JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
(An Autonomous Institute of Govt. of M.P.)
Affiliated to Rajiv Gandhi Technological University, Bhopal (MP)

Scheme of Study and Examination (w.e.f. July 2010)

M.E. II Sem. Branch : E & C Engg.

Specialization : Communication System Engineering

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
					SESSIONAL EXAM					
		L	T	P	TA	CT	TOT	ESE	SUB TOTAL	
EC-113	Detection & Estimation Theory	3	1	-	10	20	30	70	100	4
EC-114	Communication Theory	3	1	-	10	20	30	70	100	4
EC-115	Information Theory & Coding	3	1	-	10	20	30	70	100	4
	Elective - I (Any One)									
EC-116A	Wavelet Transform for Signal & Image Processing	3	1	-	10	20	30	70	100	4
EC-116B	Speech Processing									
	Elective - II (Any One)									
EC-117A	Mobile Communication & Standards	3	1	-	10	20	30	70	100	4
EC-117B	VLSI Design									
(PRACTICAL/DRAWING/DESIGN)										
EC-118L	Communication System Lab - II	-	-	2	60	-	60	90	150	6
EC-119L	Minor Project - II	-	-	2	60	-	60	90	150	6
	Total	**15**	**5**	**4**	**170**	**100**	**270**	**530**	**800**	**32**

T.A. Teachers Assessment, CT- Class Test, ESE - End Semester Examination, Total Marks 800
Total Periods : 24 Total Credits : 32

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	DETECTION & ESTIMATION THEORY	EC-113	Min "D"	Min "D"	5.0

DETECTION & ESTIMATION THEORY

Unit I Introduction to Detection Theory

Binary Hypothesis Testing, Sufficient Statistics, Decision Criteria, Performance, Receiver Operating Characteristics, Minimax Hypothesis Testing, M Hypothesis, Composite Hypothesis.

Unit II Parameter Estimation

Bayesian Estimation, Linear Least-squares Estimation, Estimation of Nonrandom parameters, Bias, Sufficient Statistic, Cramer-Rao Lower Bound, Uniform Minimum Variance Unbiased Estimates, RBLS Theorem, Asymptotic Distribution of the ML Estimate.

Unit III Detection of Known Signals in Gaussian Noise

Karhunen-Loeve Expansion of Gaussian Process, Binary Detection of Known Signals in WGN, M-ary Detection of Known Signals in WGN, Detection of Known Signals in Colored Gaussian Noise, Noise Whitening Receiver.

Unit IV Detection of Signals with Unknown Parameters

Detection of Signals with Unknown Phase, GLR Test, Detection of Signals with Unknown Amplitude and Phase, Detection win Arbitrary Unknown Parameters, Waveform Parameter Estimation.

Unit V EM Estimation and Detection of Gaussian Signals with Unknown Parameters

Detection of Gaussian Signals in WGN, Noncausal and Causal Receivers, EM Parameter Estimation Method, Motonicity, Convergence Rate, GLRT Implementation.

References:

1. Harry L. Van Trees: Detection, Estimation and Modulation Theory. Part I
2. Bernard C. Levy: Principles of Signal Detection and Parameter Estimation
3. S. M. Kay: Fundamentals of Statistical Signal Processing: Detection Theory
4. S. M. Kay: Fundamentals of Statistical Signal Processing: Estimation Theory
5. H. Vincent Poor: An Introduction to Signal Detection and Estimation
6. Mourad Barkat: Signal Detection and Estimation

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	COMMUNICATION THEORY	EC-114	Min "D"	Min "D"	5.0

COMMUNICATION THEORY

Unit I Signal Design for Band-Limited Channels

Characterization of Band-Limited Channels, Signal Design for Band-Limited Channels; Design of Band-Limited Signals for no Intersymbol Interference, with controlled ISI, Data detection for controlled ISI and with Distortion. Probability of Error in detection of PAM, Modulation Codes for Spectrum Shaping.

Unit II Communication through Band Limited Linear Filter Channels

Optimum receiver for channels with ISI and AWGN, Linear Equalization; Peak Distortion Criterion, MSE Criterion, Fractionally Spaced, Baseband and Passband Equalizer, Decision Feedback Equalization; Coefficient Optimization, Predictive DFE, Iterative Equalization, Turbo Equalization, ML Detector.

Unit III Adaptive Equalization

Adaptive Linear Equalizer, Zero Forcing Algorithm, LMS Algorithm, the Tap Leakage Algorithm, An Adaptive Channel Estimator for ML Sequence Detection, Adaptive Decision Feedback Equalizer, Adaptive Equalization of Trellis- Coded Signals, Recursive least Squares Algorithms for Adaptive Equalization, Self Recovering (blind) Equalization.

