Books:

1. P.P.Vaidyanathan, "Multirate Systems and Filter Banks", PHI

Course Description

Title of Course: Advanced Wireless and mobile communication   **Course Code: 14M11EC212**

L-T-P Scheme: 3-0-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of cellular concept and signal processing in mobile communication.

Learning outcomes: At the end of the course the students will have knowledge of cellular concept, propagation of mobile radio signals.
Course content:

Introduction: Introduction to the wireless communications and its relevance, Overview.

Cellular Concept and Engineering: Problems in mobile communication, Need for Cells, Spectrum and its utilization –frequency reuse, Cell design considerations, Cell Topology, Co-channel and adjacent –channel cells interference, Cell splitting and sectoring, Coverage and capacity of cellular system, Hand-off techniques.

Propagation of Mobile Radio Signals: Radio wave propagation mechanism, Path loss ,Outdoor and Indoor propagation models, Antenna types, size and height, Multipath propagation model ,Different types of fading and their models, Doppler effect and mobility.

Signal Processing in Mobile Communication: Speech coders, Channel coding, Modulation types, Their principles, generation and detection techniques, bandwidth and noise performance.

Multiple Access Techniques: FDMA and TDMA techniques and their performance, Number of channels.

Spread Spectrum and Code Division Multiple Access Techniques: Spread spectrum principles, Spreading and Despreading techniques,Correlation Detection ,Bandwidth considerations, Spread spectrum types,Code Division Multiple access, Different types of codes - their properties, and generation schemes, Synchronization issues in CDMA systems –transmitters & receivers, Capacity calculation.

Mobile Communication Evolution: Features of different generations of mobile communication systems, Global System for Mobiles (GSM) – features, network architecture, radio subsystem, channel types, frame spectrum, other signal processing subsystems and processing of GSM call, CDMA based mobile systems, IS-95, cdma2000 - forward and reverse channels, 3G Mobile Systems and beyond –IMT2000, UMTS, WCDMA.

Wireless Data networks: General Packet Radio Service (GPRS), Wireless LAN –IEEE 802.11x: Physical and Media Access Control layer techniques and specifications ,Wireless Metropolitan area Networks (WMAN), IEEE 802.15, IEEE 802.16 & IEEE 802.20 standards and related systems.

Advances in Wireless Communication: Orthogonal Frequency Division Multiplexing. Software Defined Radio. Recent developments.

Text Books:

1. T.S. Rappaport , "Wireless Communication " ,Second Edition, Pearson Education,2002.
2. W.C.Y. Lee, "Wireless and Cellular Telecommunications", Third Edition, McGraw-hill International Edition, 2006.

Reference Books:
1. Simon Haykin; M. Moher , "Modern Wireless Communications " ,Pearson Education,2005.

Course Description

Title of Course: Information and coding Theory   **Course Code: 14M11EC213**

L-T-P Scheme: 3-0-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of information theory and data compression.

Learning outcomes: At the end of the course the students will have knowledge of entropy, relative entropy and mutual information.

Course content:

Introduction and Preview: Basic applications of information theory and its relationship with other fields.

Entropy, Relative Entropy and Mutual Information: Entropy, Joint entropy and conditional entropy, Relative, Mutual Information, Chain Rules, Some Inequalities, Jensen's, Log Sum, Data Processing and Fano's inequality.

The Asymptotic Equipartition Property and Data Compression: The Asymptotic Equipartition Property and Data Compression.

Entropy Rates of a Stochastic Process: Markov Chains, Entropy Rate of a Random Walk, HMP.

Data Compression: Uniquely decodable codes, Kraft Inequality, McMillan Inequality, Huffman Code, The channel coding theorem, converse of coding theorem.

Error Control Coding: Coding for reliable digital transmission and storage, Types of codes, Modulation and coding. ML decoding. Performance measures.

Algebra Background: Groups, Fields, Binary field arithmetic, Vector Spaces over GF(2), Linear Block Codes, Generator and parity check matrices, Syndrome and error detection, Standard array and syndrome decoding, Hamming codes.

Cyclic Codes: Polynomial representation, Systematic encoding, Cyclic encoding, Syndrome decoding.

Convolutional codes: Structural properties, Tree, Trellis and state diagrams, Encoding of Convolutional codes, Polynomial and rational encoders, Constraint length and minimal encoders, Systematic encoders, ML decoding of convolutional codes- the Viterbi's Algorithm, Implementation issues.

Turbo Codes: Introduction. Distance properties, Performance bounds, Encoding parallel concatenated codes, Iterative decoding of turbo codes, MAP decoding-BJSR algorithm.

Text Books:
1. T. Cover & J. Thomas, Elements of Information Theory, J. Wiley, 1999.
2. Shu Lin & D. J. Costello, Error Control Coding(2nd Edn), Pearson, 2004.

Reference Books:

1. T. K. Moon, Error Correction Coding (WSE), Wiley- Interscience, 2006.

Course Description

Title of Course: CMOS Digital Design Technique   **Course Code: 14M14EC232**

L-T-P Scheme: 3-0-0   **Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of different types of digital circuits.

Learning outcomes: At the end of the course the students will have knowledge of MOSFETS, CMOS and different types of digital circuits.

Course content:

1. Basics of MOSFETS and CMOS inverter: MOSFET characteristics, Current voltage characteristics, Modeling, Scaling theory, Small device effects.

CMOS Inverter: Basic circuit and DC operation, Switching characteristics, RC modeling, Propagation delay, Rise and fall time, DC design, transient design, Power dissipation, Driving large loads.

2: Combination circuit design using CMOS:
Complementary CMOS design, Transmission gate logic Circuits BASIC structure, Electrical analysis, RC modeling, TG   based switch logic gates ,TG register, D flip flop, n-FET based storage circuits, pass transistor logic, Dynamic CMOS design, DCVSL logic .

