Detailed Syllabus
Lecture-wise Breakup

Course Code	18M22EC116/ 17M11EC118	**Semester Odd 2018 (specify Odd/Even)**	**Semester I &III** **Session** July 2018 –December 2018
Course Name	ADVANCED DIGITAL SIGNAL PROCESSING		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Vineet Khandelwal
	Teacher(s) (Alphabetically)	NIL

COURSE OUTCOMES At the end of the semester, students will be able to		**COGNITIVE LEVELS**
CO1	Recall the principles of various transform techniques like Z, Chirp Z, Hilbert, Discrete Fourier transform and Fast Fourier Transform.	Applying (Level III)
CO2	Demonstrate the ability to apply different methods to design and analyze digital FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filters with its structural realization.	Analyzing (IV)
CO3	Analyze Multirate signal processing and examine its application.	Analyzing (Level IV)
CO4	Comprehend different methods for designing adaptive filters and examine its application	Analyzing (Level IV)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**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, 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	9
2.	**Design of IIR and FIR Filters**	Digital filter specifications, selection of filter type, and filter order, FIR filter design; using windowing Techniques, Fourier Series and frequency sampling method, Design of IIR Filters Using Butterworth, Chebyshev and Elliptic Approximations, Frequency Transformation Techniques; approximation of derivatives, Impulse invariant method, Bilinear transformation, Structures for IIR Systems – Direct Form I & II, Cascade, Parallel, Lattice & Lattice-Ladder Structures, Structures For FIR Systems – Direct , Cascade, Parallel, Lattice & Lattice ladder Structures.	11

3.	**Multirate Digital Signal Processing**	Decimation & Interpolation, Sampling rate conversion, Identities, polyphase decomposition, General polyphase framework for Decimator and Interpolator, Multistage decimator and Interpolator, Efficient transversal structure for Decimator and Interpolator, FIR and IIR structure for Decimator, Filter design for FIR decimator and Interpolator, Application of Multirate Signal processing.	16
4.	**Adaptive Filters**	Introduction. Application of adaptive filters, Adaptive Direct-form FIR filters Adaptive Lattice-Ladder filters.	6
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (…)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	J.G. Proakis & D.G. Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", PHI ,3rd Edition
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
3.	P.P. Vaidyanathan, "Multirate Systems and Filter Banks", PHI, 2010

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M11EC119	Semester (specify Odd / Even)	Semester ODD Session 2018 - 19 Month from July to December
Subject Name	Advanced Wireless and Mobile Communications		
Credits	03	**Contact Hours**	03

Faculty (Names)	Coordinator(s)	1. Pankaj Kr. Yadav
	Teacher(s) (Alphabetically)	1. Pankaj Kr. Yadav

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	To review wireless and mobile communication, Cellular Concept	Remember(Level I)
CO2	To understand the concept of Propagation of Mobile Radio Signals	(Understand Level II)
CO3	To analyze the FDMA, TDMA, CDMA, OFDMA techniques wireless and mobile communication	Apply (Level III)
CO4	To evaluate GSM, UMTS and LTE Air Interface	Analyze (Level IV)

Module No.	Subtitle of the Module	Topics in Module	No. of Lectures
1.	Introduction	Introduction to the wireless communications. Its relevance. Overview. Coverage- syllabi. Recommended reading. Evaluation Scheme.	4
2.	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.	8
3.	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. Doppler effect and mobility.	6
4.	Multiple Access Techniques	FDMA, TDMA, CDMA, OFDMA techniques and their performance. Number of channels.	2
5.	OFDM in LTE	Introduction of Orthogonal Frequency Division Multiplexing, OFDM in LTE	4

6.	LTE Radio Access Networks	LTE RADIO INTERFACE; Logical, Transport and physical Channels; Reference Signals, Physical Cell ID, Time-Domain Structure, Scheduling in LTE	12
7.	LTE Advancecd and 5G RAN	Introduction of LTE-Advanced and 5G RAN; and Recent developments.	4
		Total number of Lectures	40

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	T. S. Rappaport, Wireless Communications, PHI, 2002.
2.	Gunnar Heine, GSM Networks: Protocols, Terminology and Implementation, Artech House, 1999.
3.	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
4.	Harri Holma, Antti Toskala, LTE for UMTS: Evolution to LTE-Advanced, John Wiley and Sons, 2011
5.	5G Technology Evolution Recommendations, 4G Americas, 2015
6	http://www.3gpp.org/ftp/Specs/html-info/36-series.htm