Unit IV Multi channel and Multi carrier Systems

Multichannel Digital Communications in AWGN Channels; Binary Signals, M-ary Orthogonal Signals, Multicarrier Communications; Single Carrier verses Multicarrier Modulation, Capacity of a Nonideal Linear Filter Channel, OFDM, Modulation & Demodulation in an OFDM, An FFT Algorithm Implementation of an OFDM System

Unit V Digital Communication Through Fading Multipath Channels

Characterization of Fading Multi-path Channels, The Effect of Signal Characteristics on the Choice of a Channel Model, Frequency-Nonselective, Slowly Fading Channel, Diversity Techniques for Fading Multi-path Channels, Digital signaling over a frequency-selective, slowly fading channel, Coded Waveforms for Fading Channels, Multiple Antenna Systems.

References:

1. John G.Prokis- Digital communication; MGH
2. Simon Haykins- Communication System; John Wiley
3. U. Madhow- Fundamentals of Digital Communication
4. J. R. Barry and D. G. Messerschmitt-Digital Communication, 3rd ed
5. T. S. Rappaport- Wireless Communications: Principles and Practice
6. B. P. Lathi and Zhi Ding- Modern Digital and Analog Communication Systems

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	INFORMATION THEORY & CODING	EC-115	Min "D"	Min "D"	5.0

INFORMATION THEORY & CODING

Unit I Introduction to Information Theory

Introduction to Information Theory, Entropy, Properties of Entropy, Conditional Entropy, Relative Entropy & Mutual Information, Relation Between Entropy & Mutual Information, Entropy of Discrete Memoryless Channel, Differential Entropy, Properties of Differential Entropy, Channel Capacity, Properties of Channel Capacity, SHANNON Hartley Theorem.

Unit II Source Coding

Source Coding, Source Coding Theorem, Classification of Codes, Universal Codes and Channel Capacity, Variable and Fixed Length Codes, Kraft Inequality, Optimal Codes, Bounds on Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Shannon Fano, Huffman Coding, Lempzel-Ziv Coding, Run-Length Coding.

Unit III Channel Coding

Channel Coding Theorem, Zero-Error Code, Fano Inequality and the Converse to the Coding Theorem, Equality in the Converse to the Channel Coding Theorem, Structure of Linear Block Codes, Matrix Description of Linear Block Codes, Hamming Codes, The Standard Array, Hamming Spheres and Perfect Codes, Polynomial Rings, Finite Fields Based on Polynomial Rings, Primitive Elements, Structure of Finite Fields. Viewing a Code from an Extension Field, Hamming Codes as Cyclic Codes, Cyclic Codes for correcting Double Error, Cyclic Codes for Error Detection.

Unit 4 Codes Based on Fourier Transform and Convolutional Codes

Reed-Solomon, BCH, Reed-Muller Codes, Codes without Block Structure, Trellis description of Convolutional Codes, Error Correction and distance notions, Syndrome decoding Algorithm, Convolutional Codes for correcting error bursts.

Unit 5 Codes based on Graph

Distance, Probability and Likelihood, Viterbi Algorithm, Sequential Algorithm to search a Trellis, Trellis description of Linear Block Codes, Gallager Codes, Weighted distribution of Block Codes, Performance of Block Codes, Coding Gain.

References:

1. T. M. Cover and J. A. Thomas: Elements of Information Theory
2. R. W. Yeung: Information Theory and Network Coding
3. Richard E. Blahut: Algebraic Codes for Data Transmission
4. S. Lin and D. J. Costello: Error Control Coding
5. R. G. Gallager: Principles of Digital Communication
6. A. J. Viterbi and J. K. Omura: Principles of Digital Communication and Coding

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	WAVELET TRANSFORM FOR SIGNAL AND IMAGE PROCESSING	EC-116A	Min "D"	Min "D"	5.0

WAVELET TRANSFORM FOR SIGNAL AND IMAGE PROCESSING

Unit I. Introduction and background:
Fundamentals of signal decomposition -brief overview of Fourier transform and short term Fourier transform - introduction to wavelets -continuous wavelet transform -definition CWT as a correlation -time frequency resolution , Types of wavelets, filter banks, and multiresolution analysis , signal spaces and operators; Limitations of Fourier theory; multirate signal processing.