3. Sequential circuits: Basics of latch and flip flop, CMOS register, Dynamic latches and registers. Alternative register styles, concept of pipelining

4. Timing: Basics of timing, setup hold time, clock skew and jitter problems, how to avoid skew and jitter problems, PLL.

5. Designing arithmetic building blocks: Adder, Multipliers, shifters using CMOS

6. Memory: Designing SRAM, DRAM, ROM using CMOS.

Text Books:

1. John P. Uyemura," Introduction to VLSI Circuits and Systems", John Wiley & Sons, Inc, 2002.
2. J. Rabaey, A. Chandrakasan, and B. Nikolic, Digital Integrated Circuits: A Design Perspective, 3rd Edition 2003.

Reference Books:

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits Analysis and Design", Tata McGraw-Hill Edition 2003.

Course Description

Title of Course: Multimedia System   **Course Code: 14M11CI214**

L-T-P Scheme: 3-0-0   **Course Credit: 3**

Objectives:

To understand the concepts, algorithms and design principles underlying modern multimedia systems.

Learning Outcomes:

Students will have
1. Deepen knowledge of audio and video stream.
2. Good knowledge of different encoding and compression scheme like MPEG, MPEG4.
3. Ability to deal with GPRS, 3G/4G wireless systems.

Course Contents:

➢ **Multimedia Programming -** Term Multimedia, Term Media, Characterizing Data Streams. Advanced Object Oriented Programming, Reusability, Synchronization, Expandability, Maintainability.

➢ **Digital Audio and Video Technology -** Audio Technology : Audio Representation on Computers, Speech Output, Speech Input, Speech Transmission. Audio Compression: Differential pulse code modulation, Adaptive differential PCM, Adaptive predictive coding, Linear Predictive Coding, Perceptual Coding, Audio Coders. Text Compression: Static Huffman coding, Dynamic Huffman coding, Arithmetic coding, Lempel-Ziv coding. Image Compression : Graphics Interchange format, Tagged image file format, JPEG Video Compression: MPEG, MPEG4, Audio and Video Synchronization

➢ **Multimedia Database Management Systems -** Multimedia object storage, File Retrieval structures, Disk Scheduling , Metadata for Multimedia, Multimedia Data Access, Multimedia Information Modeling, Object - Oriented Modeling, Querying Multimedia Databases.

➢ **Multimedia Communication -** Standards for multimedia communications. TCP – based system for multimedia streaming, Peer – to – Peer streaming topologies, Distributed Multimedia applications, live / on-demand broadcasting, server bandwidth, distribution control and privacy protection for Internet media delivery, High-End Interactive Television Terminals. Wireless IP networks, wireless video communication, 3G/4G wireless systems. Multimedia applications over Multihop wireless links, World Wide Web.

➢ **Multimedia Content Analysis** - Analysis of individual images, text recognition, similarity based searches in image databases, Audio Analysis, Video Analysis.

Teaching Methodology:

Teaching in this course is designed to engage the students in active and experiential learning by taking design-oriented approach with special emphasis on real world applications. Each student is also expected to do literature survey making use of the library and Digital Libraries to identify, understand, and present at least three research papers on multimedia systems.

Text Book

1. Multimedia Applications: Ralf Steinmetz and Klara Nahrstedt, Springer, 2007.

References

1. Media Coding and Content Processing: Ralf Steinmetz and Klara Nahrstedt, PHI, 2005.

2. Multimedia Database Management Systems, B. Prabhakaran, Springer, 2007.

3. Multimedia Communications Applications, Networks, Protocols and Standards: Fred Halsall, Pearson Education, 2008.

4. ACM Transactions on Multimedia Computing, Communications, and Applications (TOMCCAP).

Course Description

Title of Course: ECE Design and Simulation Lab-II   **Course Code: 14M17EC271**

L-T-P Scheme: 0-0-4   **Credit: 2**

Prerequisite: None
Objective: To learn the advance knowledge & simulation of analog and digital circuits.

Learning outcomes:
At the end of course, the students shall be able to know advanced analog and digital circuits

List of Experiments:

Experiment No: 1 Design and simulate the generic type Multiplexer and De-multiplexer.

Experiment No: 2 Design and simulate the generic type AND, OR, NAND, NOR, XOR gates.
       Activity 1: Write VHDL code for generic type AND (bit level) gate using Structural Modeling. Basic component is 2 i/p AND gate.
       Activity 2: Write VHDL code for generic type AND gate (word level) using Structural Modeling.
       Activity 3: Write VHDL code for generic type OR (bit level) gate using Structural Modeling. Basic component is 2 i/p OR gate.
       Activity 4: Write VHDL code for generic type OR gate (word level) using Structural Modeling.
       Activity 5: Write VHDL code for generic type NAND (bit level) gate using Structural Modeling. Basic component is 2 i/p NAND gate.
       Activity 6: Write VHDL code for generic type NAND gate (word level) using Structural Modeling.
       Activity 7: Write VHDL code for generic type NOR (bit level) gate using Structural Modeling. Basic component is 2 i/p NOR gate.
       Activity 8: Write VHDL code for generic type NOR gate (word level) using Structural Modeling.
       Activity 9: Write VHDL code for generic type XOR (bit level) gate using Structural Modeling. Basic component is 2 i/p XOR gate.
       Activity 10: Write VHDL code for generic type XOR gate (word level) using Structural Modeling.

