Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M21EC111	**Semester** Odd	**Semester** I **Session** 2018-19 **Month from** July **to** December
Subject Name	Microelectronic Devices Technology and Design Interface		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Saurabh Chaturvedi
	Teacher(s) (Alphabetically)	Dr Saurabh Chaturvedi

COURSE OUTCOMES - At the end of the course, students will be able to:		**COGNITIVE LEVELS**
CO1	-Relate and recall the concepts of semiconductor physics, devices and technology	Remembering (Level I)
CO2	-Understand the MOS structure and explain the operation of MOS transistors	Understanding (Level II)
CO3	-Apply the knowledge of MOSFET scaling, short-geometry effects and fabrication techniques in advanced nanoscale devices and circuits	Applying (Level III)
CO4	-Analyze the device layout and characteristics -Analyze design flow and design interface	Analyzing (Level IV)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Semiconductor physics	Semiconductor materials, Energy bands, Intrinsic carrier concentration, Doping, Carrier drift and diffusion, Generation and recombination processes, Continuity equation, Thermionic emission process, p-n junction	11
2.	MOS capacitor	MOS structure, MOS system under external bias	7
3.	MOS transistor	Physical structure of MOS transistor, Types, Threshold voltage, MOSFET operation, Layout, MOSFET capacitances, SPICE models	11
4.	Scaling of MOS transistor	Types of scaling, Short-geometry effects, Introduction to SPICE model parameters	4
5.	Fabrication of MOS transistor	Basic steps, n-well CMOS process, Twin-tub technology	3
6.	Overview of CMOS/VLSI technology	CMOS technology, VLSI design methodologies, VLSI design flow, Design hierarchy, VLSI design styles	3
7.	Design interface	CMOS lambda-based design rules, Foundry interface	3

Total number of lectures	42
Evaluation Criteria **Components** **Maximum Marks** T1 20 T2 20 End Semester Examination 35 TA 25 **Total** **100**	

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

Recommended Reading Material:	
1.	S. M. Sze, *Semiconductor devices: Physics and technology*, 2nd ed., John Wiley & Sons, 2009.
2.	A. B. Bhattacharyya, *Compact MOSFET models for VLSI design*, 1st ed., Wiley-IEEE Press, 2009.
3.	Y. Tsividis, *Operation and modeling of the MOS transistor*, 2nd ed., Oxford University Press, 2009.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M21EC112	**Semester** ODD **(specify Odd/Even)**	**Semester** I **Session** **2018**-2019 **Month from** July - December
Course Name	Digital Integrated Circuit Design		
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 exiting challenges in digital IC design, and analysis of CMOS inverter performance.	Understanding (Level II)
CO2	Identify and estimate the delay and power consumption in CMOS based gates and choosing best design configuration via logical effort.	Analyzing (Level IV)
CO3	Design and analyze combinational and sequential logic circuits effectively.	Applying (Level III)
CO4	Design different types of semiconductor memories and test integrated circuits for fault tolerance.	Evaluating (Level V)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to CMOS digital integrated circuits	Digital integrated circuit basic: cost, reliability, yield and performance, Challenges in DIC design, CMOS devices and manufacturing technology and design rules, CMOS inverters and gates, Propagation delay calculation of CMOS inverter, noise margins, power dissipation, and regenerative logic circuits	10
2.	Delay Estimation and Power consumption in CMOS gates	Delay Definitions, Switch-level RC Delay Models, Effective Resistance and Capacitance calculations, Elmore Delay Model, Linear Delay Model, Switching Activity of logic gates	7
3.	Logical Effort	Delay in a Logic gate, Multistage Logic Networks, Gate sizing, Choosing the best No. of stages, Limitation of logical effort	6
4.	Designing Arithmetic Building Blocks	Complex CMOS circuit design, Static and dynamic logic, Adders, Multipliers and Shifters	8
5.	Sequential Circuit Analysis	Timing Metrics for Sequential Circuits, Bi-stability principle, Static latches and Registers, Flip flops,	7