Unit II. Discrete-time bases and filter banks:
series expansions of discrete-time signals; analysis and design of filter banks; orthogonal and biorthogonal filter banks; tree-structured filter banks; discrete wavelet transform. Continuous-time bases and wavelets (8 hours): multiresolution analysis; iterated filter banks; wavelets and filter banks; wavelet series and its properties; regularity and approximation properties. frame theory; oversampled filter banks; continuous wavelet and short-time Fourier transforms.

Unit III. Wavelet application theory:
sparse representation; linear and nonlinear approximation in various bases; nonlinear signal estimation; multidimensional filter banks and wavelets; multiscale geometric signal processing; compressed sensing. Applications in speech, audio, image and video compression.

Unit IV. Wavelet methods for signal processing :
Noise suppression. Representation of noise-corrupted signals using frames. Algorithm for reconstruction from corrupted frame representation. denoising; feature extraction; inverse problems, signal detection tool.

Unit V. Wavelet methods for image processing:
Burt- Adelson and Mallat's pyramidal decomposition Schemes. 2D- wavelet transform, Image blurring, Image noising (by Gaussian, color ,salt and pepper etc.) and denoising ,Image compression and inverse problems. Edge detection techniques, pattern recognition, signature recognition, iris recognition, Image detection tool.

References:

1. S. Mallat: A Wavelet Tour of Signal Processing
2. G. Strang and T. Q. Nguyen: Wavelets and Filter Banks
3. I. Daubechies, "Ten Lectures on Wavelets," SIAM, 1992.
4. P. P. Vaidyanathan: Multirate Systems and Filter Banks
5. M. Vetterli, J. Kovacevic, and V. K. Goyal: The World of Fourier and Wavelets: Theory, Algorithms and Applications
6. M. Vetterli and J. Kovacevic: Wavelets and Subband Coding

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	SPEECH PROCESSING	EC-116B	Min "D"	Min "D"	5.0

SPEECH PROCESSING

UNIT I Nature of Speech Signal
Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis.

UNIT II Time Domain Methods
Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.

UNIT III Frequency Domain Methods
Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems.

UNIT IV Linear Predictive Coding of Speech
Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.

UNIT V Homomorphic Speech Analysis
Central analysis of speech, format and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification. Introduction to all the speech compression standards like H.623 etc.

References:

1 Thomas Parsons: Voice and Speech Processing
2. Rabiner L.R. & Schafer R.W.: Digital Processing of Speech Signals
3. J. L. Flanagan : Speech Analysis Synthesis and Perception - 2nd Edition
4. I. H. Witten : Principles of Computer Speech
5. Papamichalis P. E.: Practical Approaches to Speech Coding
6. Saito S. & Nakata K.: Fundamentals of Speech Signal Processing
7. Owens F.J.: Signal Processing of Speech

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	MOBILE COMMUNICATION & STANDARDS	EC-117A	Min "D"	Min "D"	5.0

MOBILE COMMUNICATION & STANDARDS

UNIT – I Review of Cellular Concepts

Introduction, frequency reuse, channel Assignment Strategies , Handoff Strategies, Interference & System Capacities-Co-Channel Interference & System Capacity, Channel Planning for wireless system, Adjacent channel interference, Power control for reducing interference, Trunking & grade of service, improving coverage and capacity in cellular systems- Cell Splitting ,Sectoring, Repeaters for range extension, A Microcell zone concept

UNIT – II Fundamentals of Wireless Communications

Radio Signal Propagation, Fading Channel Models, Narrowband and Frequency Domain Characteristics, Spread Spectrum Techniques, Multiple Access Technologies, Multipath Propagation: Angle of incidence& Spectrum of the Received signal, Received Signal Envelope Statistics, Received signal Phase, Second order Statistics.

UNIT- III 2G Mobile Technologies

GSM: Origin & Evolution of the GSM system, GSM System Architecture, GSM Radio Subsystem, GSM Channel Types, Frame Structure for GSM, Signal Processing in GSM.

CDMA (IS-95): Frequency and Channel Specification, Forward CDMA Channel- Block Interleaver, Long PN Sequence, Power control Subchannel, Orthogonal Covering, Quadrature Modulation, Reverse CDMA Channel- Block Interleaver, Variable Data Rate Transmission, Direct Sequence Spreading, Quadrature Modulation.

UNIT – IV 3G Mobile Technologies

CDMA 2000: General Architecture, Data Throughput, Forward link, Scheduling, Reverse link, Handoffs.

WCDMA: UMTS Concept- Introduction, UMTS Objectives, UMTS Cell and Network Structure, UMTS Protocol Stack, UTRA Channels, UTRA Multiplexing and Frame Structure, Packet Data, Power Control, Handovers.