Experiment No 3: Design and simulate 8:1Multiplexer using 2:1 Multiplexer.
       Activity 1: Draw logic diagram and write VHDL code for 8:1 MUX using 2:1 MUX.
       Activity 2: Draw block level diagram to implement 8:1 MUX using 2:1 MUX and write VHDL code to implement 8:1 MUX (word level) using Structural Modeling.
       Activity 3: Draw block level diagram of 8:1 MUX(word level) using 8:1 MUX (bit level) as the building block and write VHDL code to implement 8:1 MUX (word level) using Structural Modeling.

Experiment No 4: Design and simulate the 8:1Multiplexer using generic AND/ OR gates.
       Activity: Draw the logic diagram of 8:1 MUX using generic AND and OR gates. Write VHDL code for 8:1 MUX (bit level) using Structural Modeling.

Experiment No 5: Design and simulate the different types of registers in VHDL.

Activity 1: Write VHDL code for D-flip flop using behavioral modeling.

Activity2: Draw block level diagram of SISO right shift register and write VHDL code for generic SISO right shift register.

Activity3: Draw block level diagram of SIPO shift register and write VHDL code for generic SIPO shift register.

Activity4: Draw block level diagram of PISO shift register and write VHDL code for generic PISO shift register.

Activity5: Draw block level diagram of PIPO shift register and write VHDL code for generic PIPO shift register.

Activity6: Draw block level diagram of SIPO shift register and write VHDL code for generic SIPO shift register (word type).

Activity7: Draw block level diagram of PISO shift register and write VHDL code for generic PISO shift register (word type).

Experiment No 6: Design and simulate 4-bit binary up/down counter using JK flip-flop.

Activity 1: Write VHDL code for JK flip flop using behavioral modeling.

Activity 2: Draw circuit diagram of 4-bit binary up/down counter by using JK flip flop and write VHDL code.

Experiment No 7: Design and synthesize adders.

Activity 1: Draw logic diagram of Half Adder and write VHDL code using structural modeling.

Activity 2: Draw logic diagram of Full Adder and write VHDL code using structural modeling.

Activity 3: Draw logic diagram of a generic ripple-carry adder (n-bit). Write VHDL code to implement the generic adder.

Activity 4: Draw the structure of Pipelined-Adder to add 8-words and write its VHDL code. The data available to the adder is in parallel. Synthesize the pipeline adder for word length w=8, 12, 16 bits.

Text Books:

1. J. Milliman and C.C.Halkias: Integrated Electronics, Mc Graw Hill
2. Bolleystead, Electronic Devices and Circuits –
3. Ramakant A.Gayakwad: Op-Amps and Linear Integrated Circuits, P.H.I.

Reference Books:
1. Morris Mano, Digital Logic and Computer Design, PHI
2. Taub and Schilling, Digital Integrated Electronics, McGraw Hill, Int. Ed.

THIRD SEMESTER

M. Tech. (ECE), II year - III semester

S. No.	Sub Code	Subject	Core/ Elective	L	T	P	Credits
1		**DE-III**	Elective	3	0	0	3
2		**DE-IV**	Elective	3	0	0	3
3	14M19EC391	Seminar-I	Core	0	0	4	2
4	14M19EC392	Dissertation Part-I *	Core	0	0	24	12
		* To be continued in Semester IV					
		Total		**6**	**0**	**28**	**20**

Course Description

Title of Course: Digital Image Processing **Course Code: 14M14EC331**
L-T-P Scheme: 3-0-0 **Course Credit: 3**
Prerequisite: None

Objective:
To develop to understand the concept of image processing.
Learning outcomes: At the end of the course the students will have knowledge of image enhancement, restoration, analysis coding and morphological image processing.

Course content:
Introduction: Human visual system and perception, Image sensing and acquisition, Visual perception, Noise in images, Image sampling and quantization, Pixel connectivity.

Image Enhancement: Gray level transformation, histogram processing, Smoothing and sharpening spatial Filters, Smoothing and sharpening frequency domain filters.

Morphological Image Processing: Binary morphology- erosion, dilation, opening and closing operations, applications and multistage morphological edge detection. Basic gray-scale morphology operations.

Image analysis: Edge and line detection, Hough transform, segmentation, feature extraction, classification image texture analysis, Color models and color image processing.

Image restoration: Linear degradation model, inverse and Wiener filtering.

Transforms for image coding: Unitary transforms, 2D-DFT, DCT, KLT and Harr transform.

Image coding and compression: Lossy and lossless compression, entropy coding, transform coding, sub band coding, image compression standards.

Text Books:

1. R.C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Edition, Pearson Education, 2008.
2. S. Marshal et. al, Advances in Nonlinear Signal and Image Processing, Hindawi Publishing Corporation, 2006.
3. R.C. Gonzalez, Richard E. Woods and Steven L. Eddins, Digital Image Processing using MATLAB, Third Edition, Pearson Education, 2004.

Reference Books:

1. A. K. Jain, Fundamental of Digital Image Processing, Third Edition, PHI Publication, 1989.

Course Description

Title of Course: Advanced Error Control Coding   **Course Code: 14M14EC332**
L-T-P Scheme: 3-0-0   **Course Credit: 3**
Prerequisite: None
Learning outcomes: At the end of the course the students will have knowledge of different type of codes, channel and source coding.

Objectives:
To develop an understanding and awareness of different coding techniques principles and practice along with their application area. After completion of the course, students should be able to design modern coding systems, including encoders and decoders.

Course content:

Introduction to coding (e.g., channel and source coding, Shannon capacity), Linear block codes, Introduction to abstract algebra, Cyclic codes, BCH and RS codes, Convolutional codes, Trellis codes, Turbo codes, LPDC codes.

Teaching Methodology:
Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples.