		Dynamic Sequential Circuit, Schmitt Trigger	
6.	Designing Memory and Array Architecture	Semiconductor Memories, Memory peripheral Circuitry	4
7.	Testing	Introduction to testing and various concepts	4
		Total number of Lectures	**46**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Two Assignment and One 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.	J. M. Rabaey, A. Chandrakasan, B. Nikolic: Digital Integrated Circuit: A design perspective, 2nd Edition Pearson Education, Delhi-2005
2.	Weste, Neil HE, and David Money Harris. *CMOS VLSI Design*. Pearson/Addison Wesley, 2005.
3.	Geiger, Randall L., Phillip E. Allen, and Noel R. Strader. *VLSI design techniques for analog and digital circuits*. Vol. 90. New York: McGraw-Hill, 1990.
4.	*www.ieeexplore.ieee.org*

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	Understanding (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.	Evaluating (Level V)
CO4	Study basics of ARM processors and communication protocols	Understanding (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	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" 2nd 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	**Semester** Odd	**Semester** I **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	**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, 2nd Edn, Pearson, 2004.
5.	T.K. MOON: Error Correction Coding, Wiley, 2006.

Detailed Syllabus
Lab-wise Breakup

Course Code	**17M25EC111**	**Semester** Odd **(specify Odd/Even)**	**Semester** Ist **Session** 2018 -2019 **Month from** June to Dec
Course Name	VLSI Design and Simulation Lab		
Credits	2	**Contact Hours**	5

Faculty (Names)	**Coordinator(s)**	Kirmender Singh
	Teacher(s) (Alphabetically)	Shamim Akhter

COURSE OUTCOMES: At the end student will be able to		**COGNITIVE LEVELS**
CO1	Use the IC design tool and simulate frequency and transient response of basic first-order RC circuit.	Remembering (Level I)
CO2	Use embedded software to simulate basic embedded system programs.	Remembering (Level I)
CO3	Understand the output and transfer characteristics of n and p channel MOSFET using level-1 and BSIM4 model parameters and Extract level-1 MOS model parameters.	Understanding (Level II)
CO4	Apply level-1 MOS model equations in validating static and transient characteristics of CMOS inverter .	Applying (Level III)
CO5	Analyze and simulate the schematic of combinational and sequential logic circuits and make their layout.	Analyzing (Level IV)
CO6	Analyze combinational and sequential circuits using Hardware Description Language and synthesis them on FPGA tool.	Analyzing (Level IV)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Circuit Simulator tool.	To familiarize with IC design tool IC station by simulating frequency and transient response of basic first-order RC circuit	CO1
2.	Introduction to Firmware KEIL	To use embedded software KEIL to verify program of traffic light controller.	**CO2**
2.	Characteristics of MOSFET	To plot current versus voltage transfer and output characteristics of n and p channel MOSFET using Level-1 and level-54 model parameters.	CO3
3.	Extraction of MOSFET Model parameters	Extract Level-1 model parameters VT0, GAMMA and PHI of n-channel MOSFET.	CO3
4.	CMOS Inverters	To plot voltage transfer characteristics of CMOS inverter, determine switching point and noise margins.	CO4
5.	Transient analysis of combinational circuits	To Implement NAND and NOR gate using CMOS logic and perform its transient analysis.	CO5
6.	Creation of Subcircuit Model	To create subcircuit model of NAND and NOR gate. Using this model implement half adder and full adder circuits	CO5
7.	Half adder and Full Adder Circuits	Design a 2: 1 multiplexer using subcircuit model and implement half adder circuit using this model.	CO5

8	Combinational circuits using transmission Gates	To design XNOR and XOR gate using transmission gate.	CO5
9	Layout and DRC of CMOS process	To make a layout of CMOS inverter and perform the DRC	CO5
10	Layout versus schematic and parasitic extraction	To perform post layout simulation of CMOS inverter taking into effect area of source and drain regions.	CO5
11	Hardware Description Language	Introduction to modelsim tool and implement HDL code of Half adder, full adder, 2:1 multiplexer, D flipflop	CO6
12.	Introduction to FPGA	To Synthesize HDL code on Field Programming Gate Array kit and validate the functions of combinational circuits	CO6

Evaluation Criteria

Components	**Maximum Marks**
Viva1	20
Viva2	20
Day to Day	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.	S.-M. Kang and Y. Leblebici, "CMOS digital integrated circuits: Analysis and design," 3rd edition, Tata McGraw-Hill, 2003.
2.	N. H. E. Weste and D. M. Harris, "CMOS VLSI design: A circuits and systems perspective," 3rd edition, Addison-Wesley, 2005.