TD-SCDMA: Overview of TD-SCDMA, Frame Structure, Smart Antenna.

UNIT V Beyond 3G Network Architectures

HSPA and HSPA+, LTE, 802.16 WiMAX, 802.11 Wi-Fi - Network Architecture, Air Interface and Radio Network, Basic Procedures, Comparisons.

References:

1. J. M. Hernando and F. P. Fontan: Introduction to Mobile Communication
2. J. Korhonen: Introduction to 3G Mobile Communication
3. T. S. Rappaport: Wireless Communications: Principles and Practice
4. H. H. Chen and M. Guizani: Next Generation Wireless Systems and Networks
5. Martin Sauter: Beyond 3G: Bringing Networks, Terminals and the WEB Together

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	VLSI DESIGN	EC-117B	Min "D"	Min "D"	5.0

VLSI DESIGN

Unit I : Review: Basic MOS structure and its static behavior; Quality metrics of a digital design: Cost, functionality, robustness, power, and delay.

CMOS Inverter: Static CMOS inverter, switching threshold and noise margin concepts and their evaluation, dynamic behavior, power consumption and effect of scaling on CMOS performance metrics.

Unit II

CMOS Combinational Logic: Static CMOS design, ratioed logic, pass transistor logic, dynamic logic, speed and power dissipation in dynamic logic, cascading dynamic gates, CMOS transmission gate logic.

CMOS Sequential Logic: Static latches and registers, bistability principle, MUX based latches, static SR flip-flops, master-slave edge-triggered register, dynamic latches and registers, concept of pipelining, pulse registers, non-bistable sequential circuit.

Unit III : Design of Arithmetic Building Blocks: Adder, multiplier, shifter, and other operators; Power and speed trade-off in datapath structures.

Memory and Array Structure: Core, ROM, RAM, peripheral circuitry, memory reliability and yield, SRAM and DRAM design, flash memory.

Unit IV

Analog VLSI Circuit Design: Single stage amplifier configurations, cascade stage, frequency response of single stage amplifiers, basic differential pair, differential pair with
MOS loads, device mismatch effects, frequency response of differential amplifiers, Basic current mirrors, cascode current mirrors, active current mirrors, biasing, impact of device mismatch, on-chip feedback network, noise, impact of feedback on noise.

Operational amplifiers: Performance parameters, one-stage and two-stage Op Amps, gain boosting, comparison, common mode feedback, input range, slew rate, power supply rejection, noise in Op Amps.

Unit V

Oscillators and phase locked loop: Ring oscillators, LC oscillators, voltage controlled oscillators, simple Phase Locked Loop (PLL), charge pump PLL, delay locked loops.

Data converters: Data converters fundamentals, DAC architectures, ADC architectures.

Basic CMOS RF IC Design: Circuit design of transceivers, CMOS Low noise amplifiers and mixers, power amplifiers

References:

1. Rabaey, J.M., Chandrakasan, A. and Nikolic, B.: Digital Integrated Circuits: A Design Perspective
2. Kang, S. and Leblebici, Y.: CMOS Digital Integrated Circuits, Analysis and Design
3. Pucknell, D.A. and Eshraghian, K.: Basic VLSI Design
4. Eshraghian, K., Pucknell, D.A. and Eshraghian, S.: Essentials of VLSI Circuit and System
5. Hodges, D.A., Jackson, H.G. and Saleh, R.A.: Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology
6. Uyemera, P.J.: Introduction to VLSI Circuits and Systems
7. Razavi, B.: Design of Analog CMOS Integrated Circuits
8. Gray, P. R., Hurst, P. J., Lewis, S. H., and Meyer, R.G.: Analysis and Design of Analog Integrated Circuits
9. Baker, R. J., Li, H. W. and Boyce, D. E.: CMOS Circuit Design Layout and Simulation
10. Lee, T. H.: The Design of CMOS Radio-Frequency Integrated Circuits

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	COMMUNICATION SYSTEM LAB- II	EC-118L	Min "D"	Min "D"	5.0

COMMUNICATION SYSTEM LAB- II

The exercises in this component shall be designed to demonstrate the basic principles outlined in different units of the theory paper. After completing the exercises the student should have developed a good grasp of the practical utilities of the theory content.

(Suggested Exercise)

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	MINOR PROJECT - II	EC-119L	Min "D"	Min "D"	5.0

MINOR PROJECT – II

The exercises in this component shall be designed to demonstrate the basic principles outlined in different units of the theory paper. After completing the exercises the student should have developed a good grasp of the practical utilities of the theory content.

(Suggested Exercise)