Text Books:
1. Shu Lin & D.J. Costello: Error Control Coding (2nd edition. Pearson Prentice –hall. 2004).
2. T.K.Moon: Error Control Coding .Wiley Interscience .2005

Reference Books:
1. Error Control Coding: Fundamentals and Applications -- Shu Lin / Daniel J. Costello, Jr., Prentice Hall
2. Error Control Systems fro Digital Communication and Storage -- Stephen B. Wicker, Prentice Hall
3. The Theory of Information and Coding, 2nd Edition -- R. J. McEliece, Cambridge, UK: Cambridge University Press.
4. Theory and Practice of Error Control Codes -- R.E. Blahut
5. Error Correcting Codes -- W. W. Peterson, E. J. Weldon
6. Digital Communications / Fourth Edition -- John G. Proakis, McGraw Hill

Course Description

Title of Course: Analog VLSI Design **Course Code: 14M14EC333**
L-T-P Scheme: 3-0-0 **Course Credit: 3**

Prerequisite: None

Objective:
To develop to understand the concept of MOS transistor and CMOS building block.

Learning outcomes: At the end of the course the students will have knowledge of MOSFET Models for Analog CMOS Design, CMOS Analog Building Block and Switched Capacitor Filters.

Course content:

MOSFET Models for Analog CMOS Design: Introduction, Structure of MOSFET, V/I characteristics, Parasitic Capacitance, Second order effects, Small signal equivalent circuit for MOSFETs, Noise in MOSFETs.

CMOS Analog Building Block: Single Stage Amplifier, Current Sources, Source Follower, Differential Stage Amplifier, Operational Trans conductance Amplifier, Operational Amplifier.

Switched Capacitor Filters: Analog CMOS Layout Issues, Oscillators.

Text Books:

1. B.Razavi, Design of Analog CMOS Integrated Circuits, TMH 2001
2. Philip E.Allen, Douglas R. Holberg, CMOS Analog Circuit Design (2nd Edition), Oxford Univ. Press, 2003.
3. Paul R.Gray. Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits (4th Edition), John Wiley & Sons,2001.

Reference Books:

1. D.A. Johns, K. Martin, Analog Integrated Circuit Design, J. Wiley & Sons, 1997.
2. R. Gregorian, G.C. Temes, Analog MOS Integrated Circuits for Signal Processing, John Wiley & Sons, Inc., 1986.
3. Y.P. Tsividis, Operation and Modeling of the MOS Transistor, New York: McGraw-Hill, 1987.
4. BSIM3v3 User Manual, University of California, Berkeley.

Course Description

Title of Course: Biomedical Signal Processing   **Course Code: 14M14EC334**

L-T-P scheme: 3-0-0   **Credit: 3**

Prerequisite
Students must have already completed the course on Signal Systems and Digital Signal Processing related subjects.

Objective:
The objective of this course is to provide some insight about the various tools and techniques for diagnosis of diseases through signal processing techniques and algorithms. This course is purely applied and will be useful for electronics and communication engineering students. This subject will also useful for the students working in the area of bio-signal processing for their thesis.

Learning outcomes:
At the completion of this course, students will have a basic understanding of various bio-signals, which are important for humans. They will learn how to acquire, analyze and predict this bio-signal related to human physiology. Also students can develop some better bio-signal processing algorithms.

Course content:
Introduction: Genesis and significance of bioelectric potentials, ECG, EOG, EMG and their monitoring and measurement, Spectral analysis, digital and analog filtering, correlation and estimation techniques, AR / ARMA models, Adaptive Filters, **ECG:** Pre-processing, Measurements of amplitude and time intervals, Classification, QRS detection, ST segment analysis, Baseline wander removal, wave form recognition, morphological studies and rhythm analysis, automated diagnosis based on decision theory ECT compression, Evoked potential estimation. **EEG:** evoked responses, Epilepsy detection, Spike detection, Hjorth parameters, averaging techniques, removal of Artifacts by averaging and adaptive algorithms, pattern recognition of alpha, beta, theta and delta waves in EEG waves, sleep stages, **EMG:** wave pattern studies, biofeedback, Zero crossings, Integrated EMG. Time frequency methods and Wavelets in Biomedical Signal Processing

Teaching Methodology:
This course will be offered for ECE students and will be covered through the interactive lectures (3H/W). The teaching and learning will be coupled with some audio visual aid and whiteboard-Markers. A continuous evaluation process will be adopted through the quizzes and special assignments.

Text Books:
1. Willis J Tompkins, ED. "Biomedical Digital Signal Processing", Prentice-Hall of India, 1996.
2. R E Chellis and R I Kitney, "Biomedical Signal Processing", in IV parts, Medical and Biological Engg. And current computing, 1990-91.

Reference Books:
1. Special issue on Biological Signal Processing, Proc. IEEE 1972
2. Arnon Kohen, "Biomedical Signal Processing", Volumes I & II, CRC Press.
3. Metin Aray, "Time frequency and Wavelets in Biomedical Signal Processing", IEEE Press, 1999. Current Published literature.

Course Description

Title of Course: Digital Signal Processors and Applications   Course Code: 14M14EC335
L-T-P scheme: 3-0-0   Credit: 3

Prerequisite
Students must have basic concepts of Digital Electronics, Digital signal processing, Microprocessors and Microcontrollers.

Objective:
After going through this coursehe student would learn: Architecture of a Real time Signal Processing Platform, Different Errors introduced during A-D and D-A converter stage, Digital Signal Processor Architecture, Difference in the complexity of programs between a General Purpose Processor and Digital Signal Processor

Learning outcomes:
The students will be able to understand and implement the real time DSP systems such as FIR, IIR filters.