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M22EC121	**Semester** ODD **(specify Odd/Even)**	**Semester** I **Session** 2018 -2019 **Month from** July to December
Course Name	RF MICROELECTRONICS		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	SHIVAJI TYAGI
	Teacher(s) (Alphabetically)	SHIVAJI TYAGI

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Defining the RF, wireless standards, system specification and system and circuit design.	Remembering (Level-I)
CO2	Comparing various process technology nodes (both silicon and III-V) and behavior of components and circuits at RF frequency.	Understanding (Level-II)
CO3	Identify the challenges involved in RF circuits and choosing the best option for RF circuit by making use of various parameters.	Applying (Level-III)
CO4	Analysis of MOS Amplifier circuits at high frequency by comparing various topologies.	Analyzing (Level-IV)
CO5	Evaluating various topologies and choosing the best option according to design specification.	Evaluating (Level-V)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction: Concepts, Components and Systems	Defining RF, Wireless Standards, System Specification, System and Circuit Design Overview, S-Parameter, Smith Chart, Transmission Lines (Micro strip, Strip line, Coplanar Waveguides); Radio as A Typical RF System	08
2.	RF Device Technology	Behavior of Passive Components , Passive Devices – Resistors, Capacitor, Inductors, Transformers; Active Devices – MOSFET, BJT, HEMTs; Substrate Materials – HMICs, MMICs, CMOS; Characteristics and Fabrication Process detail	06
3.	Issues in RF Circuit Design: Noise, Linearity & Signals	RF Specifications – Stability, Power Gain, Noise, Non-Linearity, Sensitivity, Dynamic Range, Modulated Signals-Phase Modulation, Frequency Modulation	04
4.	Resonant Circuits and Filter Design	Some Definitions, Resonance, Loaded/Unloaded Q, Insertion Loss, Impedance Transformation, Coupling, Filter Types, Filter Design at High Frequency	06
5.	Transistor at Radio Frequency	Basic MOS Amplifier – DC and low-frequency problem ; High-frequency behavior of basic amplifiers, Amplifiers loaded with coupled resonance circuits	06
6.	Low Noise Amplifiers	General Considerations, Problem of Input Matching, LNA Topologies, Design schemes, Noise in LNA, Narrowband and Wideband LNA design	06

7.	Mixers	Performance Parameters, Active and Passive mixers	04
8.	Voltage Controlled Oscillators	Introduction, Oscillator Types, Negative Resistance approach to L-C oscillators, Feedback Approach to L-C oscillators, Frequency Stability of L-C Oscillators	04
		Total number of Lectures	**44**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Behzad Razavi, "RF Microelectronics", Second edition, Prentice-Hall 2012**
2.	Thomas Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Second Edition, Cambridge University Press, 2003
3.	David Pozar, "Microwave and RF Design of Wireless Systems", 3rd Edition, Wiley 2000
4.	R. Ludwig and G. Bogdanov, "RF Circuit Design: Theory and Applications" 2^{nd} edition 2000.
5.	NPTEL Course: RF Integrated Circuits by Dr Shouri Chatterjee, IITD

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12EC125	**Semester** : Odd 2018 **(specify Odd/Even)**	**Semester** Ist **Session** 2018 -2019 **Month** **July – Dec. 2018**
Course Name	Detection and Estimation Theory		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Vikram Karwal
	Teacher(s) (Alphabetically)	Dr. Vikram Karwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	The course aims to familiarize student with stochastic processes and its properties.	Apply Level (C3)
CO2	The course helps students to analyze probabilistic models and estimate the parameters of the model parameters.	Analyze Level (C4)
CO3	The course helps students evaluate the observations of the noise-corrupted functions and determine the best estimate of the state.	Evaluate Level (C5)
CO4	The course helps student compute the optimality criteria to quantify best estimates or detection decisions and limits on performance.	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of random variables	Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of random variables, Schwarz Inequality, Orthogonality principle in estimation, Central limit theorem, Random Process, stationary process, autocorrelation and autocovariance functions, Spectral representation of random signals, Wiener Khinchin theorem, Properties of power spectral density, Gaussian Process and white noise	5
2.	Parameter estimation theory	Principal of estimation and applications, Properties of estimates, unbiased and consistent estimators, MVUE, CR bound, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties; Baysean estimation: Mean Square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation	7
3.	Estimation of signal in presence of White Gaussian Noise(WGN)	Linear Minimum Mean-Square Error(LMMSE) Filtering: Wiener Hoff Equation FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear prediction of signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters	8
4.	Complexity Computations	Principle and Application, Steepest Descent Algorithm, Convergence characteristics; LMS algorithm, convergence, excess mean square error, Leaky LMS algorithm; Applications of Adaptive filters; RLS algorithm, derivation,	8