Lecture-wise Breakup

<table>
<tr><td>Course Code</td><td>18M11GE111</td><td colspan="2">Semester Odd</td><td colspan="2">Semester I Session 2018 -2019
Month from July to December</td></tr>
<tr><td>Course Name</td><td colspan="5">Research Methodology & Intellectual Property Rights</td></tr>
<tr><td>Credits</td><td colspan="2">2</td><td>Contact Hours</td><td colspan="2">2-0-0</td></tr>
<tr><td rowspan="2">Faculty (Names)</td><td>Coordinator(s)</td><td colspan="4">Prof. B. P. Chamola</td></tr>
<tr><td>Teacher(s) (Alphabetically)</td><td colspan="4">Prof. B. P. Chamola</td></tr>
<tr><td colspan="5">COURSE OUTCOMES:</td><td>COGNITIVE LEVELS</td></tr>
<tr><td colspan="5">After pursuing the above mentioned course, the students will be able to:</td><td></td></tr>
<tr><td>CO111.1</td><td colspan="4">understand the basic concepts and types of research</td><td>Understanding Level (C2)</td></tr>
<tr><td>CO111.2</td><td colspan="4">define a research problem, its formulation, methodologies and analyze research related information</td><td>Analyzing Level (C4)</td></tr>
<tr><td>CO111.3</td><td colspan="4">follow research ethics, understand IPR, patents and their filing related to their innovative works.</td><td>Understanding Level (C2)</td></tr>
<tr><td>CO111.4</td><td colspan="4">understand and analyze the statistical data and apply the relevant test of hypothesis in their research problems</td><td>Analyzing Level (C4)</td></tr>
<tr><td>Module No.</td><td>Title of the Module</td><td colspan="3">Topics in the Module</td><td>No. of Lectures for the module</td></tr>
<tr><td>1.</td><td>Research</td><td colspan="3">What is research? Types of research. What is not research? How to read a Journal paper?</td><td>3</td></tr>
<tr><td>2.</td><td>Report writing</td><td colspan="3">How to write report? Use of Mendeley in report writing. How to write a research paper? Problem identification and solving.</td><td>4</td></tr>
<tr><td>3.</td><td>Ethics, IPR and Research methodologies</td><td colspan="3">Research ethics, patents, intellectual property rights, plagiarism regulation 2018. Steps in research process and common methodologies to attempt solution to research paper.</td><td>8</td></tr>
</table>

4.	Basics of statistics and probability distributions	Basic statistical concepts. Handling of raw data, Some common probability distributions.	7
5.	Test of hypothesis and regression analysis	Hypothesis testing. Parametric and non-parametric data, Introduction to regression analysis.	8
Total number of Lectures (Course delivery method: open ended discussion, guided self-study, lectures)			**30**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
Assignments	30 (Viva, Quiz, Assignments)
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.	**Stuart Melville and Wayne Goddard**, Research methodology: An Introduction for Science & Engineering Students, Kenwyn, South Africa : Juta& Co. Ltd., 1996.
2.	**Kothari, C.R.,** Research Methodology: Methods and Techniques, New Age International, New Delhi, 2009.
3.	**Kumar, Ranjit,** Research Methodology: A Step by Step Guide for Beginners, 2nd Edition, Sage Publications Ltd., 2005.
4.	**Ramappa, T.,** Intellectual Property Rights Under WTO, S. Chand, New Delhi, 2008.
5.	**Wayne Goddard and Stuart Melville,** Research Methodology: An Introduction, Kenwyn, South Africa : Juta& Co, 2001.