Course content:
Evolution of Digital Signal Processors, Comparative Performance with General Purpose Processor Processor classes: General Purpose - high performance, embedded processors and processor cores, Microcontrollers etc. Signal Modeling: Difference Equation, Convolution, Transfer Function, Frequency Response. Signal Processing: Data Manipulation Algorithms Filtering Estimation, Correlation. Implementation of various DSP algorithms and applications: Communications, Audio and video processing, Graphics, image enhancement, 3- D rendering, Frequency domain filtering - FIR and IIR, Frequency- time transformations – FFT. Basic architecture of DSP kits, programming concepts for various real time systems.

Teaching Methodology:
Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples.

Text Books:
1. Sen M. Kuo and Woon-Senq Gan-Digital Signal Processors: Architectures,   Implementations and Applications: United States Edition.
2. B. Bhaskar and M Venkataramani: Digital Signal Processors: Architecture, Programming & Applications, McGraw Hill.

Reference Books:
1. Rulph Chassaing and Donald Reay: Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK, John Wiley & Sons.

Course Description

Title of Course: Performance Evaluation of Communication Systems   Course Code: 14M14EC336

L-T-P scheme: 3-0-0   **Credit: 3**

Prerequisite:

Student must have studied the course like Analog communication, Digital Communication, Signal and System, Digital signal processing, Advance Wireless and mobile communication, Probability and Random variables.

Objectives:

The performance analysis is an important topic in the area of communication system (any type). The objective of this course is to build basic concepts of system performance measures like average SNR, Outage Probability, Average bit and symbol error rate (BEP and SEP). The objective is to give an in-depth knowledge of the procedure to calculate the average SNR and bit error rate of digital communication system in different environment like in AWGN channel, in fading channel. To give the knowledge about different types of fading, random variables, moment generating function, probability density function of different types. This is an advance and specialized course for wireless and digital communication engineering.

Learning Outcomes:

The students shall acquire the generic skills to determine and analyze the performance of any type of communication system in different types of channel. They will also learn about the random variable theory and their uses in digital communication engineering.

Course Content:

Introduction to Analog and Digital Communication Systems. Different types of modulation techniques and different types of shift keying methods (BPS, QPSK, FSK, and QAM). Random variable theory, Random function, probability density function (PDF), cumulative distributive function (CDF) and moment generating functions. System Performance Measures like Average signal to noise ratio (SNR), Outage Probability, Average Bit error Probability (BEP), Coherent and Non-coherent detection, Fading Channel Characterization and modeling, Slow and fast fading, flat and frequency selective fading, Rayleigh, Nakagami-m, Rice, Weibull and Beckmann distribution . Integrals involving the Gaussian Q function, Marcum Q function, Probability of error expression in different types of fading channel. Performance of multi channel receivers (diversity), performance of multi-user communication, multi-carrier communication systems.

Teaching Methodology:

Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples.

Text Books:

1. Digital Communications, Fourth Edition, J.G. Proakis, McGraw Hill, 2000.
2. T.S. Rappaport , "Wireless Communication " ,Second Edition, Pearson Education,2002.
3. A. Papoulis and S. U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, Tata McGraw Hill, 1998.

Reference Books:

1. M. K. Simon and M. S. Alouini, "Digital communication over fading channels", 2nd Edition, Willey.
2. M. Abramowitz and I. A. Stegun "Handbook of mathematical functions".

Course Description

Title of Course: Spread Spectrum Theory   **Course Code: 14M14EC337**
 L-T-P Scheme: 3-0-0   **Credit: 3**
Prerequisite: None

Objective:

In this course student should be able to understand the architecture and elements of a spread-spectrum system and a CDMA system, characteristics of spread-spectrum signal waveforms, application of knowledge of communications technology to CDMA and wireless systems, methods for spread-spectrum and CDMA system performance analysis and capture most recent development in CDMA and its role in 3G & 4G wireless systems.

Learning Outcomes:

The Students will be able to learn basic concepts of spread spectrum communication.

Course Content:

Pseudo-random codes, modulation and demodulation techniques, synchronization, statistical distributions, direct sequence (DS) and frequency hopping (FH) spread spectrum, and capacity calculation for a CDMA system. Students gain an overview of wireless architecture, spread spectrum communication, statistical distributions used in wireless communication, design of optimum receivers, calculation of theoretical capacity of a CDMA system, coding and decoding processes in CDMA, effects of interference in CDMA, and synchronization in CDMA wireless communication systems. 3G wireless systems using CDMA technologies are also studied in this course.

Text Books:
1. J. S. Lee and L. E. Miller, CDMA Systems Engineering Handbook, Artech House, 1998.
2. R. L. Peterson, R. E. Ziemer, and D. E. Borth, Introduction to Spread Spectrum Communications, Prentice Hall, 1995.
3. R. C. Dixon, Spread Spectrum Systems with Commercial Applications, 3rd ed., John Wiley & Sons, 1994. T. S. Rappaport, Wireless Communications: Principles and Practice (2nd Edition), Prentice Hall, 2001.

Reference Books:

1. W. C. Y. Lee, Mobile Communications Engineering: Theory and Applications, 2nd edition, McGraw Hill, 1997.
2. J. G. Proakis, M. Salehi, and G. Bauch, Contemporary Communication Systems Using MATLAB and Simulink, Second edition, Brooks/Cole Pub Co., 2004.
3. A. J. Viterbi, CDMA: Principles of Spread Spectrum Communication, Addison-Wesley, 1995.

Course Description

Title of Course: Synthesis of Digital Systems   **Course Code: 14M14EC338**
L-T-P scheme: 3-0-0   **Credit: 3**

Prerequisite
> Strong background of VLSI circuits, logic Design, and integrated circuit design,Familiarity with EDA tools and VLSI packages with excellent proficiency in HDL coding.