		Matrix inversion Lemma, Initilization, tracking of nonstationarity.	
5.	Kalman Filtering	Principle and application, Scalar Kalman filter, Vector Kalman filter	3
6.	Detection Theory	Hypothesis testing, Bayesian, Neyman-Pearson and Minimax detetion, Composite Hypothesis testing, Generalized LRT, Sequential and Distributed Detection, Non-parametric detection, Detection in Gaussian noise	9
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Assignment, 5 Quiz, 5 Class Participation, 10 Attendance)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	An Introduction to Signal Detection and Estimation by H. Vincent Poor
2.	Linear Estimation by Thomas Kailath, Ali H sayed, Babak Hassibi
3.	Fundamentals of Statistical Signal Processing: Detection theory by Steven M Kay
4.	Fundamentals of Statistical Signal Processing: Estimation theory by Steven M Kay

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18M12EC114/17M22EC113	Semester Odd	Semester FIRST Session 2018-19 Month from July to Dec
Subject Name	HDL Based Digital Design		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Atul Kumar Srivastava
	Teacher(s) (Alphabetically)	Atul Kumar Srivastava , Shruti Kalra

Course Objectives:

- Verilog IEEE 1364 standard
- Hardware Descriptive language programming (RTL, testbenches & UDP's)
- Combinational & Sequential Circuit Description
- Component Test & Verification

Course Outcome:

- Logic Design with Verilog, Gate level and data flow modeling, FSM modeling, Fault analysis , synthesis and FPGA's

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Understand the concept of Verilog and their application in Digital systems design systems.	Understanding (C1)
CO2	Identify theoretical and practical requirements for implementation and designing of Finite state machines.	Applying (C3)
CO3	Understand the concept of Asynchronous Finite State Machines and their application in Digital systems design systems.	Understanding (C1)
CO4	Understand the concept of Fault and Analysis in Digital systems design systems	Analyzing (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	HDL Based Design	Introduction to Logic Design with Verilog, Gate Level, data flow level, UDP, data types, behavioral level, ,structural modeling, operators, test bench, function and task, system task, compiler directive, synchronization, FSM Modeling	**17**
2.	Finite State Machine (FSM)	FSM Design methodology, Pulse generations, Frequency Dividers, conversion between Mealy and Moore, State Reduction, State Assignment, Implementation, and state diagram partitioning	**8**
3.	Asynchronous Finite State	Asynchronous Analysis, Design of Asynchronous Machines, Flow table	**9**

	Machines	realization, reduction, state assignments and design, Cycle and race analysis. Hazards, Essential Hazards, and its removal	
4.	Fault Analysis	s-a-0, s-a-1 fault analysis using path sensitization method, Boolean Difference Method,	**5**
5.	Introduction to FPGA	FPGA Architecture, Implementation using ISE, System Generator based Implementation, Accel DSP based implementation	4
		Total number of Lectures	**43**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Roth, Charles H. *Digital systems design using VHDL*. Vol. 20. PWS publishing company, 1998.
2.	Bhasker, Jayaram, and Jayaram Bhasker. *A Vhdl primer*. Prentice Hall PTR, 1999.
3.	Pedroni, Volnei A. Circuit design with VHDL. MIT press, 2004.
4.	Z.Kohavi: Switching and Finite Automata Theory, 2nd Edition, Tata Mc-Graw Hill, 2001
5.	A. Anand Kumar : Fundamental of Digital Circuits, PHI, 2nd Edition 2012

Detailed Syllabus
Lecture-wise Breakup

Course Code	18M12EC115	**Semester** ODD **(specify Odd/Even)**	**Semester** ODD **Session** 2018 - 2019 **Month from** July - December
Course Name	Advanced Optical Communication Systems		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Amit Kumar Goyal
	Teacher(s) (Alphabetically)	Dr Amit Kumar Goyal

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Develop an understanding of optical fiber, its structure, types, propagation, transmission and non-linear properties.	Remembering (Level I)
CO2	Identify and examine the different kinds of losses and signal distortion along with their compensation techniques in optical Fibers.	Analyzing (Level IV)
CO3	Classify the Optical sources and detectors and their principle of operation. Analize various coupling techniques.	Understanding (Level II)
CO4	Design a fiber optic link based on budget analysis.	Evaluating (Level V)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Overview of Optical fiber Communications	Introduction to fiber optics, Physics of light. Principles of fiber optics: Introduction, light propagation, Skew rays. TIR condition, FTIR, Goos-hanchen shift. Effective index method to determine propagation constant, Fibers Modes, V Number analysis for optical fiber, Significance of V-b diagram, Mode Coupling, Step Index fibers, Graded Index fibers. Single mode fibers- Cut off wavelength, line width, propagation velocities. Non-linear effects in optical fiber	7
2.	Signal Degradation in Optical fibers	Signal distortion in optical fibers- Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity, Group delay, Types of Dispersion - Material dispersion, Wave-guide dispersion, Intermodal dispersion, Fiber Birefringence, Polarization Mode Dispersion. Introduction to Dispersion compensation techniques, Advanced chromatic dispersion compensation, Advanced PMD compensation (both optical and electrical).	7

3.	Optical Sources	Light emitting diode (LEDs)- structures designing and performance analysis, Quantum efficiency, Power, Modulation, Laser Diodes -Modes & threshold conditions, resonant frequencies, structures, characteristics single mode lasers, Modulation of laser diodes, external quantum efficiency, laser diode rate equations. Source to fiber power launching: - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Various fiber to light coupling techniques, Laser diode to fiber coupling, LED coupling to single mode fiber.	8
4.	Photodetectors & Receivers	Optical detectors- principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Optical receiver: Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers.	8
5.	Optical system design	Optical Amplification, Doped fiber amplifier, semiconductor optical amplifier, Analog and digital systems. Coherent optical fiber communication systems. Modulation and line coding. Bandwidth and rise time budgets, Power budget, and dynamic range. Power penalty, Channel capacity measurement.	6
6.	Advanced Optical Systems and Networks	Wavelength Division Multiplexing. Long haul and metro WDM system, WDM system analysis, design and performance evaluation, Introduction to Photonic crystal technology, Photonic crystal fibers, Introduction to Optical Networks, Local area network, Metropolitan-Area N/W,SONET/SDH, Introduction to Free Space optical Communication.	8
7.			
		Total number of Lectures	**44**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill International edition, 2000.
2.	John M. Senior, Optical Fiber Communications, 2nd Edition, PHI, 2002.
3.	D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Fiber Optic Communications, Pearson Education, 2005.
4.	Govind P. Agarwal, Fiber Optic Communication Systems, 3rd Edition, John Wiley, 2004.

5.	Joseph C. Palais, Fiber Optic Communications, 4th Edition, Pearson Education, 2004
6.	Journal articles i.e. IEEE, Springer, IOPscience, Elsevier and Video lectures from nanohub, NPTEL, MIT video lectures

Detailed Syllabus
Lecture-wise Breakup

Course Code	18M12EC113	**Semester** Odd	**Semester** 1st (M.Tech) **Session** 2018 - 2019 **Month from** July 2018 to Dec 2018
Course Name	Basics of Embedded System Design		
Credits	3	**Contact Hours**	3 per week

Faculty (Names)	**Coordinator(s)**	Mandeep Singh Narula
	Teacher(s) (Alphabetically)	Mandeep Singh Narula