Objective:
- To covers topics in the advanced design, analysis, implementation with Verilog HDL,
- To provide an overview of emerging SoC design and test methods
- To provide in depth understanding of logic and system design, synthesis, and optimization for area, speed and power consumption.
- To describe digital design for testability techniques at the behavioral and RTL levels

Learning Outcomes:

Upon successful completion of this course, students will be able to:
- Design and manually optimize complex combinational and sequential digital circuits
- Model combinational and sequential digital circuits by Verilog HDL
- Design and model digital circuits with Verilog HDL at behavioural, structural, and RTL levels
- Design ASIC, SoC and apply test methods to troubleshoot complex digital system.

Course Content:
> Digital Logic Design Review, Verilog Hardware Description Language (HDL),Programmable Logic Architecture and LPMs, Timing Constraints and Timing Models in Programmable Logic, Pipelining for Increased Throughput, Sequential Logic Synthesis using Verilog, Mealy & Moore Models, Analysis & Synthesis of Synchronous sequential circuits, Digital system design Hierarchy, ASM charts, Hardware description language, Control logic Design Reduction of state tables, State Assignments, Analysis and synthesis of Asynchronous sequential circuits, critical and non-critical races, Essential Hazard, Fault Modeling, Fault classes and models – Stuck at faults, Bridging faults, transition and intermittent faults. Fault Diagnosis of combination circuits by conventional methods- Path sensitization technique, Boolean different method and Kohavi algorithm.

Teaching Methodology:

Lectures would cover the core theoretical and practical concepts that are explained in the text and reference materials with adequate examples. Lab sessions will have conceptual and logic building approach that would aid in strengthening the design principles and testing of Complex Digital systems on chip level.

Text Books:
1. Digital principles and design – By Donald D.Givone
2. Digital Design – By Morris Mano- 3rd Edition, PHI
3. Digital circuits and logic design – By Samuel C.Lee,
4. 4. Verilog HDL- By Samir Palnitkar

Reference Books:
1. Andrew Rushton, VHDL for logic synthesis, Wiley.
2. Mark Zwolinski, Digital system design with VHDL, Prentice-Hall.

3. Giovanni De Micheli, Synthesis and optimisation of digital circuits, McGraw HillSabih Gerez, Algorithms for VLSI design automation, Wiley.
4. John P Elliott, Understanding behvioural synthesis, Kluwer.
5. Logic Design Theory – By N.N.Biswas, PHI. Switching and Finite Automata Theory – By Kohavi ZVI, 2nd Edition, TMH.

Course Description

Title of Course: Wireless Networks   **Course Code: 14M14EC339**
L-T-P scheme: 3-0-0   **Credit: 3**
Prerequisite: None

Objective:

The objective of this course is to build basic concepts of Wireless Networks d to give an introduction to fundamental concepts in the design and implementation of wireless networks, their protocols, and applications.

Learning Outcomes:

The Students will be able to learn basic concepts of Wireless and Mobile Network Architecture, Wireless Application Protocol, Distributed Mobile Computing.

Course Content:

Wireless and Mobile Network Architecture: Principle of Cellular Communication, Overview 1G, 2G, 2.5G and 3G and 4G technologies. GSM Architecture and Mobility management hand off management, Network signaling. Mobile Computing fundamental challenges, Mobile Devices –PDA and mobile OS, PalmOs, Win CE and Symbian. **Mobile IP Protocol Architecture**: Mobile IP and IP v 6 and its application in mobile computing, Cellular Digital Packet Data CDPD, VOIP, GPRS Services, Wireless Local Loop-WLL system. **Wireless Application Protocol (WAP):** The Wireless Application Protocol application environment, wireless application protocol client software, hardware and websites, wireless application protocol gateways, implementing enterprise wireless application protocol strategy. **Wireless Markup Language:** An Introduction to Wireless Technologies, Markup Languages , An Introduction to XML, Fundamentals of WML., Writing and Formatting Text , Navigating Between Cards and Decks, Displaying Images, Tables, Using Variables, Acquiring User Input. **Wireless Markup Language Script:** An Introduction to WMLScript, WMLScript Control Structures, Events, Phone.com Extensions, Usability. **Application of Mobile computing:** ASP and Dynamic WAP Sites, XML and XSLT, Dynamic WML Generation with ASP and XSLT, Developing WAP Applications using Emulators. **Distributed Mobile Computing:** Distributed OS and file systems, Mobile Computing Software (Pervasive Computing) Development Strategies and tools, Data Management for Mobile Computing.

Text Books:

1. Yi Bing Lin, "Wireless and Mobile Networks Architecture", John Wiley.
2. Wrox, "The Beginning WML and WML Script", Wrox Publication .
3. Tomasz Imielinski et.al, "Mobile Computing", Kluwer Academic Press 1996.
4. Uwe Hansmann, "Pervasive Computing Handbook. The Mobile World", IEE publication 2002.

Course Description

Title of Course: Seminar-I **Course Code: 14M19EC391**
L-T-P Scheme: 0-0-4 **Course Credits: 2**

Objectives: To analyse the topic of seminar with scope of work.

Learning Outcome: This course helps to collect useful information from the literature on the assigned topic.

Seminar topic: One faculty assigned to each M. Tech student. Usually the assigned faculty suggest a particular research topic to the concern student. Subsequently student collects research papers. The faculty assigned/ supervisor gives one / two research paper and advice the student to make detail study on
   a. Authors contribution
   b. Mathematical analysis
   c. Performance comparison parameters

Evaluation Scheme for M. Tech. Seminar

Mid Semester presentation	End Semester presentation	DTDW		Report	Total
P1	**P2**	**Attendance**	**Sincerity and Progress of the Scheduled Work**		
20	30	10	25	15	100

*The marks of P1, P2 will be provided by committee only.
*Grading will be done on Absolute Scale.
*Each group comprises of one student only.