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Study basics of embedded systems and its applications	Understand (Level II)
CO2	Understand different instructions of microprocessor and microcontrollers	Analyzing (Level IV)
CO3	Ability to Interface the memory chips and peripheral chips with 8085 microprocessors and microcontrollers.	Evaluate (Level V)
CO4	Study basics of ARM processors and communication protocols	Understand (Level II)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Embedded Systems	Embedded System and its applications, Design Parameters of Embedded System and its significance, Embedded System design flow and design life cycle, Digital Circuit Parameters (Open collector outputs, Tristate outputs, I/O source and sinking, Fan-in and Fan-out, Propagation delay, Figure of merit, PAL, PLA, CPLD, FPGA, SOC	4
2.	Introduction to Microprocessors and Microcontrollers	Introduction (Microprocessor Versus Microcontrollers, Microcontrollers for Embedded Systems, Embedded Versus External Memory Devices, CISC Versus RISC Processors, Harvard Versus Von-Neumann architecture, 8051/8031/8052 Microcontroller (Basic architecture, Pin configuration, Memory organization (registers and i/o ports), Assembly language programming**)** (addressing modes and instruction set), Timers and Interrupts, Serial Communication.	10
3.	Real World Interfacing with Microcontroller	Interfacing of single LED, Blinking of LED with timer and without timer, Interfacing of push-button and LED, Interfacing of 7-segment display, Interfacing of 8 push-buttons to control 7-segment display, Intelligent LCD Display, Interfacing of intelligent LCD display, Interfacing of Matrix Keyboard to control 7-segment display, ADC and DAC Modules, Interfacing of ADC0804, Interfacing with	12

		DAC0808, Different wave generation through DAC0808, Stepper Motor & DC Motor, Interfacing with stepper & DC motor, Different Sensor Interfacing, (IR Sensor, DTMF, Temperature Sensor, LDR)	
4.	Introduction to RTOS and ARM Microprocessor	Real Time Operating System (RTOS), Types of real time tasks, Task Periodicity, Process state diagram, Kernel and Scheduler, Scheduling algorithms, Shared data (Resource) and Mutual Exclusion, Semaphore, Introduction to ARM, Features, ARM Pipeline, Instruction Set Architecture (ISA), Thumb Instructions, Exceptions in ARM	10
5.	Communication Protocols	Communication Protocols, Serial Protocols (Inter IC (I2C), Controller Area Network (CAN), Serial Peripheral Interface (SPI), Universal Serial Bus (USB)), Parallel Protocols (Peripheral Component Interconnect (PCI), ARM Bus), Wireless Protocols (Infrared Data Association (IrDA), Bluetooth, IEEE 802.11)	2
6.	Low Power Embedded System Design	Introduction, Sources of Power Dissipation, Dynamic power dissipation (Short circuit power, Switching Power, Glitching Power, Static power dissipation), Power Reduction Techniques (Algorithmic power minimization, Architectural power minimization, Parallelism for low power, Pipelining for low power, Logic and circuit level power minimization, Different encoding techniques, Logic synthesis for low power, Technology mapping, Control logic power minimization, System Level Power Management, Advanced configuration and power interface (ACPI)	4
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Muhammad Ali Mazidi, “The 8051 microcontroller and Embedded Systems using Assembly and C”, 2nd Edition, Pearson Education, 2008.
2.	Frank Vahid / Tony Givargis, “Embedded System Design”, Willey India, 2002.
3.	Santanu Chattopadhyay, “Embedded System Design”, 1st Edition, PHI Learning, 2010.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**17M12EC213**	**Semester Odd (specify Odd/Even)**	**Semester** I **Session** 2018 -2019 Month from Jul to Dec
Course Name	Information and Coding Theory		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Ms. Neetu Singh
	Teacher(s) (Alphabetically)	Ms. Neetu Singh

COURSE OUTCOMES At the completion of the course, students will be able to:		**COGNITIVE LEVELS**
CO1	Understand the concept of probability, its relation with information, entropy, and their application in communication systems.	Understand Level C2
CO2	Identify theoretical and practical requirements for implementing and designing compression algorithms.	Analyze Level C4
CO3	Analyze the need for channel coding in digital communication systems, the relationship between bandwidth and capacity of communication channels with its importance in real life communication systems.	Analyze Level C4
CO4	Generate block codes for error detection and correction.	Analyze Level C4
CO5	Generate convolutional codes for error detection and correction.	Analyze Level C4