P1

S. N.	Component	Marks
1	Introduction and literature survey (chronological development)	4
2	Significance and possible application	4
3	In-depth analysis and description of allotted topic	4
4	Overall knowledge and contribution	4
5	Presentation and defense	4
	Total	**20**

P2

S. N.	Component	Marks
1	Literature survey in continuation	6
2	A comparative analysis of existing work	6
3	Finding of possibilities in the area	6
4	A road map to attain the possibilities	6
5	Presentation and defense	6

Total	30

Attendance

S.N.	Component	Provided By	Marks
1	Attendance	Supervisor	10

Report

S.N.	Component	Provided By	Marks
1	Report	Supervisor	15

Sincerity and Progress of the Scheduled Work

S.N.	Component	Provided By	Marks
1	Sincerity & Punctuality	Supervisor	25

Course Description

Title of Course: Dissertation Part-I   **Course Code: 14M19EC392**
L-T-P Scheme: 0-0-24   **Course Credits: 12**

Objectives: To analyze the title and proposed a model for Dissertation.

Learning Outcome: To study of literature survey, formulate the research problem and develop necessary methodology related to research problem. A workable design/ algorithm to be developed based on the proposed methodology, algorithm a design to be noted.

Course Contents:

Title of the Dissertation- This should be carefully decided by the student after discussing with the dissertation supervisor or the guide. Explain the relevance and importance of the dissertation; Write a brief (1 or 2 pages) introduction of the dissertation explaining its relevance and importance.

Student has to spend two hours daily in library to analyze the problem. It is also essential for student to meet supervisor twice in a week to discuss the research problem. After four weeks of registration the first evaluation has been done before committee to revive the literature survey and formulation of the problem. .In second the evaluation, the student has to show the progress of work in terms of design level, mathematical model/ algorithm etc. At end of semester, simulation based design has been analyzed by the committee.

Evaluation Scheme for Dissertation Part-I

The following evaluation scheme will be followed in each semester while evaluating and awarding grades:

a) day to day work — 35% awarded by the Supervisor(s)
b) One Mid-Term Seminar by the students on the project work — 15% awarded by a panel of examiners
c) One Viva-Voce Examination Between Test T-2 and Test T-3 — 15 % awarded by a panel of examiners
d) Dissertation Report — 15% awarded by the supervisor (s)
e) Final Viva-Voce/ Defense/ Dissertation — 20% awarded by a panel of three teachers including Supervisors. In case of M.Tech. Programs, External examiner being a part of the panel

FOURTH SEMESTER

M. Tech. (ECE), II year - IV semester

S. No.	Sub Code	Subject	Core/Elective	L	T	P	Credits
1		**DE-V**	Elective	3	0	0	3
2		**DE-VI**	Elective	3	0	0	3
3	1419EC491	Seminar-II	Core	0	0	4	2
4	1419EC492	Dissertation Part-II **	Core	0	0	24	14
		Total		**6**	**0**		**22**

Notes-
1. Dissertation ** to be continued from III semester.
2. Final evaluation of dissertation will be based on the cumulative performance in all III and IV.
3. It is desirable to have one publication from the dissertation.

List of Electives

List of Departmental Electives for I Semester (DE-1)		
To be updated from time to time		
S. No.	Sub Code	Subject
1	14M14EC131	Detection and Estimation
2	14M14EC132	Microwave theory and Circuits
3	14M14EC133	Speech Processing

	List of Departmental Electives for II Semester (DE-II)	
	To be updated from time to time	
S. No.	Sub Code	Subject
1	14M14EC231	Antenna Theory & Design

2	14M14EC232	CMOS Digital Design Technique
3	14M14EC233	Adaptive Signal Processing
4	14M14EC234	Optical Networks

List of Departmental Electives for III semester (DE-III & DE-IV)		
To be updated from time to time		
S. No.	**Sub Code**	**Subject**
1	14M14EC331	Digital Image Processing
2	14M14EC332	Advanced Error Control Coding
3	14M14EC333	Analogue VLSI Design
4	14M14EC334	Biomedical Signal Processing
5	14M14EC335	Digital Signal Processors and Applications
6	14M14EC336	Performance Evaluation of Communication Systems
7	14M14EC337	Spread Spectrum Theory
8	14M14EC338	Synthesis of Digital Systems
9	14M14EC339	Wireless Networks

List of Departmental Electives for IV semester (DE-V & DE-VI)		
To be updated from time to time		
S. No.	**Sub Code**	**Subject**
1	14M14EC431	Wavelets and Applications
2	14M14MA432	EM Theory for Microwave and Fiber Optics

Course Description

Title of Course: Wavelets and Applications   **Course Code: 14M14MA431**
 L-T Scheme: 3-0-0   **Credit: 3**

Prerequisite: None

Objective:
To learn about concepts of wavelet functions and wavelet transforms that are used in solving ordinary and partial differential equations, data compression, denoising, signal and image processing.

Learning Outcomes:
At the end of the course the student will have the background of basics of wavelets necessary for understanding other courses of engineering and allied sciences.

Course content:
Basics of linear algebra, Fourier series and Fourier transform. The problem of approximation of functions in various spaces, Inner product, Norm, Orthogonality, Banach and Hilbert spaces, B-splines. Wavelet basics, Haar, Morlet, Meyer and Daubechies wavelets. Design of wavelets. Orthogonal and biorthogonal bases. Wavelet Transforms. Multiresolution analysis. Compactly supported wavelets. Cardinal spline wavelets. Numerical algorithms. Discrete time bases, series expansions of discrete time signals, DWT. Analysis and design of filter banks, Orthogonal and biorthogonal filter banks, Tree structured and linear phase filter banks. Subband filtering. Applications to Image and Video compression, solution of differential and integral equations. Wavelet software- Matlab, LabVIEW etc.

Text Books:
1. Soman, K.P., Ramachandran, K.I., Insight into Wavelets: From theory to practice, Prentice Hall of India, 2004
2. Strang, G., Introduction to Linear Algebra, Wellesley-Cambridge Press, 1993
3. Strang, G, Nguyen, T., Wavelets and Filter Banks, Wellesley-Cambridge Press, 1997
4. Chui, C.K., An Introduction to Wavelets, Academic Press, 1992

Reference Books

1. Daubechies, I., Ten Lectures on Wavelets, SIAM, 1992
2. Hernandez E, Weiss, G., A First course on Wavelets CRC Press, 1996
3. Christensen, O., Frames and Bases, Birkhauser, 2008

Course Description

Title of Course: Electromagnetic Theory for Microwaves & Fiber Optics
Course Code: 14M114EC432
 L-T-P scheme: 3-0-0   **Credit: 3**
Prerequisite: None

Objective:
To learn about concepts of electromagnetic theory, wave propagation and different types of waveguide.

Learning outcomes:

The students will be able to understand the knowledge of wave propagation waveguides and periodic structures.
Course content:

Basic Electromagnetic Theory: Maxwell's Equations, Boundary conditions, Wave Equations, Poynting's Theorem. Scalar and Vector Potentials.

Plane Wave Propagation: Sinusoidal uniform plane waves, Wave polarization, Reflection and refraction.

Time – Varying Boundary Value Problems: The Uniqueness Theorem, Solution of Helmholtz equations in rectangular and circular cylindrical coordinates, Vector Eigen functions and normal modes.

Metallic Waveguides: Classification of wave solutions, General Characteristics of metallic waveguides, Rectangular hollow waveguides, Circular cylindrical hollow waveguides.

Dielectric Waveguides: Circular cylindrical waveguides and optical fibers.

Periodic Structures: Characteristics of slow waves, Periodic systems, Disk-loaded waveguide, The Sheath helix and the tape helix models.

Electromagnetic Waves in Dispersive Media: Classical theory of dispersion in material media, Wave velocities.

Waves in Electron beams: Permittivity tensor for an electron beam, Space charge waves.

Gaussian beams: Fundamental Gaussian beams. Characteristics of Gaussian beams. Higher-order modes of Gaussian beams.

Text Books:
1. K.Zang and D.Li,"Electromagnetic Theory for Microwaves and Optoelectronics," Springer, 1998.
2. R.E.Collin, "Foundations for Microwave Engineering (2nd Edn)" IEEE Press,2005

Reference Books:
1. K.K. Sharma, "Optics: Principles and Applications", Elsevier, 2006.

Course Description

Title of Course: Seminar-II   **Course Code: 14M19EC491**

L-T-P Scheme: 0-0-4   **Course Credits: 2**

Objectives: To analyse the topic of seminar with scope of work.

Learning Outcome: This course helps to collect useful information from the literature on the assigned topic.

Seminar topic: One faculty assigned to each M. Tech student. Usually the assigned faculty suggest a particular research topic to the concern student. Subsequently student collects research papers. The faculty assigned/ supervisor gives one / two research paper and advice the student to make detail study on
- d. Authors contribution
- e. Mathematical analysis
- f. Performance comparison parameters

Evaluation Scheme for M. Tech. Seminar

Mid Semester presentation	End Semester presentation	DTDW		Report	Total
P1	**P2**	**Attendance**	**Sincerity and Progress of the Scheduled Work**		
20	30	10	25	15	100

*The marks of P1, P2 will be provided by committee only.
*Grading will be done on Absolute Scale.
*Each group comprises of one student only.

P1

S. N.	Component	Marks
1	Introduction and literature survey (chronological development)	4
2	Significance and possible application	4
3	In-depth analysis and description of allotted topic	4
4	Overall knowledge and contribution	4
5	Presentation and defense	4
Total		**20**

P2

S. N.	Component	Marks
1	Literature survey in continuation	6
2	A comparative analysis of existing work	6
3	Finding of possibilities in the area	6
4	A road map to attain the possibilities	6
5	Presentation and defense	6

Total		**30**

Attendance

S.N.	Component	Provided By	Marks
1	Attendance	Supervisor	10

Report

S.N.	Component	Provided By	Marks
1	Report	Supervisor	15

Sincerity and Progress of the Scheduled Work

S.N.	Component	Provided By	Marks
1	Sincerity & Punctuality	Supervisor	25

Course Description

Title of Course: Dissertation Part-II   **Course Code: 14M19EC492**

L-T-P Scheme: 0-0-24   **Course Credits: 12**

Objectives: To analyze the title and proposed a model for Dissertation.

Learning Outcome: To study of literature survey, formulate the research problem and develop necessary methodology related to research problem. A workable design/ algorithm to be developed based on the proposed methodology, algorithm a design to be noted.

Course Contents:

Title of the Dissertation- Same problem is to be continued by the student in this semester.

<u>**Evaluation Scheme for Dissertation Part-II**</u>

The following evaluation scheme will be followed in each semester while evaluating and awarding grades:

a)	day to day work	35% awarded by the Supervisor(s)
b)	One Mid-Term Seminar by the students on the project work	15% awarded by a panel of examiners
c)	One Viva-Voce Examination Between Test T-2 and Test T-3	15 % awarded by a panel of examiners
d)	Dissertation Report	15% awarded by the supervisor (s)
e)	Final Viva-Voce/ Defense/ Dissertation	20% awarded by a panel of three teachers including Supervisors. In case of M.Tech. Programs, External examiner being a part of the panel.