Module No.	**title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of Basic Probability	Probability spaces. Random variables. Distributions and densities. Functions of random variables. Statistical Averages. Inequalities of Markov and Chebyshev. Weak law of large numbers.	3
2.	Information Measure	Discrete entropy. Joint and conditional entropies. Entropy in the continuous case. Maximization of continuous entropy. Entropy of a bandlimited white Gaussian process.	5
3.	Data Compression	Uniquely decipherable and instantaneous codes. Kraft- McMillan inequality. Noiseless coding theorem. Construction of optimal codes.	4
4.	Data Transmission	Discrete memoryless channel. Mutual information and channel capacity. Shannon’s fundamental theorem and its weak converse. Capacity of a bandlimited AWGN channel. Limits to communication – Shannon limit.	5
5.	Error Control Coding	Coding for reliable digital transmission and storage. Types of codes. Modulation and	3

		coding. ML decoding. Performance measures.	
6.	Linear Block Codes	Algebra Background, Groups, Fields, Binary field arithmetic. Vector Spaces over GF(2). Generator and parity check matrices. Syndrome and error detection. Standard array and syndrome decoding. Hamming codes.	8
7.	Cyclic Codes	Polynomial representation, Systematic encoding. Cyclic encoding, Syndrome decoding.	6
8.	Convolutional Codes	Generator Sequences. Structural properties. Convolutional encoders. Optimal decoding of convolutional codes- the Viterbi algorithm.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	R.B. ASH: Information Theory, Dover, 1990.
2.	R. BOSE: Information theory, coding and cryptography, Macgraw Hill 2008.
3.	R.W. YEUNG: Information Theory and Network Coding, Springer, 2008.
4.	S. LIN & D.J. COSTELLO: Error Control Coding, 2^{nd} Edn, Pearson, 2004.
5.	T.K. MOON: Error Correction Coding, Wiley, 2006.

<u>**Detailed Syllabus**</u>

Lab-wise Breakup

Course Code	17M15EC114	**Semester: Odd 2018 (specify Odd/Even)**	**Semester** 1st **Session** 2018 -2019 **Month from** July to December
Course Name	ECE Design and Simulation Lab -I		
Credits		**Contact Hours**	

Faculty (Names)	**Coordinator(s)**	Vikram Karwal
	Teacher(s) (Alphabetically)	Vikram Karwal, Vivek Dwivedi

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	At the end of the module the student will be able to explain relative merits and demerits of wireless communication technologies.	Remember Level (I)
CO2	At the end of the lab the students will be able to simulate the radio propagation model	Understand Level (II)
CO3	Plan a wireless communications system for a given environment in which it is to be deployed.	Apply Level (III)
CO4	Select a wireless technology or a combination of technologies to suit a given application.	Analyze Level (IV)
CO5	Use of MIMO technology in 5G communication	Evaluate Level (V)
CO6	Perform measurements with commercial equipment and understand the effects of radio channel on the OFDM signal as well as strategies to compensate them	Create Level (VI)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Exp.1	Introduction to MATLAB and its various applications.	CO1
2.	Exp.2	To study and simulate Rayleigh distribution using two signals that follow normal distribution.	CO2
3.	Exp.3	To study and simulate Rician distribution using two signals that follow normal distribution.	CO2
4.	Exp.4	To study and simulate Propagation Path loss Models: Free Space Propagation, log distance and log normal.	CO2
5.	Exp.5	To write a MATLAB program to calculate the median path loss for Outdoor Propagation – Okumura Model and Hata Model.	CO3
6.	Exp.6	To study atmospheric turbulence models and implement them using MATLAB.	CO3
7.	Exp.7	To study and simulate the SISO outdoor channel models i.e. FWGN channel model and Jakes model.	CO4
8.	Exp.8	To simulate the channel capacity for MIMO system.	CO5
9.	Exp.9	To analyze the performance of MIMO systems by using space time code technique.	CO5
10.	Exp.10	OFDM systems implementation using MATLAB	CO6
11.	Exp.11	To obtain the PAPR analysis of single-carrier signal and the performance of PAPR & BER with clipping and filtering	CO6

		reduction technique.	
12.	Exp.12	Final Project Based on the pre-knowledge of wireless communication system.- Adaptive Channel Estimation and Data Estimation	

Evaluation Criteria

Components	**Maximum Marks**
Viva -1	20
Viva -2	20
D2D	60
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Principles of Communication Systems Simulation with Wireless Applications William H. Tranter K. Sam Shanmugan Theodore S. Rappaport Kurt L. Kosbar
2.	Digital Communication over Fading Channels -A Unified Approach to Performance Analysis By Marvin K. Simon Mohamed-Slim Alouini
3.	Adaptive Filters by Ali H Sayed